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Medicinal and poisonous plants 3

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(Editors)

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- Noppamas Soonthornchareonnon, Mahidol University, Department of Pharmacognosy, Faculty of Pharmacy, 447 Sri Ayutthaya Road, Ratchathevi, Bangkok 10400, Thailand (*Baliospermum montanum*, *Buchnera*, *Dendrotrophe umbellata*, *Dischidia*, *Gonocaryum gracile*, *Grewia*, *Murdannia*, *Prismatomeris tetrandra*, *Streptocaulon*, *Suregada*, *Tiliacora triandra*, *Typhonium*)
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- Tran Cong Khanh, Hanoi College of Pharmacy, 9 Vu Huu Loi St., 13-15 Le Thanh Tong, Hanoi, Vietnam (*Rhaphidophora*)
- Tran Dinh Ly, IEBR-NCSNT, Hoang Quoc Viet Road, Cau Giay, Hanoi, Vietnam (*Aganosma*, *Dregea volubilis*, *Toxocarpus villosus*)
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Foreword

When the Prosea Task Force on Medicinal and Poisonous Plants met in Bogor (Indonesia) in March 1996 it soon became clear that the task of the editorial team of Prosea 12: 'Medicinal and poisonous plants' would be immense but challenging. Now, almost seven years later, with the publication of this present volume, the work has finally come to an end. Almost 1300 medicinal and poisonous plants have been reviewed in nearly 550 papers, in which local knowledge has been combined with up-to-date information on their pharmacological properties, and all other aspects have also been covered. Such a comprehensive and complete overview of this large and complicated commodity group is unparalleled.

This third volume covers principally the lesser-known species, on which often little or no information is available concerning their phytochemistry and pharmacology. However, amongst these may well be medicinal plants that accumulate active principles with future importance in the medical treatment of life-threatening diseases, such as malaria, AIDS and cancer. Ethnomedical knowledge still represents a valuable lead element in today's innovative approaches in drug discovery. Together with advances in the understanding of pharmacological activity and therapeutic efficacy on a molecular interaction level, this aspect contributes to screening and experimental strategies. This publication may serve as a starting point for research and development of novel plant drugs and new targets in therapy, and will hopefully play a role in improving the primary health care for the fast-growing population of South-East Asia.

Nieuwegein, October 2002

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1 Introduction

The general aspects of medicinal and poisonous plants were highlighted in the introduction of Prosea 12(1): 'Medicinal and poisonous plants 1'. These included definitions, subgrouping, role, phytochemistry, biological and pharmacological activities, therapeutical applications, botany, ecology, agronomy, harvesting, handling after harvest, processing, utilization, quality control, genetic resources, breeding, research and development, from plant to drug and prospects. The introduction of Prosea 12(2): 'Medicinal and poisonous plants 2' provided more detailed information on quality control of herbal drugs. The focus of the introduction of the present volume is on conservation aspects of medicinal plants.

1.1 Choice of species

The choice of the genera/species covered in each of the 3 volumes on medicinal and poisonous plants has been somewhat arbitrary, although the 3 volumes essentially reflect the importance of species: the most important ones in Prosea 12(1), the least important ones in Prosea 12(3). This implies that on the whole the medicinal and poisonous plants treated in the present volume are less known. Generally, little or no information is available on their phytochemistry and pharmacology. However, several genera/species covered in this volume have recently attracted attention because of interesting pharmacological properties (e.g. *Butea*, *Calophyllum*, *Galbulimima belgraveana*, *Gynura* and *Morinda*). Others are poorly known in South-East Asia, but have at least some medicinal reputation outside the region (e.g. *Ajuga bracteosa*, *Cecropia peltata*, *Cestrum nocturnum*, *Clusia*, *Cocculus*, *Hymenocallis*, *Kigelia africana*, *Leonotis nepetifolia*, *Ruellia tuberosa* and *Tecoma stans*). The latter category comprises many species introduced in South-East Asia. In addition, some genera are unimportant in South-East Asia, but include species that are medicinally important elsewhere (e.g. *Cynoglossum*, *Drosera*, *Gentiana*, *Melissa* and *Taxus*).

1.2 Collection from the wild versus cultivation

In general, plant species used as a source of drugs receive high priority in conservation activity. The extent of the trade in drugs of plant origin is enormous and largely unmonitored, and harvesting from the wild predominates. Comparatively few medicinal plants are cultivated. It is estimated that 70–90% of material for medicinal use is collected from wild populations (Lange & Schippmann, 1997).

1.2.1 The need for conservation

A number of medicinal plant species have become rare due to thoughtless exploitation of the natural resources. Several species are close to extinction, e.g. *Rauvolfia serpentina* (L.) Benth. ex Kurz which has been included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Particularly in India many plant species used in local medicine are threatened or even close to extinction.
Many countries of the world, including those of South-East Asia, do not have an inventory of their medicinal plants. Thailand, Malaysia and the Philippines recently started to make such an inventory. Lack of population data of species is prevalent. An assessment of threat is therefore difficult to achieve. However, such information is essential to conservation efforts. The greatest conservation threat is posed by the high demand for slow-growing, slow-reproducing, habitat-specific species. Any intended use of a wild species requires an effective management system and a legal framework based on sound scientific information. For plant species used as a source of drugs, the resource management plan must address the following aspects (Lange & Schippmann, 1997):

- Assessment of threat according to the literature and experience of experts.
- Collection of population data by field research.
- Investigation of data on the biology of species: distribution, life form, habitat requirements, plant community aspects, growth rates, reproductive biology and breeding system.
- Review of existing harvesting systems: plant parts used, detrimental collection techniques and socio-economic aspects.
- Review of national regulations for the utilization in the source country.
- Extent of wild-harvesting versus cultivation.
- Review of volume of plant material harvested and traded.
- Establishment of a management system: annual harvesting quota, seasonal restrictions, regional restrictions, restrictions to certain plant parts or size classes and domestication projects.
- Installation of a continuous monitoring and re-evaluation system.

Conservation of medicinal plants is hampered by the fact that they form a very large and heterogenous group concerning growth habit, distribution, reproduction, phenology and ecological requirements. The diverse conservation needs of the species make it extremely difficult to develop a coherent conservation strategy for the commodity group as a whole.

1.2.2 Joint efforts for conservation

Coordinated international work on medicinal plant conservation on a global scale has only just started. The World Conservation Union (IUCN), the World Health Organization (WHO) and the World Wide Fund for Nature (WWF) jointly published 'Guidelines for the conservation of medicinal plants' (1993). A joint programme of the United Nations Educational, Scientific and Cultural Organization (UNESCO), WWF and Royal Botanic Gardens Kew has launched the 'Peoples and Plants Initiative'. The 'Directory for Medicinal Plant Conservation' (Kasparek, Gröger & Schippmann, 1996) lists more than 200 networks, organizations and projects in this field. To coordinate the various efforts in

medicinal plant conservation worldwide, the IUCN Species Survival Commission established the Medicinal Plant Specialists Group in 1994. In all these programmes the term 'medicinal plant' is applied in a very broad sense, covering also plants used in adjacent fields such as cosmetics or functional food products, because nowadays cosmetics and food products are developed to add certain biological effects (e.g. anti-ageing and antioxidant activities). The International Plant Genetic Resources Institute (IPGRI) furthers the conservation and use of genetic diversity, and may provide a logical framework to support, guide and lead the global effort to conserve medicinal plant species and for their sustainable exploitation.

1.2.3 Germplasm collection

In Asia organized efforts to collect and conserve germplasm of medicinal plants are rare. In most countries, no germplasm collection of medicinal plants takes place at all (Chomchalow in Chomchalow & Henle, 1993). Traditional cultivars and their wild relatives represent particularly valuable sources for e.g. resistance to diseases, and therefore need to be collected, evaluated and conserved.
Plant germplasm can be stored in seed genebanks and field collections (ex situ), or protected in its natural habitat (in situ). The first method of storage is only possible for species with seeds that do not lose their viability within a short time. Appropriate seed storage technologies have to be worked out for the different species. In-vitro culture of organs, tissues, cells and protoplasts may be suitable for species with recalcitrant seeds. The second method is appropriate for conservation, but existing field collections are often for exhibition purposes and do not cover the genetic diversity of the species concerned. Collections of medicinal plants in South-East Asia are present in Indonesia, Malaysia, the Philippines and Thailand, each consisting of a few hundred accessions. For ex-situ conservation, priority should be given to those plants whose natural habitats have been destroyed or cannot be conserved, or to plants which have become rare or extinct at the local level. In-situ conservation is the best method for conserving germplasm, but is only useful when conservation areas are large enough, well chosen and effectively protected. In-situ and ex-situ conservation complement each other in conserving a maximum of genetic diversity.
An important objective of genetic conservation is to make germplasm more easily available to breeders. Samples from germplasm collections should be freely available to professional plant scientists, but property rights should be respected.

1.2.4 Cultivation and breeding

In several tropical countries a kind of transition exists between plants raised by cultivation and those collected from the wild. Young plants are collected in the wild and then planted out in fields. This kind of production may be called 'wild cultivation'. Botanical drugs obtained in this way are traded as cultivated products (Lange & Schippmann, 1997).
Loss of genetic diversity may cause problems when attempts are made to domesticate medicinal plants. A well-known example is the genus *Cinchona*, the

bark of which has been used for quinine extraction to treat malaria since the end of the 19th Century. Overcollecting led to a drastic decline of the natural populations in South America. Domestication has prevented *Cinchona* from becoming extinct, but the genetic variability became very narrow. Therefore conservation of the last wild stands of *Cinchona* is important for future breeding efforts (Lange & Schippmann, 1997).

Availability of land limits the large-scale planting of medicinal plants. Agroforestry may be an option, combining the cultivation of agricultural crops such as oil palm or rubber with medicinal plants. Enrichment planting with selected species is also possible, both in natural forest and in plantation forest. Tests with enrichment planting of *Eurycoma longifolia* Jack showed promising results in Malaysia, and cultivation trials in oil-palm plantations also indicate interesting possibilities (Azizol Abdul Kadir & Mohd. Ilham Adenan in Nair & Ganapathi, 1998).

It should be checked whether the cultivated plants have the same qualities as the mother stock from the wild, as qualities often depend on growing conditions. Large pharmaceutical companies have well-established laboratories and nurseries to study and grow economically important medicinal plants, but the results are often not freely available because of economic and commercial implications (Rao & Rao in Nair & Ganapathi, 1998).

Genetic improvement of medicinal plants has hardly begun. When plant breeders have exploited most of the available variability in a certain species they look for other sources of variability through hybridization with wild species. Some of the difficulties in breeding quantitative characters can be overcome by combining the traditional techniques with modern molecular techniques. These latter techniques can provide genes to traditional plant breeders from previously inaccessible sources (e.g. unrelated plant species, viruses and bacteria) (Nazmul Haq in Chomchalow & Henle, 1993).

1.2.5 Recommendations for the wise use of medicinal plants

According to IUCN, WHO and WWF (1993) the cultivation of plants as sources of drugs is the best and most promising way to satisfy the market's expanding demand for these raw materials. For wild plant species that are endangered through overexploitation this is certainly the only method to stop their decline and to secure their long-term survival. However, as long as there is a lack of knowledge concerning efficient species-specific cultivation techniques, collecting in the wild will continue to play an important role.

In 2002 the Bonn Guidelines were adopted at the sixth meeting of the Conference of the Parties to the Convention on Biological Diversity. These guidelines were developed in response to growing concerns in many developing countries that the commercial and scientific gains realized from their genetic resources were being reaped only by bio-prospectors based in foreign countries. Although voluntary, the guidelines should improve the way foreign companies, collectors, researchers and other users gain access to valuable genetic resources in return for sharing the benefits with the countries of origin and with local and indigenous communities. This refers especially to medicinal plant resources. For the commercialization of natural resources, benefit sharing may be an incentive for their long-term conservation through local communities. To achieve conserva-

tion goals, commercial users of plant resources should incorporate the costs of sustainable use into their marketing calculations.

1.3 The medicinal and poisonous plants of South-East Asia in retrospect

In the three Prosea volumes on medicinal and poisonous plants about 1290 species are reviewed belonging to 548 genera. All genera have been rated concerning their medicinal importance (based on the text of the papers). The 269 genera valued as having regional or at least local medicinal importance are used for the determination of the most important families of medicinal and poisonous plants, and habit and habitat ratios (Tables 1, 2 and 3, respectively). They belong to 92 different families, illustrating the great diversity of South-East Asian medicinal plants. It should be noted that there are many more medicinally used plants in South-East Asia, but they have another primary use and are treated in other Prosea volumes (see chapter 3 on medicinal and poisonous plants with other primary use). The total number of South-East Asian medicinal and poisonous plants (with recorded uses in the literature) amounts to approximately 2200 species.

Some plant families comprise markedly more medicinal plants than others. Table 1 shows the 10 most important families in terms of number of genera with at least local medicinal importance treated in the Prosea volumes 12(1), 12(2) and 12(3). The weighted importance is determined by dividing this number by the total number of genera classified in the family in the Prosea Basic list of species and commodity grouping (Jansen et al., 1991), which is considered to level down the size of the family. However, families with many small genera in South-East Asia (such as *Compositae*) are probably underestimated and those with few but often large genera (such as *Verbenaceae*) overestimated. It is evident that *Compositae* is an important family of medicinal plants in South-East Asia, but smaller families such as *Amaranthaceae*, *Labiatae*, *Menispermaceae* and *Simaroubaceae* are also of considerable importance. This can be at least partly explained by the common presence of active compounds, such as sesquiterpenoid lactones in *Compositae*, essential oils containing phenolic compounds in *Labiatae*, bisbenzylisoquinoline and protoberberine alka-

Table 1. The 10 most prominent families of medicinal plants in South-East Asia and their weighted importance.

Family	Number of genera	Weighted importance
Compositae	23	0.354
Leguminosae	22	0.158
Apocynaceae	14	0.292
Rubiaceae	12	0.164
Euphorbiaceae	11	0.167
Labiatae	10	0.435
Menispermaceae	10	0.667
Verbenaceae	9	0.391
Simaroubaceae	7	0.875
Amaranthaceae	6	0.600

loids in *Menispermaceae* and quassinoids in *Simaroubaceae*.
Table 2 presents the share of the predominant habit of the genera with at least local medicinal importance treated in Prosea 12. Table 3 shows the share of the predominant habitat of these genera. It can be concluded from these tables that herbs of open, often disturbed habitats, which are often weeds, form the most important group of well-documented medicinal and poisonous plants in South-East Asia. Species restricted to a forest habitat account for a comparatively small share (31%) of the more important medicinal plants. This is a remarkable result considering the fact that forest is still the prevailing land cover in South-East Asia and comprises the most species-rich habitat types, being especially rich in woody species. It seems most likely that the high proportion of herbs from disturbed habitats amongst the more important medicinal plants is because they are so widely distributed and common that they are the most obvious plants to be tried for medicinal purposes. This also suggests that the forest in South-East Asia still accommodates a vast reservoir of potential drug species awaiting pharmacological investigation.

Table 2. Habit of more important South-East Asian medicinal and poisonous plants (in %).

Habit	Proportion
Tree	18%
Shrub	26%
Liana	12%
Herb	44%

Table 3. Habitat of more important South-East Asian medicinal and poisonous plants (in %).

Habit	Proportion
Forest habitat (wild)	31%
Open habitat (wild)	59%
Cultivated	10%

2 Alphabetical treatment of genera and species

Acacia Miller

Gard. Dict., abr. ed.: 4 (1754).
LEGUMINOSAE
$x = 13$; *A. concinna*, *A. pennata*: $2n = 26$

Origin and geographic distribution *Acacia* is a very large genus of over 1300 species and occurs throughout tropical and subtropical regions. Australia is richest with about 700 species occurring naturally. In Malesia, about 30 species have been found.

Uses The 4 *Acacia* species treated here are all used medicinally in South-East Asia. In traditional medicine in Peninsular Malaysia a poultice of leaves is applied to the head for headache, and in Java leaves are used to treat fever. Boiled roots are applied as a poultice against rheumatism and smallpox in Malaysia, and the roots are used against cough and in a complex mixture of dart poison. The stem juice is used in Sumatra to treat sprue. Ash from the pods has been used in Peninsular Malaysia to treat itch. In Thailand the roots are used as an antipyretic and pods as an expectorant and to treat cough.

Acacia species are economically important as sources of timber (e.g. *A. mangium* Willd.), gum (e.g. *A. nilotica* (L.) Willd. ex Del.), tannin (e.g. *A. catechu* (L.f.) Willd. and *A. mearnsii* De Wild.) and essential oil (e.g. *A. farnesiana* (L.) Willd.). Moreover, they may be useful in reafforestation (e.g. *A. auriculiformis* A. Cunn. ex Benth.), for fire protection, to prevent soil erosion, to rehabilitate poor and degraded soils as nitrogen-fixing plants, and as ornamentals. Several of these species have medicinal importance. For example, cutch isolated from the heartwood of *A. catechu* is used to treat cough and sore throat, and its bark is said to be effective against dysentery, diarrhoea and in healing wounds. *A. farnesiana* has numerous medicinal applications in South-East Asia, e.g. the bark is used to treat cough, bleeding gums, gonorrhoea and bladder complaints, the leaves are applied to ulcers and sores, the roots are used against sore throat and tuberculosis, and the fruits against dysentery and inflammation of the skin and mucous membranes.

Properties The seeds of *A. pennata* contain the biogenic amine N-methyltyramine (about 0.5% on a dry weight basis). This compound increased blood pressure in anaesthetized rats, relaxed guinea-pig ileum and increased the force and rate of contraction of guinea-pig right atrium by inducing the release of noradrenaline. It has similar pharmacological properties to tyramine, which is a known cause of dietary migraine. The fruit pulp of *A. concinna* and *A. pennata* has fish stupefying properties and is used in India to catch fish in ponds. The bark contains lupeol, α-spinasterol and tannin (about 9%), and the stem contains sitosterol. The fruit pulp of *A. concinna* contains about 5% saponin. A saponin fraction of the bark showed strong cytotoxic activity against KB cells, as well as spermicidal activity in vitro. Upon alkaline hydrolysis this saponin mixture gave prosapogenols. A monoterpenoidal amide, concinnamide, was isolated from the seeds; it can be synthesized from (−)-linalool, which has antimicrobial activity. Kinmoonosides A–C were isolated as cytotoxic saponins from the fruits.

Extracts of *A. nilotica* bark and pods showed inhibitory effects against HIV-1 replication, and also antibacterial and molluscicidal activities. They inhibited platelet aggregation and had inhibitory effects on paw oedema and pyrexia in rats; they also produced a significant increase in the hot plate reaction time in mice. Triterpenoid saponins isolated from *A. auriculiformis* showed anthelmintic properties and antifilarial activity. Several species (e.g. *A. nilotica* and *A. farnesiana*) showed antimicrobial effects. Some of the pharmacological properties of *Acacia* species are reported to be at least partly due to the presence of tannins.

Botany The following description is applicable to the 4 species treated here.

Scandent shrubs or woody climbers up to 40 m long; branchlets armed with prickles. Leaves alternate, bipinnate, stipulate; petiole and rachis with extrafloral nectaries; leaflets opposite, numerous, small, asymmetrical at base. Inflorescence consisting of pedunculate glomerules aggregated into a raceme or panicle. Flowers bisexual or male, 5-merous, yellowish or creamy, with numerous stamens. Fruit a pod, brownish. Seeds flattened, with a hard blackish-brown testa with pleurogram.

In Malesia, *A. pennata* flowers from November to March and fruits have been found from April to August, *A. concinna* and *A. pluricapitata* can be found flowering and fruiting throughout the year.

A. concinna, *A. pennata*, *A. pluricapitata* and *A. pseudointsia* all belong to the subgenus *Aculeiferum*. They are closely related and sometimes confused. *A. pennata* is a variable species in which 4 subspecies have been distinguished; only subsp. *kerrii* Nielsen is found in Malesia.

Ecology *A. concinna*, *A. pluricapitata* and *A. pseudointsia* occur in primary and secondary rain forests, often at riversides, the former two species

also in forest margins and clearings, up to 1000 m altitude. *A. pennata* is found in the drier parts of Malesia in monsoon forest and scrub vegetation, up to 1200 m altitude.

Management In tests in India, vegetative propagation by cuttings proved successful. Terminal branch cuttings treated with indole-butyric acid (1500 ppm) showed the highest percentage of rooting (54%).

Genetic resources The 4 *Acacia* species treated here do not seem to be endangered because they often occur in secondary forest and scrub vegetation and are widespread. However, in some regions a species can be rare, e.g. *A. pluricapitata* and *A. pseudointsia* in Thailand.

Prospects The bioactivity of the saponins present in the *Acacia* species treated here deserves more attention, particularly the antimicrobial and cytotoxic activities.

Literature 239, 247, 263, 541, 542, 711, 760.

Selection of species

Acacia concinna (Willd.) DC.

Prodr. 2: 464 (1825).

Synonyms *Acacia rugata* (Lamk) Buch.-Ham. ex Benth. (1842), *Acacia sinuata* (Lour.) Merr. (1935).

Vernacular names Soap pod tree (En). Indonesia: kate-kate kecil (Moluccas), gongai (Banda). Cambodia: bânla: sâ-'öt, ba:y dâmna:ëb. Laos: 'sôm^{2} po:y^{1}. Thailand: som khon, som poi (northern). Vietnam: keo l[as] me.

Distribution *A. concinna* is widely distributed in tropical Asia and occurs throughout South-East Asia.

Uses In India and Thailand, a decoction of young leaves is taken for body pain, headache and fever. A decoction of the pods is said to relieve biliousness and acts as a purgative. The pods are in great demand in India as an Ayurvedic product for promoting hair growth and to remove dandruff; they are sold dried and as powder in the market. They have emetic, laxative and diuretic properties and are ingested to treat constipation and kidney and bladder affections. The seeds are used externally in Thailand and India to treat skin diseases. *A. concinna* is used as a hedge plant in Indonesia, whereas the tips of stems are occasionally eaten as a vegetable. In India, tender leaves are used in chutneys; they are acidic. The fruits are sometimes used in cooking in the Philippines. The dried pods are steeped in scented water for ablution during the Water Festival and New Year celebration in Thailand.

Acacia concinna (Willd.) DC. – 1, branch with leaves; 2, flowering branch; 3, flower; 4, fruit.

Observations An erect, spreading or scrambling shrub or liana, up to 18(–30) m long; leaflets membranous, lateral veins of leaflets forming a reticulate pattern beneath, glands on petiole and rachis circular to elliptical; flower glomerules 7–12 mm in diameter; pod oblong, often with constrictions, 4.5–15 cm × 1.5–2 cm. *A. concinna* occurs in primary and secondary rain forests, often at riversides, also in forest margins and clearings, up to 1000 m altitude.

Selected sources 247, 249, 250, 263, 334, 760, 778, 833, 922.

Acacia pennata (L.) Willd.

Sp. pl. 4: 1090 (1806).

Vernacular names Indonesia: areuy garut (Sundanese), ri got, rembete (Javanese). Cambodia: thmâ: roëb'. Laos: 'han, 'han 'kha:w (Louang Prabang). Thailand: nam khi raet (south-western), cha om (central, peninsular), phakla (northern). Vietnam: d[oj]c t[aw]ng (Binh Tri Thiên), m[os]c m[ef]o (Bac Thai), d[aa]y s[oos]ng r[aws]n.

Distribution India, Burma (Myanmar), Indo-China, Thailand, Java, the Lesser Sunda Islands and south-western Sulawesi.

Uses *A. pennata* has been used in Laos against anaemia. In India, a decoction of young leaves is taken to treat body pain, headache and fever, and a decoction of the roots is applied against rheumatism and cough. The bark is used in India as a substitute for soap, and for tanning fishing nets and to produce reddish-brown leather with a stiff, somewhat harsh structure. *A. pennata* is sometimes cultivated in hedges in Thailand, and the leaves are occasionally used as a vegetable.

Observations A scandent shrub or liana; leaflets chartaceous, lateral veins of leaflets not forming a reticulate pattern beneath, glands on petiole and rachis circular to broadly elliptical or patelliform; flower glomerules 6–8 mm in diameter; pod oblong, (6.5–)9–15.5 cm × 1.5–2.5 cm. *A. pennata* is found in the drier parts of Malesia in monsoon forest and scrub vegetation, up to 1200 m altitude.

Selected sources 121, 182, 237, 247, 249, 250, 334, 512.

Acacia pluricapitata Steudel ex Benth.

Lond. Journ. Bot. 1: 516 (1842).

Vernacular names Indonesia: segani recop bulung (Lampung), garut areuy (Sundanese), got (Javanese). Vietnam: s[oos]ng r[aws]n (Sông Bé).

Distribution Southern Vietnam, Thailand, Peninsular Malaysia, Sumatra and Java.

Uses In traditional medicine in Peninsular Malaysia, a poultice of leaves has been applied to the head to treat headache, and in Indonesia the stem juice has been used against sprue.

Observations A scandent shrub or liana up to 21 m long; leaflets chartaceous, lateral veins of leaflets not forming a reticulate pattern beneath, glands on petiole and rachis obconical or cylindrical; flower glomerules 7–8 mm in diameter; pod linear-oblong, often with constrictions, 7–12.5 cm × 2–2.5 cm. *A. pluricapitata* occurs in primary and secondary rain forest, often at riversides, also in forest margins and clearings, up to 1000 m altitude.

Selected sources 247, 249, 250, 334.

Acacia pseudointsia Miq.

Fl. Ind. Bat. 1: 12 (1855).

Vernacular names Malaysia: kelichi, kayap (Peninsular). Thailand: khee chaang (northern).

Distribution Thailand, Peninsular Malaysia, Sumatra, Java and Borneo.

Uses In Peninsular Malaysia, ash from the fruits has been used as powder to treat itch.

Observations A straggling shrub or liana up to 40 m long; leaflets chartaceous, lateral veins of leaflets forming a reticulate pattern beneath, glands on petiole and rachis elliptical to oblong; flower glomerules 9–10 mm in diameter; pod oblong to lanceolate, 18–25 cm × 3.5–5 cm. *A. pseudointsia* occurs in primary and secondary rain forests, often at riversides, up to 1000 m altitude.

Selected sources 121, 247, 249, 334.

S. Aggarwal

Acriopsis javanica Reinw. ex Blume

Bijdr. fl. Ned. Ind.: 377 (1825).

ORCHIDACEAE

$2n = 40$

Vernacular names Brunei: kambang sa-tahun. Indonesia: ki plengpeng (Sundanese), tongkil-tongkil (Batak), bosur-bosur hau (Sumatra). Malaysia: anggerek darat, sakat bawang, sakat ubat kepialu (Peninsular). Papua New Guinea: gaere (Musa), sakko (Amele), sandaru (Orokaiva). Thailand: ruuhinee (Nakhon Si Thammarat). Vietnam: t[oor] y[ees]n.

Origin and geographic distribution *A. javanica* occurs from Burma (Myanmar), Indo-China and Thailand, throughout Malesia, to the Solomon Islands and Australia (Cape York Peninsula); possibly also in India (Sikkim).

Uses There are records from Malaysia of a decoction of *A. javanica* roots and leaves used internally to treat fever.

Properties Traces of alkaloids have been identified in *A. javanica*.

Botany An epiphytic herb up to 115 cm tall, with creeping, branched rhizome; main roots fleshy, with many thin catch roots; pseudobulbs crowded, ovoid, 1.5–6 cm × 1–3 cm, each pseudobulb with (2–)3–4 leaves. Leaves linear, 5–32 cm × 0.5–2 cm. Inflorescence a many-flowered panicle, erect or drooping, peduncle up to 60 cm long. Flowers 8–14 mm in diameter, greenish-white to cream-coloured with purple markings, with 2 boat-shaped sepals, 2 spreading petals and a 3-lobed lip placed before the lower sepal (together giving a cross-shaped outline to the flower); column straight, hood covering the anther which has 4 pollinia in 2 pairs attached to a slender stipe. Fruit globular, ellipsoid or obovoid, 1–2.5 cm × 1 cm, opening with 3 valves. Seeds very small, fusiform, situated between long hairs.

A. javanica can be found flowering and fruiting throughout the year.

Acriopsis is a genus of 6 species, of which *A. javanica* is the most widely distributed. Three varieties are distinguished, based on the shape of the lip.

Ecology *A. javanica* is a common epiphyte on trees in primary and secondary rain forests, freshwater and coastal swamp forests, up to 1600 m altitude.

Genetic resources *A. javanica* is widely distributed and common and does not seem to be threatened. However, var. *floribunda* (Ames) Minderhoud & de Vogel is only known from 2 collections in the Philippines.

Prospects It is not possible to determine the potential of *A. javanica* as a medicinal plant because no information exists on the phytochemistry and pharmacological properties.

Literature 121, 628.

Other selected sources 331, 334.

Diah Sulistiarini

Acrotrema costatum Jack

Mal. Misc. 1(5): 36 (1820).

DILLENIACEAE

$2n$ = unknown

Vernacular names Malaysia: meroyan punai tanah (Pahang, Peninsular). Thailand: pot khon, wan chai maha prap, san tao (peninsular).

Origin and geographic distribution Southern Burma (Myanmar), peninsular Thailand, Peninsular Malaysia and northern Sumatra; possibly also in Bangka.

Uses *A. costatum* has been mentioned in Peninsular Malaysia as one of the many plant resources used as protective medicine after childbirth.

Properties The presence of the flavonoids apigenin and luteolin has been recorded for *A. costatum*. 0.12% (dry weight) of betulinic acid (a triterpene) has been found in *A. uniflorum* Hook. from Sri Lanka. Several flavonoids have been isolated from the latter, of which kaempferol and quercetin occur in the largest amounts.

Botany A small perennial herb with a horizontal woody rhizome. Leaves in a rosette or on a very short stem and then arranged spirally, simple, obovate, 7–25 cm × 3–10 cm, dentate, auriculate at base, hairy, deep green, usually with a whitish or greyish area along the midrib or marked with red; petiole 1–2(–6) cm long. Inflorescence a terminal erect raceme, red-hairy, bracteate, up to 12-flowered. Flowers regular, 5-merous, bisexual, opening singly, c. 3 cm in diameter; petals yellow; stamens numerous, in 3 bundles; carpels 3. Fruit a follicle enclosed by the persistent sepals, irregularly dehiscent, with up to 15 seeds. Seeds finely echinate, with a white aril.

Acrotrema comprises 9 species, 7 of which are endemic to Sri Lanka and 1 to southern India.

Ecology *A. costatum* occurs in dense rain forest, also in secondary forest, often on moist shady rocks, up to 1000 m altitude. It is common in many localities.

Management *A. costatum* can be cultivated successfully under partial shade, but hard soils and strong sunlight are not suitable. Leaf litter provides nutrients and conserves moisture around plants, and is therefore recommended.

Genetic resources *A. costatum* has a rather limited area of distribution and is largely confined to dense lowland rain forest, a habitat which is under increasing pressure. Therefore, it is likely to be liable to genetic erosion, although it is still locally common. The presence of genetic diversity is reflected in a fair morphological variation, but this has not yet been investigated.

Prospects Very little is known about *A. costatum*. There is little prospect of any increase in its importance as a herbal medicine, which is now minor. However, the presence of flavonoids, of which some have proven anti-inflammatory and antispasmodic activities (e.g. apigenin, luteolin and quercetin) in *A. costatum* and related species might be a starting point for research. It may have ornamental value because of its decorative foliage and flowers.

Literature 121, 247.

Other selected sources 249, 331, 731.

H.C. Ong

Actinorhytis calapparia (Blume) H.A. Wendland & Drude ex Scheffer

Ann. Jard. Bot. Buitenzorg 1: 156 (1876).

PALMAE

$2n$ = unknown

Synonyms *Areca calapparia* Blume (1838–1843).

Vernacular names Calappa palm (En). Indonesia: jambe sinagar (Sundanese), jawar (Javanese), pinang kalapa (Ambon). Malaysia: pinang penawar, pinang sendawa, pinang hantu (Peninsular). Philippines: tangalo (Bagobo).

Origin and geographic distribution Calappa palm is native to New Guinea and the Solomon Is-

lands, but has been introduced and is now widespread throughout Malesia.

Uses The fruit of calappa palm is sometimes used in a lotion to treat scurf. Powdered seeds are occasionally used as baby powder. The fruit kernel can be eaten, although it is tough, and it is used for chewing as a substitute for betel nut from areca palm (*Areca catechu* L.). Calappa palm is also planted as ornamental, e.g. in gardens, as it is very decorative. It is also considered a magic plant, protecting the person who carries a fruit. It is often planted around villages. The fruit kernel is often used as a toy by children.

Properties There is no information available on the properties of calappa palm. The fruit kernels of areca palm, however, contain polyphenolics (e.g. (+)-catechin and procyanidin), especially when unmature. It is possible that the fruits of calappa palm contain similar compounds.

Botany A medium-sized tree up to 15 m tall, with slender, erect, bare stem, conspicuously marked with leaf scars and with a large conical mass of roots at base. Leaves alternate, pinnate, arching, up to 3 m long, with tubular sheaths forming a long, slender crown shaft; leaflets very numerous. Inflorescences on the stem below the leaves, large, widely spreading, horizontal or pendulous, branching to 3 orders proximally, to 1 order distally, with tubular prophyll entirely enclosing the inflorescence in bud; ultimate branches bearing spirally arranged triads (consisting of 2 lateral staminate flowers and a central pistillate flower) in the proximal half to two-thirds, and paired or solitary staminate flowers distally. Flowers unisexual, 3-merous, petals about twice as long as sepals; male flowers with numerous stamens and rudimentary pistil; female flowers larger, with superior unilocular ovary crowned by 3 large stigmas, and 3 rudimentary stamens. Fruit an ovoid drupe, c. 6 cm long, turning red at maturity, endocarp with circular operculum, 1-seeded. Seed globose, with lateral, longitudinal hilum, endosperm deeply ruminate.

A. calapparia starts flowering when 4–5 years old.

Actinorhytis comprises 2 species. Most characteristic are the arching leaves, slender crown shafts, conical masses of roots at the base of the trunk, widely spreading inflorescences below the leaves, and comparatively large fruits. The genus is ranked in the tribe *Areceae*.

Ecology In its native area, calappa palm is found in lowland rain forest up to 1000 m altitude. It can not stand too dry soils, and prefers clayey or loamy soils.

Management Calappa palm is propagated by seed. Fully ripe fruits are dried for a few days and then planted in shallow pits 2–5 cm apart; later the seedlings are transferred to nursery beds at a spacing of 30 cm. The young trees are transplanted into the field when 1–2 years old.

Genetic resources Although calappa palm originally had a limited area of distribution, it is now widespread in Malesia. It does not seem to be endangered, but some protection of wild populations in New Guinea and the Solomon Islands is recommended to prevent genetic erosion.

Prospects Calappa palm is an interesting multipurpose tree. However, almost nothing is known about its properties. Research is needed to determine the scientific basis for the medicinal applications. Selection and breeding work combined with research on methods of propagation might enhance its ornamental value.

Literature 334, 941.

Other selected sources 117, 121, 437, 760, 821.

Juliana Jonathan

Adenia Forssk.

Fl. Aegypt.-Arab.: 77 (1775).

PASSIFLORACEAE

$x = 12$

Origin and geographic distribution *Adenia* comprises almost 100 species and is distributed in the tropical and subtropical regions of the Old World. Africa is richest in species (about 60), followed by Madagascar (about 20) and southern Asia (about 15). In Malesia, 6 species occur, of which *A. heterophylla* is the most widespread, occurring from Indo-China to the Solomon Islands and northern Australia.

Uses In South-East Asia *Adenia* is used medicinally for various complaints. The stem juice of *A. cordifolia* is applied as an eyewash against conjunctivitis, and the leaves are used to treat convulsions. A decoction of *A. heterophylla* roots has been used to treat stomach troubles. A poultice of leaves of *A. macrophylla* is applied to treat headache, and a lotion of the roots to treat ringworm. *A. penangiana* is used to treat chest and body pain.

A. hondala (Gaertner) W.J. de Wilde from southern India and Sri Lanka possesses antiseptic properties. The juice is used to treat chest complaints. The roots are an ingredient of tonics, and the juice of roots and leaves is applied externally against skin troubles.

Several *Adenia* species are important medicinal plants in Africa, the most important being *A. cissampeloides* (Planchon ex Hook.) Harms, *A. lobata* (Jacq.) Engl. and *A. volkensii* Harms. The most common uses include external application of stem decoctions as a sedative, and internal application of stem and leaf decoctions to treat gastro-intestinal troubles, chest complaints, cough and fever.
The poison present in various plant parts is sometimes used in hunting. In Indo-China, rice grains soaked in a maceration of *A. cardiophylla* (Masters) Engl. are used to capture birds; the birds die almost immediately after ingesting the rice, but their meat remains edible. In Africa, pounded stems and roots of several species are applied as fish poison.
The stems are sometimes used as binding material.

Properties In an in-vitro test, an extract of stems and leaves of *A. cordifolia* showed antibacterial activity, i.e. total inhibition of growth of *Staphylococcus aureus* and partial inhibition of growth of *Escherichia coli*. However, biological screening of a 1:1 ethanol-water extract showed negative results for antiviral, antibacterial, antifungal and spasmolytic activities. Toxicity tests showed a LD_{50} of 681 mg/kg body weight when administered intraperitoneally to mice.
Cyanogenic compounds and toxic proteins are the cause of the poisonous properties of roots and stems. Several of these compounds are pharmaceutically interesting and have been studied in African *Adenia*. The polyacetylenic di-epoxide gummiferol isolated from the leaves of *A. cissampeloides* exhibits significant activity against the KB human cell line and a broad spectrum against other human cancer cell lines. Volkensin is a highly toxic compound from the roots of *A. volkensii*; it is a galactose-specific lectin and a potent inhibitor of eukaryotic protein synthesis. This ricin-like toxin resembles modeccin, which is purified from the roots of the African *A. digitata* (Harv.) Engl. Modeccin agglutinates erythrocytes of several mammalian species. Furthermore, the cyanogenic glycosides tetraphyllin B and epi-tetraphyllin B have been isolated from the roots of *A. cissampeloides*, *A. glauca* Schinz and *A. volkensii*.

Botany Woody or herbaceous perennial climbers, usually dioecious, often with tubers. Leaves simple, entire or lobed, pinnately or palmately veined; petiole with 1–2 glands at apex; stipules minute. Inflorescence axillary, cymose, often with 1(–3) tendrils. Flowers unisexual, (4–)5(–6)-merous, mostly greenish to yellowish, with saucer-shaped, cup-shaped or tubiform hypanthium; sepals free or partially connate; petals free or partially connate with the calyx tube, corona present or absent; disk mostly composed of 5 strap-shaped or clavate appendages; stamens 5, free or partially connate, anthers mostly acute or acuminate, reduced to staminodes in female flowers; ovary superior, vestigial in male flowers, with 3(–5) styles. Fruit a 3-valved capsule, leathery or woody, stipitate, red when mature. Seeds compressed, with pitted testa, enclosed in an aril. Seedling with epigeal germination; cotyledons foliaceous.
All species treated here can be found flowering and fruiting throughout the year, but flowering occurs mostly in the rainy season. Pollination is probably carried out by insects; bees and ants have been observed visiting the flowers.
In *Adenia*, 6 sections have been distinguished. The species found in Malesia belong to section *Erythrocarpus* (e.g. *A. cordifolia*, *A. heterophylla*, *A. macrophylla*) and section *Microblepharis* (*A. penangiana*).

Ecology *Adenia* occurs in primary and secondary forest, also in scrub vegetation and forest edges and clearings, up to 1200(–2000) m altitude. All species are found in regions with per-humid climatic conditions, except *A. heterophylla*, which shows a preference for seasonal climates.

Genetic resources The species treated here have fairly large areas of distribution, are locally common, and occur in various habitats. They do not seem to be at risk of genetic erosion. However, two other Malesian species, *A. kinabaluensis* W.J. de Wilde from Sabah and *A. crassa* Merr. from the Philippines, have very restricted distributions and may easily become endangered.

Prospects Very little is known about the properties and pharmacological activity of South-East Asian *Adenia*. There is more information available on the African species, and as several pharmacologically interesting compounds have been found, research on South-East Asian *Adenia* seems worthwhile.

Literature 120, 182, 247, 296.

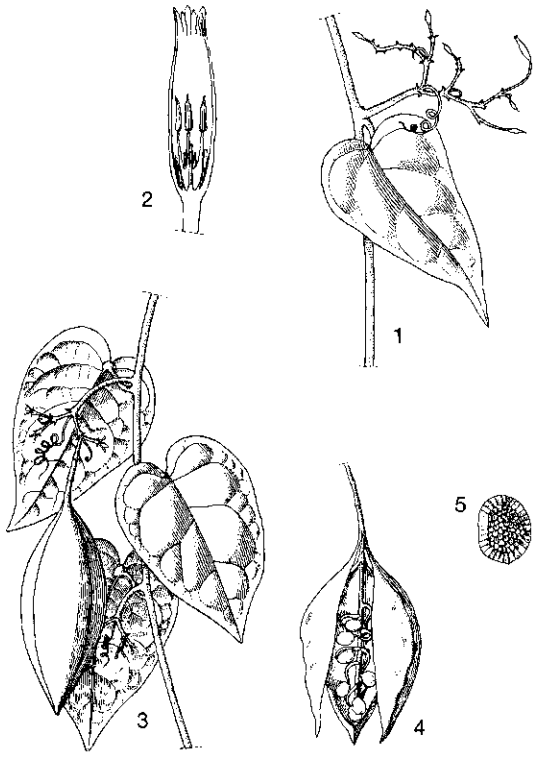
Selection of species

Adenia cordifolia (Blume) Engl.

Bot. Jahrb. 14: 376 (1891).

Synonyms *Adenia obtusa* (Blume) Engl. (1891), *Adenia populifolia* auct. non (Blume) Engl.

Vernacular names Indonesia: areuy babalingbingan, areuy calingcing (Sundanese), layang-



Adenia cordifolia (Blume) Engl. – 1, branch with male inflorescence; 2, male flower in longitudinal section; 3, branch with fruit; 4, dehisced fruit; 5, seed with aril removed.

layang (Kedayan). Malaysia: akar kail, akar kelipunang (Peninsular).

Distribution Peninsular Malaysia, Sumatra, western Java, Borneo and the Philippines (Palawan).

Uses The stem juice is used in an eyewash in Sumatra to treat conjunctivitis. In Malaysia the leaves have been used for fumigating children suffering from convulsions. The stems are used for binding purposes under water.

Observations A liana up to 20 m long; leaves entire, rounded to deeply cordate and not peltate at base, with 2 glands on deeply hollowed auricles at the apex of the petiole, auricles separate from the leaf blade; flowers tubiform-urceolate with connate sepals with erect lobes, corona absent; fruit ellipsoid-oblong to fusiform. *A. cordifolia* occurs both in scrub and forest vegetation, also in peat swamp forest, up to 1200 m altitude.

Selected sources 87, 121, 205, 247, 296, 334.

Adenia heterophylla (Blume) Koord.

Exkurs.-Fl. Java 2: 637 (1912).

Synonyms *Adenia populifolia* (Blume) Engl. (1891), *Adenia acuminata* (Blume) King (1903).

Vernacular names Indonesia: areuy patuk manuk (Sundanese), kabelo (Kangean), sasariwu (Talaud Islands). Papua New Guinea: malasibi. Philippines: binoyok-boyok (Tagalog), saka-saka (Ilokano), tabungau (Mindoro). Cambodia: var kombo. Laos: khua 'phak poun, khua ngouang bouang. Vietnam: th[uw] di[eej]p d[ij] di[eej]p.

Distribution The Andaman Islands, Indo-China, southern China, Thailand, Malesia (except Peninsular Malaysia, Sumatra and Borneo), the Solomon Islands and northern Australia.

Uses In the Philippines, a decoction of the root is considered a remedy for stomach troubles. The poisonous fruit is sometimes used for hunting, although the juicy aril has been mentioned as being edible and sweet. The poison from the fruit is used in the Andaman Islands as an arrow-poison.

Observations A liana up to 30 m long; leaves entire to 5-partite, not peltate at base, with 2 glands on shallowly concave auricles at the apex of the petiole, auricles more or less adnate to leaf blade; flowers tubiform with connate sepals having reflexed lobes, corona absent; fruit ellipsoid to oblong. *A. heterophylla* is a variable species in which 4 subspecies and 2 varieties have been distinguished. In Malesia, subsp. *heterophylla* var. *heterophylla*, subsp. *heterophylla* var. *celebica* (Koord.) W.J. de Wilde and subsp. *australis* (R.Br. ex DC.) W.J. de Wilde are found. *A. heterophylla* occurs both in scrub and forest vegetation up to 1000 m altitude (in New Guinea up to 2000 m), and shows a preference for seasonal climates.

Selected sources 182, 205, 247, 250.

Adenia macrophylla (Blume) Koord.

Exkurs.-Fl. Java 2: 637 (1912).

Synonyms *Adenia singaporeana* (Wallich ex G. Don) Engl. (1891), *Adenia acuminata* auct. non (Blume) King.

Vernacular names Brunei: akar petjah tutuban. Indonesia: akar jala, akar talun tungang, sautan (Sumatra). Malaysia: akar saut, mentimun paya, pedendang (Peninsular).

Distribution Peninsular Malaysia, Sumatra, western and central Java, and Borneo.

Uses A poultice of the leaves is applied in Peninsular Malaysia to headache, and a lotion made from the roots is used against ringworm. In Sumatra, the inner bark has been used for spinning threads for fishing tackle.

Observations A liana up to 25 m long; leaves entire to slightly lobed, acute-acuminate to rounded and not peltate at base, with 2 glands on semi-orbicular auricles at the apex of the petiole, auricles more or less adnate to leaf blade; flowers narrowly tubiform-urceolate with connate sepals having refexed lobes, corona absent; fruit globular to fusiform. *A. macrophylla* is a variable species in which 3 varieties have been distinguished; these all occur in Malesia. *A. macrophylla* occurs in primary and secondary forest up to 1000(–1500) m altitude, also in forest edges, on many different soils.

Selected sources 121, 205, 247, 334.

Adenia penangiana (Wallich ex G. Don) W.J. de Wilde

Blumea 15: 266 (1967).

Synonyms *Adenia nicobarica* (Kurz ex Trim.) King (1903), *Adenia parvifolia* Pierre ex Gagnep. (1920).

Vernacular names Laos: sa ya nang. Thailand: paak kaa, moak mok, khee kaa (peninsular). Vietnam: th[uw] di[eej]p l[as] nh[or], d[aa]y say n[aws]ng.

Distribution The Nicobar Islands, Indo-China (Laos, southern Vietnam), peninsular Thailand, Peninsular Malaysia and Sumatra.

Uses *A. penangiana* is used in the Nicobar Islands (India) to treat chest and body pain.

Observations A small climber or creeper up to 6 m long; leaves entire, peltate at base, with 2 free or contiguous glands at base of leaf blade; flowers campanulate with free, spreading sepals, corona of fine hairs or a finely laciniate membrane present; fruit ellipsoid to oblong. *A. penangiana* is a variable species in which 2 varieties are distinguished: var. *penangiana* is found throughout the range of the species, var. *parviflora* (Pierre ex Gagnep.) W.J. de Wilde in peninsular Thailand and north-western Peninsular Malaysia. *A. penangiana* occurs both in scrub and forest vegetation, also on limestone, up to 1200 m altitude.

Selected sources 205, 247, 250, 867.

Muhammad Mansur

Adenosma R.Br.

Prodr.: 442 (1810).

SCROPHULARIACEAE

x = unknown; *A. indiana*: $n = 36$

Origin and geographic distribution *Adenosma* comprises about 15 species and is distributed in tropical Asia and Australia. In Indo-China, 9 species have been found, in Thailand 7 species. Approximately 5 species occur in Malesia, of which *A. caerulea*, *A. indiana* and *A. javanica* (Blume) Koord. are the most widespread.

Uses In Malaysia, a decoction of *Adenosma* roots has been used internally to treat bowel complaints and rheumatism. In Vietnam, the flowering tops are applied as a diuretic, diaphoretic and cholagogue, as a tonic and alterative for women after childbirth, and to treat fever, jaundice, viral hepatitis, oliguria, ophthalmia, vertigo and dyspepsia. Extracts and decoctions of *A. caerulea* are commonly used in Vietnam; they are considered to have powerful antibacterial, cholagogue, diuretic and stomachic effects. In China, *A. caerulea* is applied to treat rheumatoid arthritis and skin diseases, and *A. indiana* to treat fever, headache, dyspepsia, gastroenteritis and skin inflammations. The latter species is also used to make a potion to soothe the body. It is also applied as insecticide; it is put in bundles in rooms or spread on beds. The plants are also put on the body for perfume and decoration.

A. bracteosa Bonati is also considered a valuable medicinal plant in Indo-China.

Properties Plants are fragrant, both in fresh and dry condition, due to the presence of an essential oil (up to 1%). More than 35 constituents have been identified in the essential oil from the aerial parts of Vietnamese *A. caerulea*, the major constituents being α-pinene (about 23%), 1,8-cineol (18%) and γ-terpinene (17%). L-fenchone was the main component of the essential oil of *A. indiana* (about 34%); other compounds include L-limonene (23%) and α-humulene (12%). In essential oil from Vietnamese *A. bracteosa* thymol (about 26%) was the major component, followed by linalool (13%) and (E)-β-farnesene (10%); however, a different chemotype of *A. bracteosa* has also been found, which contains 1,8-cineole, carvacrol (34%), methyl carvacrol (19%) and β-bisabolene (17%).

Studies in Vietnam showed that *Adenosma* drugs are non-toxic; they display antibacterial and antiphlogistic activity and increase bile secretion. Extracts of *A. caerulea* and *A. indiana* showed marked anti-inflammatory activity in tests on laboratory animals. Treatment of patients suffering from hepatitis showed positive results.

Botany Annual or perennial herbs, often aromatic. Leaves opposite, simple, serrate, petiolate or subsessile; stipules absent. Inflorescence axillary and terminal, head-like or spike-like. Flowers bisexual, with 2 bracteoles at base of calyx; calyx irregularly 5-lobed; corolla with cylindrical tube,

bilabiate, upper lip entire to emarginate, lower lip 3-lobed; stamens 4, included, didynamous, adnate to halfway the corolla tube; ovary superior, 2-locular, style filiform, stigma 2-lobed. Fruit a capsule, dehiscent with 4 valves, many-seeded. Seeds small, with reticulate testa.

Ecology *Adenosma* is found in open forest and forest edges, grassland, rainfed rice fields and along watercourses, up to 1300 m altitude.

Management In Vietnam, *A. caerulea* is cultivated for medicinal purposes; it is propagated by seed. When seedlings attain a height of 15–20 cm, they are transplanted in the field at a planting distance of about 20 cm. They should be kept free of weeds and top-dressed with manure. The plants can be harvested 3.5–4 months after planting. The yield is 2.5–3 t/ha of air-dry material.

In some areas of China, *A. indiana* is intercropped with upland rice. It is planted together with the rice at the beginning of the rainy season, but in different planting holes. It is harvested 1–2 months after rice harvesting.

Plants are usually collected at the flowering stage. The whole plant except for the root is gathered. Plants are dried in the shade; overheating should be avoided.

Genetic resources The *Adenosma* species treated here are widely distributed and occur commonly in disturbed vegetation. This makes them in general unlikely to be at risk of genetic erosion. However, up to 100 t of dry *A. caerulea* plant material is collected annually from the wild in Vietnam, and this has led to a decline in population size. For this reason, the species has started to be cultivated in recent years.

Prospects The *Adenosma* species in Malesia seem to be poorly known and little used. However, elsewhere in mainland South-East Asia they are popular medicinal plants. They contain pharmacologically interesting compounds, particularly in the essential oil, and seem to have potential as insecticide as well.

Literature 250, 673, 741.

Selection of species

Adenosma caerulea R.Br.

Prodr.: 443 (1810).

Synonyms *Adenosma glutinosa* (L.) Druce var. *caerulea* (R.Br.) Tsoong (1974).

Vernacular names Malaysia: rumput gembot, magun jantan, berpulut (Peninsular). Laos: ha:x na: (Borikhane), hlak na: (Khammounane). Thailand: ya khao kam (north-eastern), sanam chao (south-eastern). Vietnam: nh[aa]n tr[aaf]n, ch[ef] c[as]t, ch[ef] n[ooj]i.

Distribution India, Sri Lanka, Indo-China, southern China, Thailand, Peninsular Malaysia, Java, Borneo and Australia.

Uses In Malaysia, a decoction of the roots has been used internally to treat bowel complaints and rheumatism. In Vietnam, the flowering tops are used as a diuretic, diaphoretic and cholagogue, and in tonics and alterative for women after childbirth as well as to treat fever, jaundice, viral hepatitis and eye inflammations. In China, *A. caerulea* is used to treat rheumatoid arthritis and skin complaints.

Observations An erect perennial herb up to 100 cm tall, stems densely glandular hairy; corolla 8–25 mm long, pilose outside, purple; fruit 7 mm × 5 mm. *A. caerulea* occurs in edges of evergreen forest, in open, grassy forest, upland rice fields and on sandy locations along watercourses, up to 1300 m altitude.

Selected sources 6, 121, 217, 249, 250, 671, 673, 731, 741, 971.

Adenosma indiana (Lour.) Merr.

Comm. Fl. cochinch.: 351 (1935).

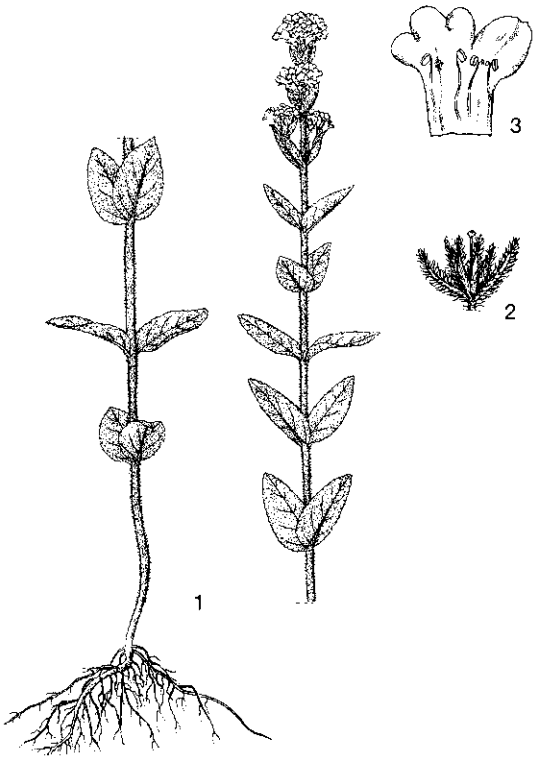
Synonyms *Adenosma capitata* (Benth.) Benth. ex Hance (1873), *Adenosma buchneroides* Bonati (1913), *Adenosma bilabiata* (Roxb.) Merr. (1923).

Vernacular names Malaysia: rumput kuching-kuching, ruku hutan, tasek-tasek (Peninsular). Cambodia: mréch' te:hs (general). Laos: hnha:z khauz kamx (Sédone). Thailand: phrik kratai (south-eastern), kratai cham (south-western), khao kam (eastern). Vietnam: nh[aa]n tr[aaf]n hoa d[aaf]u, b[oof] b[oof], ch[ef] n[ooj]i.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Java, Borneo and the Philippines.

Uses In Malaysia, a decoction of the roots has been used internally to treat bowel complaints and rheumatism. The plant was also used as a poultice against pain in the abdomen. In Vietnam, the flowering tops are used as a diuretic, diaphoretic and cholagogue, and in tonics and alterative for women after childbirth and to treat fever and jaundice. In China, *A. indiana* is used to make a potion to soothe the body. It is also applied as an insecticide; it is put in bunches in rooms or spread on beds. The plants are also put on the body for perfume and decoration.

Observations An erect annual herb up to 70 cm



Adenosma indiana (Lour.) Merr. – 1, habit of plant; 2, flower with corolla removed; 3, opened corolla showing stamens.

tall, stems white-hirsute; corolla 5–6 mm long, glabrous outside, violet; fruit 3.5 mm × 2.5 mm. *A. indiana* occurs in open deciduous forest, open shady grassland, rice fields and along watercourses up to 1200 m altitude.

Selected sources 121, 217, 249, 250, 533, 671, 731, 854, 971.

Nguyen Tap & Nguyen Kim Bich

Aeginetia indica L.

Sp. pl. 2: 632 (1753).

OROBANCHACEAE

$n = 15$

Synonyms *Aeginetia pedunculata* auct. non (Roxb.) Wallich.

Vernacular names Indonesia: rajatawa (Javanese). Philippines: dapong-tubo (Tagalog), suako-ti-uak (Iloko), lapo (Ibanag). Thailand: so-suai (Karen, Mae Hong Son), dok din daeng (Trat), paak cha khe (north-eastern). Vietnam: l[eej] du[uw][ow]ng, tai d[aas]t.

Origin and geographic distribution *A. indica* occurs throughout tropical and subtropical Asia, from India and Sri Lanka to China and Japan, and throughout South-East Asia, but its distribution is poorly known. In Malesia, it is recorded from Java and the Philippines; possibly also in Peninsular Malaysia and New Guinea.

Uses In the Philippines an infusion of *A. indica* is used internally against diabetes, and a decoction to treat fluid accumulations due to acute nephritis. In Vietnam and Thailand, *A. indica* is also applied to treat diabetes, and in Taiwan against hepatitis and other liver diseases.

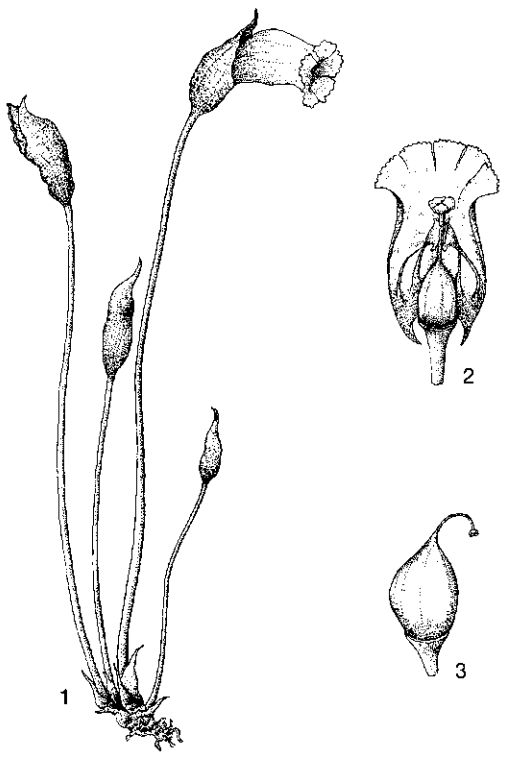
Properties Aeginetic acid, the monoterpenoid lactone aeginetolide, 3 polyene compounds and β-sitosterol were identified in an ethanolic extract of the whole plant, and the glycosides hydroxy-β-ionone glucoside, aeginetoside and the iridoid isoaucubin were identified in an n-butanol extract.

The extract from seeds induced potent antitumour immunity against fibrosarcomas in mice. It was demonstrated that the extract contained polysaccharides and proteins. The polysaccharides induced B cell mitogenic and thymocyte co-stimulatory effects in vitro, whereas the proteins mediated antitumour activity in vivo. In-vitro activities of the extract on the induction of cytokine production and lymphocyte proliferation have been recorded; these might contribute to the in-vivo antitumour effect. Antihepatotoxic activity has also been recorded for *A. indica*.

Botany A slightly fleshy parasitic herb up to 40 cm tall, somewhat reddish; stem subterranean or scarcely emergent above the ground, with few scale-like leaves. Flowers on long pedicels up to 30 cm long from the axils of scales, bisexual, zygomorphic; calyx spathe-like, split in front nearly to the base, 2–3 cm long; corolla gamopetalous, 3–5 cm long, with elongate, curved tube, limb obscurely 2-lipped having 5 subequal lobes, pinkish-purple; stamens 4, inserted on the corolla tube, included; ovary superior, 1-celled, style slender with large peltate stigma. Fruit an ovoid to globose capsule, many-seeded. Seeds very small, brownish.

The seeds germinate slowly and show distinct dormancy.

Aeginetia is a small genus of approximately 6–10 species and is distributed in tropical and subtropical Asia, from India and Sri Lanka to Japan and New Guinea. *A. indica* has probably often been confused with *A. pedunculata* (Roxb.) Wallich, which usually has shorter pedicels and larger



Aeginetia indica L. – 1, habit of flowering plant; 2, flower with calyx removed and opened corolla; 3, fruit.

whitish or yellowish flowers with purplish or bluish corolla lobes.

Ecology *A. indica* is parasitic on the roots of grasses, and occurs mainly in grassland, but sometimes also in forest. *Imperata* and rice (*Oryza sativa* L.) are common hosts in Java, *Miscanthus* in Taiwan and Japan. However, several other hosts have been mentioned, e.g. millet (*Panicum miliaceum* L.), maize (*Zea mays* L.), but also *Carex*, *Luzula*, *Zingiber* and *Canna* spp. *A. indica* can be a destructive parasite in rice, and sometimes in other crops as well.

Genetic resources *A. indica* has an extremely large area of distribution and occurs in anthropogenic habitats. It is not threatened by genetic erosion.

Prospects The antitumour activity of *A. indica* found in tests with mice warrants more research concerning the active compounds and to establish the value in human cancer treatment. The findings show that proteins are present that may be useful immunotherapeutic agents for patients with malignant diseases. The reported activity against diabetes should also be investigated. A thorough taxonomic revision of *Aeginetia* is needed.

Literature 129, 130, 131, 231, 694, 697, 760.
Other selected sources 62, 121, 182, 334, 544.

R.H.M.J. Lemmens

Aeschynanthus Jack

Trans. Linn. Soc. London 14: 42, t. 2, f. 3 (1823).
GESNERIACEAE
x = 15, 16; *A. lamponga*: $2n$ = 64, *A. longicaulis*: $2n$ = 28, 30, *A. radicans*: $2n$ = 30, 32

Origin and geographic distribution *Aeschynanthus* comprises about 150 species, and is distributed from Nepal, India and Sri Lanka, through Indo-China, southern China, Thailand and the whole of Malesia, to the Solomon Islands. The total number of species occurring in South-East Asia is not known, but about 30 species have been recorded for Borneo as well as the Philippines.

Uses Some medicinal uses have been recorded for *Aeschynanthus* in Peninsular Malaysia: an infusion has been given to children as a vermifuge, and the leaves have been used to poultice boils and to treat headache. Several species are cultivated as an ornamental and also as indoor pot plant in temperate regions. This is due to their vividly coloured flowers and/or attractively mottled foliage, e.g. *A. longicaulis*, *A. radicans* and *A. speciosus* Hook.

Properties Very little is known about the properties and phytochemistry of *Aeschynanthus*. Caffeic acid has been isolated from the leaves of *A. longiflorus* (Blume) DC.
A. pulcher (Blume) G. Don (perhaps only a form of *A. radicans*) has been recorded as causing dermatitis, but the allergenic compounds are unknown.

Botany Epiphytic shrubs or herbs, often scandent or drooping. Leaves opposite or in whorls, more or less fleshy, pinnately veined. Inflorescence an axillary or terminal fascicle or cyme, or flowers solitary. Flowers bisexual, 5-merous; calyx dentate to partite; corolla gamopetalous, with terete-funnel-shaped, curved tube and 2-lipped limb having 5 unequal lobes; fertile stamens 4, inserted at the base of the corolla, didynamous, exserted, staminode 1, inserted on the posterior wall of the corolla tube; disk annular; ovary superior, linear, shortly stipitate, style with broad stigma. Fruit a linear 2-valved capsule, many-seeded.

Seeds ellipsoid, acutely tuberculate, often with an elaiosome, on each end with a single white hair, or on one end with a single hair and on the other with a tuft of hairs. Seedling with epigeal germination; cotyledons unequal in size; first leaves pubescent, later leaves more or less glabrous.

The flowers are probably pollinated by birds, having exserted anthers shedding pollen downwards, strong protandry and copious nectar.

Aeschynanthus has been subdivided into 5 sections. In older literature, the species are ranked in the genus *Trichosporum*, which is older than *Aeschynanthus*. However, *Aeschynanthus* has been conserved against *Trichosporum*.

Ecology The plants are usually epiphytic on trees, but they sometimes also grow on rocks.

Management *Aeschynanthus* can be easily grown from seed, but even more easily propagated from cuttings. In-vitro micropropagation is practised successfully with some ornamental species. Anthracnose caused by *Colletotrichum gloeosporioides* has been observed in cultivated *A. radicans*. Tobacco mosaic virus has been recorded in pot plants of some cultivated *Aeschynanthus*.

Genetic resources As is often the case in large genera, some species have large areas of distribution and are common (e.g. *A. radicans*), whereas others are endemic to a small region or have been collected in a few locations. Moreover, the distribution of most species is not completely known. A large-flowered form of *A. radicans* has been noticed on Java.

Prospects Although *Aeschynanthus* is probably not much used in traditional medicine, research on its phytochemistry and biological activity is desirable. A thorough taxonomic revision of the genus is still lacking.

Literature 121, 123, 331.

Selection of species

Aeschynanthus lamponga Miq.

Fl. Ned. Ind., Suppl. 1(3): 563 (1861).

Synonyms *Trichosporum lampongum* (Miq.) Burkill (1935).

Vernacular names Malaysia: akar melukut (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses The leaves have been used for poulticing in Malaysia, but it is not clear for what complaints.

Observations A herb with slender, creeping and rooting stem; leaves elliptical-ovate to lanceolate-ovate, obtuse; corolla much longer than calyx, c. 5 cm long, red; fruit unknown. *A. lamponga* occurs as an epiphyte in forest up to 1000 m altitude.

Selected sources 121, 789.

Aeschynanthus longicaulis R.Br.

Benn., Pl. jav. rar. 2: 116 (1840).

Synonyms *Aeschynanthus marmoratus* T. Moore (1853), *Trichosporum marmoratum* (T. Moore) O. Kuntze (1891).

Vernacular names Malaysia: maman kurai (Peninsular). Thailand: taanlaai, nommia hin (Surat Thani), uleang khaao kam (Chiang Mai). Vietnam: m[as] d[af]o th[aa]n d[af]i.

Distribution Burma (Myanmar), Vietnam, Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia, the leaves have been used for poulticing boils. *A. longicaulis* is a popular ornamental, particularly for its foliage.

Observations A tufted herb of c. 30 cm tall; leaves lanceolate, acute, with dark green markings above and purple markings beneath; corolla much longer than calyx, 2–3.5 cm long, greenish with brown bars in the mouth; seeds with 1 hair at one end and with a tuft of hairs at the other. *A. longicaulis* grows on trees, bamboos and limestone rocks, up to 850 m altitude.

Selected sources 121, 123, 770, 789.

Aeschynanthus radicans Jack

Trans. Linn. Soc. London 14: 43 (1823).

Synonyms *Trichosporum radicans* (Jack) Nees (1825).

Vernacular names Malaysia: akar berenas, akar setebal, akar kechubong ayer (Peninsular).

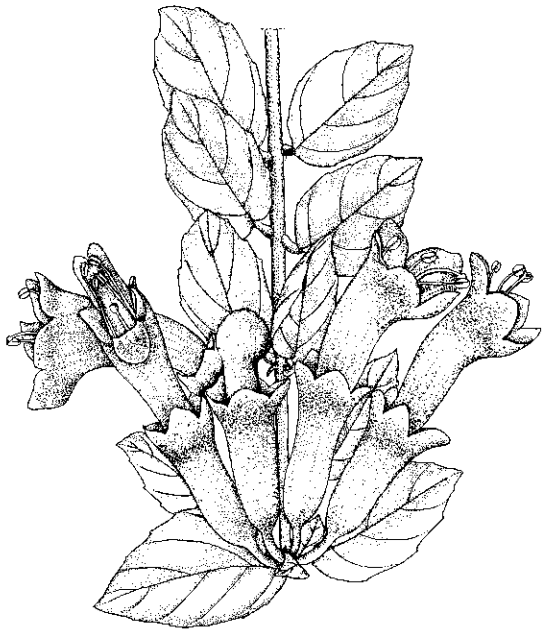
Distribution Peninsular Malaysia, Singapore, Sumatra, Java and Borneo.

Uses The leaves have been used for a poultice on the head to treat headache.

Observations A creeping herb up to 150 cm long; leaves broadly ovate to ovate-lanceolate, obtuse to subacute; corolla much longer than calyx, 4.5–7.5 cm long, bright red; seeds with 1 hair at each end. *A. radicans* grows in forests on trees and rocks up to 1750 m altitude, and is common in many regions.

Selected sources 62, 121, 731, 770, 789, 952.

R.E. Nasution



Aeschynanthus radicans Jack – flowering stem.

Aganosma (Blume) G. Don

Gen. Syst. 4: 77 (1837).
APOCYNACEAE
x = unknown; *A. dichotoma*: $2n = 22$

Origin and geographic distribution *Aganosma* comprises 8 species and is distributed from India and Sri Lanka, through Indo-China, southern China, Thailand and western Malesia to the Philippines and the Moluccas. Only 2 species occur naturally in Malesia, but a third one (*A. dichotoma*) is cultivated in gardens. 6 species have been found in Thailand, and 4 in Vietnam.

Uses In India, *A. dichotoma* is credited with antiseptic, emetic and anthelmintic properties and is also used to treat bronchitis. The leaves are used against biliousness, and the flowers for treating eye troubles. In Malaysia, a decoction of *A. marginata* roots is commonly used internally to treat urinary troubles, as a tonic during fever, and as an emmenagogue. In Thailand, roots, stems, leaves, flowers and fruits of the latter species are applied against fever. In India, *A. wallichii* is said to be useful in diseases of the bile and blood. The latex of some species is occasionally used as rubber in Indo-China. The fibrous bark is sometimes used for binding purposes.

Properties The leaves of *A. marginata* have a sweetish taste. Flavonoids such as rutin, robinin and other glycosides of kaempferol and quercetin have been isolated from *Aganosma*.

Botany Lianas or scramblers, producing latex; stems often lenticellate. Leaves opposite, simple and entire, petiolate; stipules absent, but often with an interpetiolar ridge bearing glands. Inflorescence a terminal or sometimes axillary panicle. Flowers bisexual, 5-merous, actinomorphic, usually fragrant; sepals with free lobes; corolla gamopetalous, with narrowly cylindrical tube sometimes somewhat inflated below and spreading to erect lobes in bud overlapping to the right, white, sometimes yellowish; stamens inserted to a slightly widening part of the corolla tube, included, attached in a ring to the pistil head; disk of 5 fused, occasionally free lobes surrounding the ovary; ovary superior, consisting of 2 separate carpels united into a common style, pistil head ovoid with a short sharp projection on top. Fruit consisting of 2 linear or somewhat fusiform follicles, longitudinally dehiscent, many-seeded. Seeds narrowly elliptical, flattened, with numerous long hairs at apex.
The flowers are pollinated by insects such as bees and flies. *Aganosma* belongs to the subfamily *Apocynoideae*. *A. caryophyllata* G. Don is a synonym of *A. wallichii*, but the name *A. caryophyllata* has also often been used for *A. dichotoma*.

Ecology *A. marginata* occurs in many different habitats, but especially in drier evergreen and deciduous forest and in scrub vegetation, up to 850 m altitude. *A. wallichii* is found in evergreen forest up to 400 m altitude.

Management *Aganosma* is usually propagated by seed; stem cuttings can also be used.

Genetic resources *A. marginata* and *A. wallichii* have fairly large areas of distribution, but they seem to be rare in some regions, e.g. in Sumatra, Java and Borneo for the first species, and in Peninsular Malaysia and Sumatra for the second. *A. dichotoma* is almost only known from cultivation; only few collections seem to represent wild specimens, and these come from a small area in eastern India (near Puri, Orissa). Several other *Aganosma* species from Vietnam and Thailand, which are scattered in occurrence, seem vulnerable to genetic erosion.

Prospects Too little is known about properties and phytochemistry of *Aganosma* to be specific about its prospects. However, the widespread use of some species, e.g. *A. marginata*, in traditional medicine warrants modern research.

Literature 182, 331, 625.

Selection of species

Aganosma dichotoma (Roth) K. Schumann

Engl. & Prantl, Nat. Pflanzenfam. 4(2): 173 (1895).

Synonyms *Aganosma caryophyllata* auct. non G. Don.

Distribution Probably native to India and commonly cultivated there, but sometimes also in gardens in Malesia (e.g. Peninsular Malaysia, Singapore and Java).

Uses In India, *A. dichotoma* is credited with antiseptic, emetic and anthelmintic properties and is used to treat bronchitis. The leaves are used against biliousness, and the flowers for treating eye troubles. It is also an ingredient of Ayurvedic medicine.

Observations A liana; leaves without a distinct intramarginal vein, lateral veins 2–4(–6) pairs; sepals longer than the corolla tube, stamens inserted at 0.4–0.5 of corolla tube length, disk longer than ovary; follicle fusiform.

Selected sources 182, 625.

Aganosma marginata (Roxb.) G. Don

Gen. Syst. 4: 77 (1837).

Synonyms *Aganosma acuminata* G. Don (1837).

Vernacular names Malaysia: sekati lima, akar gerit puteh, akar ara tanah (Peninsular). Thailand: maduea din (general), duea khruea (northern), yaan duei bit (Surat Thani). Vietnam: ch[ef] l[oo]ng, luy[ees]n h[uw][ow]ng.

Distribution Eastern India, Bangladesh, the Andaman Islands, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Singapore, northern Sumatra, western Java, northern Borneo (Sabah), Sulawesi, the Lesser Sunda Islands, the Moluccas (Seram) and the Philippines.

Uses In Malaysia and Vietnam, a decoction of the roots and/or leaves is commonly used internally to treat urinary troubles, as a tonic during fever, as an emmenagogue, and to treat anaemia and loss of appetite. In Thailand, roots, stems, leaves, flowers and fruits have been used against fever. The latex is occasionally used as rubber in Indo-China, and the fibrous bark for binding purposes.

Observations A liana or scrambler; leaves with a distinct intramarginal vein, lateral veins 8–18 pairs; sepals shorter than or as long as the corolla tube, stamens inserted at 0.3–0.5 of corolla tube length, disk shorter than or as long as ovary; follicle linear. *A. marginata* occurs in many different habitats, but especially in drier evergreen and deciduous forest and in scrubland, up to 850 m altitude.

Selected sources 62, 121, 182, 249, 625, 789.

Aganosma wallichii G. Don

Gen. Syst. 4: 77 (1837).

Synonyms *Aganosma caryophyllata* G. Don (1837), *Aganosma blumei* A.DC. p.p. (1844), *Aganosma calycina* A.DC. (1844).

Vernacular names Thailand: khao haai (Pattani), ta khloi yaan, thao man daeng (Surat Thani).

Distribution India, Burma (Myanmar), Thailand, Peninsular Malaysia, northern Sumatra, western and central Java.

Uses In India, *A. wallichii* is credited as useful in diseases of the bile and blood.

Observations A large liana; leaves without a distinct intramarginal vein, lateral veins 5–13 pairs; sepals longer than corolla tube, stamens inserted at 0.2–0.4 of corolla tube length, disk longer than ovary; fruit unknown. *A. wallichii* occurs in evergreen forest up to 400 m altitude.

Selected sources 62, 121, 182, 249, 625, 789.

Tran Dinh Ly & Tran The Bach

Agelaea macrophylla (Zoll.) Leenh.

Fl. Mal. Ser. I, Vol. 5: 502 (1958).

CONNARACEAE

$2n$ = unknown

Synonyms *Agelaea wallichii* Hook.f. (1876), *Agelaea trinervis* (Llanos) Merr. (1918), *Castanola macrophylla* Schellenb. (1938).

Vernacular names Indonesia: areuy kokotokan (Sundanese), anceng (Javanese), akar tanduk (Sumatra). Malaysia: akar pinang kutai, akar nyamok, kelentit nyamok (Peninsular). Philippines: tayabak, ulali (Tagalog), dagtung (Manobo). Thailand: thao som ching (Surat Thani), ma khroh (Krabi). Vietnam: d[aa]y tr[uw][owf]ng ng[aa]n.

Origin and geographic distribution *A. macrophylla* occurs in Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Bali, Borneo, the Moluccas and the Philippines.

Uses In Malaysia, a decoction of *A. macrophylla* roots has been used to treat rheumatism and stomach-ache, and, together with *Smilax* sp., as an aphrodisiac. In the Moluccas (Seram) the

leaves are made into a poultice, which is applied to wounds and cuts; the warm liquid from boiled roots is used in the same way.
The stem can be used as a rope; it is strong and durable, also under water, and can be used to bind rafts and nets. The oil from the seeds has been used as lamp-oil in Vietnam.

Properties Very little research has been done on the phytochemistry of *Connaraceae* in general and none at all on Asian species. Tannins are known to be common, whereas bark, fruits and seeds are often toxic, and sometimes used to poison mammals such as rats and dogs. Glabrin, a low molecular weight (<500) compound with a possible amino acid nature, has been isolated as the toxic principle from the bark of several *Connaraceae* species from Madagascar, including *A. pentagyna* (Lamk) Baillon. This species is used in Ghana to treat mouth infections. However, in a test, extracts from roots, stems and leaves did not show antibacterial activity, although extracts from several other *Connaraceae* species did show significant antibacterial activity.

Botany A large liana, with stem up to 4 cm in diameter. Leaves trifoliolate; petiole up to 15 cm long; stipules absent; leaflets ovate to elliptical-oblong, 4–34 cm × 2–14 cm, entire, upper surface with many mucous cells looking like small pits in dried material. Inflorescence axillary, paniculate, often several together in the axil of a sometimes rudimentary leaf, up to 5 cm long. Flowers bisexual, (4–)5-merous, up to 6 mm long, sweet-scented, more or less heterodistylous; pedicels jointed; sepals nearly free; petals much longer than sepals, free, whitish; stamens 10, shortly united at base, 5 slightly longer than other 5; carpels 5, superior, free. Fruit consisting of 1–5 follicles, these obovoid, with or without a beak at apex, velutinous, orange to red, dehiscing by a ventral suture, 1-seeded. Seeds with fleshy, yellow to red testa in lower part and black, glossy testa in upper part, without endosperm; cotyledons thick, planoconvex.
A. macrophylla shows a type of heterostyly which can be considered as transitional between heterodistylous and heterotristylous.
Agelaea is a genus of 6 species, 4 of which occur in tropical Africa and 2 in South-East Asia. Several species are extremely variable and consequently numerous species have been described in the past. *A. macrophylla* belongs to the section *Troostwykia*, together with the only other South-East Asian *Agelaea* species, *A. borneensis* (Hook.f.) Merr., and the African *A. paradoxa* Gilg.

Agelaea macrophylla (Zoll.) Leenh. - 1, part of flowering stem; 2, flower; 3, dehisced fruit showing seed.

Ecology *A. macrophylla* occurs in all kinds of forest, primary as well as secondary, on marshy soils to limestone rocks, up to 800 m altitude.

Genetic resources *A. macrophylla* is common in all types of forest and has a large area of distribution. It is not threatened or liable to genetic erosion.

Prospects Too little is known about the phytochemistry and biological activity of *A. macrophylla* to judge its prospects as a medicinal plant.

Literature 79, 96, 113, 247.
Other selected sources 121, 249, 250, 331.

R.H.M.J. Lemmens

Aglaia Lour.

Fl. cochinch. 1: 173 (1790).
MELIACEAE
x = unknown; *A. edulis*: $n = 40$, *A. elliptica*: $2n = 68$

Origin and geographic distribution *Aglaia* currently consists of 105 species, but it is expected that more will be discovered. It is distributed from

southern India and Sri Lanka, through Burma (Myanmar), Indo-China, Thailand, towards the Malesian area, northern Australia, New Caledonia, the Solomon Islands, Fiji and Samoa. Within Malesia, the largest number of species is found in Borneo (50), followed by Peninsular Malaysia (48), Sumatra (38), the Philippines (35) and New Guinea (33).

Uses Several *Aglaia* species are used in traditional medicine: leaves to treat wounds, fever, headache, asthma, jaundice, and as a tonic e.g. after childbirth; flowers against fever, asthma, jaundice and after childbirth; fruits to treat inflammatory diseases, and bark against tumours.

Most *Aglaia* species are known for their hardwood, which is mainly used for construction. However, *Aglaia* wood is suitable for a wide range of purposes. The fruit and the seed aril of some species are edible. The flowers, particularly those of *A. odorata*, are aromatic and may be used in tea or to perfume household textiles.

Properties Several cyclopenta[b]benzofurans have been isolated from stems and fruits of *A. elliptica*. These were found to be very potent cytotoxic substances when evaluated against a panel of human cancer cell lines. Rocaglamide derivatives (cyclopentatetrahydrobenzofurans) isolated from several *Aglaia* species showed growth-inhibiting properties on human cancer cell lines, didesmethyl-rocaglamide being the most active compound. The cyclopenta[b]benzofuran 4'-demethoxy-3',4'-methylenedioxy-methyl rocaglate was capable of delaying tumour growth in an in vivo mouse model. Aglafolin and rocaglamide, isolated from the stems of *A. rimosa*, showed significant cytotoxicity in 6 cancer cell lines. Aglafolin was also found to completely block platelet aggregation caused by arachidonic acid and platelet-activating factor (in vitro and in vivo). A number of 3,4-secoapotirucallanes with moderate cytotoxic activity against KB cells have been isolated from *A. argentea* bark. The cycloartanes, argenteanones A–E and argenteanols A–E, isolated from *A. argentea* leaves also display significant cytotoxic activity against KB cells. Aglain A, B and C and odorine were also isolated from *A. argentea*. Bisamide alkaloids have also been isolated from *Aglaia*: pyramidatine from leaves of *A. silvestris*, piriferine, aglaedithioduline and aglaiduline from *A. edulis*, and odorine and 5'-epi-odorine from *A. odorata*. None of these bisamides showed significant cytotoxicity, but piriferine, odorine and 5'-epi-odorine were found to inhibit the growth of vinblastine-resistant KB cells by enhancing the anticancer activity of vinblastine. The antileukaemic diamide (–)-odorinol has been isolated from leaves and twigs of *A. odorata*. Odorine and odorinol isolated from *A. odorata* inhibited both the initiation and promotion stages of mouse skin carcinogenesis. Fruit extracts of *A. elaeagnoidea* showed an inhibitory effect on lipid peroxidation in biological membranes.

Foliar, flower, fruit and twig extracts of *A. elaeagnoidea*, *A. elliptica* and *A. odorata* showed inhibitory activity on larval growth and antifeedant effect against the polyphagous lepidopteran larvae of *Spodoptera* spp. and *Helicoverpa armigera*. In *A. elaeagnoidea*, cyclopenta[b]benzofurans were found to be responsible for the activity. These compounds also showed antifungal activity. In *A. elliptica* and *A. odorata*, rocaglamide derivatives were identified as the active compounds, with pannellin and pannellin-1-O-acetate as the most active.

Investigation of the oil from root bark of an unidentified species in India has revealed antimicrobial and anthelmintic activities in vitro, and central nervous system depressant action in mice.

Botany Dioecious, usually small or medium-sized trees, sometimes large and up to 40(–50) m tall, rarely shrubs. Indumentum consisting of stellate hairs, or stellate or peltate scales present, at least on the younger parts. Leaves arranged spirally, usually imparipinnate, rarely with a single leaflet, stipules absent; leaflets entire, acuminate to caudate at apex. Inflorescence usually axillary, occasionally ramiflorous or cauliflorous; male inflorescence large, much divaricately branched, with up to several thousand flowers; female inflorescence similar but usually smaller. Flowers functionally unisexual, 3(–4) or 5(–6)-merous; calyx cup-shaped; petals free or united at base, often yellow, sometimes white or pink; stamens united to form a tube, anthers (3–)5–10(–21), inserted on the inner face of the tube; ovary superior, 1–3(–10)-locular, style short or absent, style-head small. Fruit a globose to pear-shaped berry or nut, less frequently a 1–3(–4)-valved capsule, 1–4(–6)-seeded. Seeds large, usually with an aril nearly or completely covering the seed, without endosperm. Seedling with semi-hypogeal germination; cotyledons peltate; first 2 leaves simple and opposite, subsequent leaves arranged spirally, simple at first, later with increasing number of leaflets.

Small insects, probably mainly dipterans, are most likely the main pollinators of *Aglaia* flowers. Two main types of fruits can be distinguished: dehiscent fruits containing seeds with a red odour-

less aril which are dispersed by birds, and indehiscent fruits containing seeds with a white, yellow, orange or brown and sweet-tasting aril which are dispersed by primates.

Aglaia belongs to the tribe *Aglaieae* and is most closely related to the genus *Lansium*. It is divided into 2 sections on the basis of whether the fruits are dehiscent; section *Amoora* was formerly regarded as a separate genus. The genus *Aphanamixis* is closely related to *Aglaia*. *Aphanamixis polystachya* (Wallich) R.N. Parker has medicinal value in India, e.g. the bark is used in a liniment to treat rheumatism, and research has shown that it also contains compounds with antitumour, antiviral and insecticidal activities.

Ecology *Aglaia* usually occurs scattered and is locally common but never dominant. It is found in both primary and secondary forest, generally in evergreen rain forest, sometimes in monsoon or deciduous forest. *Aglaia* is found up to 1500 m altitude, but some species ascend as high as 2500(–3800) m.

Management Seeds should be sown as soon as possible after harvesting; they do not need any pretreatment. The seed germination rate of *A. lawii* is 50%, of *A. silvestris* 100% in 27–43 days. Seed of *Aglaia* is sometimes destroyed by larvae of various groups of insects.

Genetic resources Several species of *Aglaia* show considerable morphological variation, which is often correlated with geographical distribution. Possible future germplasm collection activities should take this into account.

Prospects Rocaglamide derivatives and bisamide alkaloids found in several *Aglaia* species could play a potential role in the treatment of malignant diseases and are worth investigating in further studies of experimental medicine and pharmacology. Some of the insecticidal compounds are similar with regard to their activity to azadirachtin (from *Azadirachta indica* A.H.L. Juss.), a well-known plant-based insecticide, and therefore have good prospects as a pesticide.

Literature 98, 185, 247, 328, 492, 536, 541, 635, 636, 695, 702, 805, 1012.

Selection of species

Aglaia argentea Blume

Bijdr. fl. Ned. Ind.: 170 (1825).

Synonyms *Aglaia splendens* (Koord. & Valeton) Koord. & Valeton (1897), *Aglaia multifoliola* Merr. (1915), *Aglaia discolor* Merr. (1929).

Vernacular names Indonesia: bayur (Sumatra), tanglar (Java), luka-lukam (Moluccas). Malaysia: pasak (Peninsular), jalongan sasak (Sabah, Sarawak), lantupak (Dusun, Sarawak). Philippines: kansulud (Panay Bisaya). Burma (Myanmar): tagat-thitto. Thailand: sangkhriat-klong (Trang).

Distribution Burma (Myanmar), peninsular Thailand, throughout Malesia but rare in the Philippines, the Solomon Islands and northern Australia (Cape York Peninsula).

Uses *A. argentea* is a potential source of compounds with anticancer and insecticidal properties. It is a fairly important source of timber. The aril of the seed is edible.

Observations A small to medium-sized tree up to 30 m tall; leaflets 9–19, subopposite, with 11–25 pairs of secondary veins, smooth, glabrescent above, below densely covered with white and some brown peltate scales, often having a short fimbriate margin; flowers 5-merous, anthers 5, stylehead subglobose or ovoid, longitudinally ridged; fruit indehiscent, 2(–3)-locular. *A. argentea* is fairly common and occurs scattered in primary or secondary evergreen to semi-evergreen forest, up to 1300 m altitude.

Selected sources 182, 247, 541, 635, 636, 702.

Aglaia edulis (Roxb.) Wallich

Calcutta Gard. Rep.: 26 (1840).

Synonyms *Aglaia sulingi* Blume (1825), *Aglaia latifolia* Miq. (1868), *Aglaia pirifera* Hance (1877).

Vernacular names Indonesia: balik-balik (Sumatra), langsatan (Java), langsat-lotung (Bali). Philippines: kaniue, curran kaniue (Tagalog), malasaging (Filipino). Thailand: khangkhao (north-eastern, eastern), kholaen (Prachuap Khiri Khan), changkru (Khmer, Chanthaburi). Vietnam: ng[aa]u diu, g[ooj]i [oor]i.

Distribution Western India, Bhutan, the Nicobar Islands, peninsular Burma (Myanmar), Cambodia, Vietnam, southern China, peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Bali, Borneo, Sulawesi, Halmahera, and the Philippines.

Uses The pericarp of the fruit is used to treat diarrhoea. The wood is used e.g. for construction, but supplies are limited. The aril of the seed is edible.

Observations A generally small to medium-sized tree up to 20 m tall; leaflets 5–9(–11), subopposite to alternate, with 5–16 pairs of secondary veins, usually with numerous pits on both surfaces, glabrous above, below with few to numerous

reddish or pale brownish stellate hairs and scales or peltate scales with an irregular or fimbriate margin; flowers usually 5-merous, anthers 5, style-head ovoid or depressed globose, longitudinally ridged; fruit indehiscent, 3-locular. *A. edulis* occurs scattered and is comparatively rare. It is found in primary evergreen forest along the seashore, but also in secondary forest, up to 1700 m altitude.

Selected sources 182, 247, 541, 805.

Aglaia elaeagnoidea (A.H.L. Juss.) Benth.

Fl. Austr. 1: 383 (1863).

Synonyms *Aglaia roxburghiana* (Wight & Arnott) Miq. (1868), *Aglaia wallichii* Hiern (1875), *Aglaia canariifolia* Koord. (1898).

Vernacular names Indonesia: kemubang, pancal kidang (Java), mata-mata (Bajau, Bali). Philippines: mata-mata (general), gupak (Cebu Bisaya). Thailand: kradukkhiat (Nakhon Ratchasima), khangkhao. Vietnam: g[ooj]i n[us]i, g[ooj]i d[or].

Distribution Nepal, India, Sri Lanka, Cambodia, Vietnam, Taiwan, Thailand, Peninsular Malaysia (rare), throughout the rest of Malesia except for Sumatra, towards northern Australia, New Caledonia, Vanuatu and Samoa.

Uses Fruit extracts are used in traditional medicine in Nepal and India to treat inflammatory diseases and febrile complaints; the seeds are said to be useful for relieving painful micturition. The wood is used e.g. for house construction. The aril of the seed is edible and sweet.

Observations A shrub or small to medium-sized tree up to 20 m tall; leaflets (1–)3–7, subopposite, with 5–10 pairs of secondary veins, with numerous pits and numerous pale brown or pale orange-brown peltate scales with a short fimbriate margin on both surfaces; flowers 5-merous, anthers 5, style-head ovoid, with 2 small apical lobes; fruit indehiscent, 2-locular. *A. elaeagnoidea* is fairly common and often found in coastal areas, but also in primary or secondary, deciduous or evergreen inland forest up to 1100 m altitude.

Selected sources 182, 247, 505, 513, 541.

Aglaia elliptica Blume

Bijdr. Fl. Ned. Ind.: 171 (1825).

Synonyms *Aglaia oxypetala* Valeton (1901), *Aglaia harmsiana* Perk. (1903), *Aglaia havilandii* Ridley (1930).

Vernacular names Indonesia: bajing talang (Sumatra), langsat-langsat (Kalimantan), pisek (Sulawesi). Malaysia: peler tupai (Peninsular), segera, bunyau (Iban, Sarawak). Philippines: malatumbaga (general), mata-mata (Bikol), malasaging (Filipino).

Distribution Southern Burma (Myanmar), peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Bali, Flores, Borneo, Sulawesi and the Philippines.

Uses Bathing in water boiled with the bark is a remedy against tumours, and the leaves are applied to wounds. The wood is used e.g. for furniture, general construction and agricultural implements.

Observations A small to medium-sized, sometimes fairly large tree up to 20(–40) m tall; leaflets (5–)7–11(–15), subopposite to alternate, with 6–19 pairs of secondary veins, sometimes pitted, with numerous reddish-brown to pale orange-brown stellate hairs or scales, especially on the veins below; flowers 5-merous, anthers 5, style-head ovoid or depressed globose, with 2 small apical lobes or a central depression; fruit indehiscent, 2-locular. *A. elliptica* is locally common in primary and secondary evergreen forest on various soils, up to 2000 m altitude.

Selected sources 185, 247, 536, 541, 686.

Aglaia lawii (Wight) C.J. Saldanha ex Ramamoorthy

C.J. Saldanha & Nicolson, Fl. Hassan Distr.: 392, pl. 76 (1976).

Synonyms *Aglaia littoralis* Zippelius ex Miq. (1868), *Amoora korthalsii* Miq. (1868), *Amoora lawii* (Wight) Beddome (1871).

Vernacular names Indonesia: lasih (Sumatra), langsat lutung (Java), kayu jangan (Sulawesi). Malaysia: bekak (Peninsular), segera (Iban, Sarawak), lasat-lasat (Dayak, Sabah). Philippines: talisaian (Ibanag), salotoi (Ibanag), sulmin (Tagalog). Burma (Myanmar): tagat-thitto. Thailand: sang katong (peninsular). Vietnam: g[ooj]i duy[ee]n h[ar]i.

Distribution India, Burma (Myanmar), Indo-China, Thailand, throughout Malesia and the Solomon Islands.

Uses In the Philippines, the leaves have been used to treat headache. *A. lawii* is an important source of timber.

Observations A medium-sized to fairly large tree up to 40 m tall; leaflets (1–)2–7(–11), subopposite to alternate, with 5–21 pairs of secondary veins, with numerous pits on both surfaces, glabrous or with numerous pale brown or pale orange-brown peltate scales with an irregular to

fimbriate margin on the lower surface; flowers 3–4(–6)-merous, anthers (5–)6–10(–11), style-head ovoid, with (2–)3 apical lobes or columnar with a truncate apex; fruit dehiscent, (2–)3(–4)-locular. *A. lawii* is locally common in primary and secondary evergreen to deciduous forest, up to 1650 m altitude.

Selected sources 247, 541.

Aglaia odorata Lour.

Fl. cochinch. 1: 173 (1790).

Synonyms *Aglaia chaudocensis* Pierre (1896), *Aglaia duperreana* Pierre (1896), *Aglaia oblanceolata* Craib (1926).

Vernacular names Chinese rice-flower (En). Indonesia: pacar cina (Sumatra, Java), bunga maniran (Kalimantan), pacar culam (Java, Moluccas). Malaysia: me shui lan (Chinese, Peninsular), chulan, pokok telur belangkas (Peninsular). Philippines: cinamomo (Sp), sinamomong-sunsong (Tagalog). Burma (Myanmar): thanat-ka-wa. Cambodia: trayang. Laos: 'khai[1] pou. Thailand: homklai (peninsular), khayong (northern), prayong (central). Vietnam: ng[aa]u, hoa ng[aa]u.

Aglaia odorata Lour. – 1, flowering branch; 2, male flower; 3, male flower with sepals and petals removed; 4, longitudinal section of male flower with sepals and petals removed.

Distribution Burma (Myanmar), Cambodia, Vietnam, Hainan (China) and Thailand; possibly in Laos and the Moluccas. Cultivated in India, Sri Lanka, Vietnam, Peninsular Malaysia, Sumatra and Java.

Uses The flowers are applied externally to the body after childbirth or internally against fever, and they are used for scenting tea and cigarettes, and to perfume clothes. In Indonesia, an infusion of the leaves is drunk as a tonic to treat excessive menses and venereal diseases. In the Philippines, a decoction of the roots and leaves is used as a tonic. The flowers and leaves are used in Vietnam to treat fever, asthma and jaundice. The leaves are considered expectorant, stimulant and antipyretic, and they are used to treat convulsions and menorrhagia. The wood is excellent for turnery. More important is its use as an ornamental, e.g. in hedges.

Observations A shrub or small tree up to 10 m tall; leaflets 3–5(–7), opposite, with 5–9 pairs of secondary veins, usually smooth and glabrous or occasionally with few yellowish-brown stellate scales with a fimbriate margin below; flowers 5-merous, anthers 5, style-head ovoid or narrowly ovoid, longitudinally ridged and with 2 small apical lobes; fruit indehiscent, 1-locular. *A. odorata* occurs scattered but is locally common and found in evergreen primary and secondary forest, sometimes along the coast, up to 700 m altitude.

Selected sources 121, 182, 247, 298, 328, 395, 505, 541, 671, 695, 760, 805.

Aglaia rimosa (Blanco) Merr.

Sp. Blanc.: 212 (1918).

Synonyms *Aglaia llanosiana* C.DC. (1878), *Aglaia goebeliana* Warb. (1891), *Aglaia elliptifolia* Merr. (1909), *Aglaia lanceolata* Merr. (1910).

Vernacular names Indonesia: hitang mararu (Moluccas), mansaambra (Biak). Papua New Guinea: chokere'n (Plitty, Manus Province). Philippines: bayanti (Tagalog), botgo (Bikol, Tagalog), gasatin (Iloko).

Distribution Taiwan, the Philippines, Sulawesi, the Moluccas, New Guinea, New Britain and New Ireland.

Uses In Papua New Guinea, the scraped bark is boiled in water and the decoction drunk daily by patients with a badly swollen stomach. *A. rimosa* is a potential source of compounds with anticancer properties. The wood is used for house construction.

Observations A shrub to medium-sized tree up to 30 m tall; leaflets (3–)9–11(–15), subopposite,

sometimes alternate, with 7–17(–20) pairs of secondary veins, above glossy and often rugulose, sometimes pitted and glabrescent, below sometimes pitted and with few to numerous radiating peltate scales with a dark orange-brown or dark reddish-brown centre and a paler, entire to ragged margin, sometimes interspersed with few darker scales; flowers 4–5-merous, anthers 5, rarely 6, style-head broadly ovoid or subglobose, with 2 small apical lobes; fruit indehiscent, 2-locular. *A. rimosa* is locally common in secondary forest, along rivers and along the coast, up to 1350 m altitude.

Selected sources 247, 492, 541, 1012.

Aglaia silvestris (M. Roemer) Merr.

Interpr. Herb. amboin.: 210 (1917).

Synonyms *Aglaia ganggo* Miq. (1861), *Aglaia pyramidata* Hance (1877), *Aglaia cedreloides* Harms (1942).

Vernacular names Indonesia: ganggo (general), pacar kidang (Sumatra), kayu wole (Sulawesi). Malaysia: bekak (Peninsular), segera (Sarawak), lantupak (Dusun, Sabah). Philippines: salamingai (Tagalog), panuhan (Negrito). Thailand: chanchamot (Chanthaburi). Vietnam: g[ooj]i n[us]i.

Distribution The Andaman and Nicobar Islands, Cambodia, southern Vietnam, peninsular Thailand, throughout Malesia (except for the Lesser Sunda Islands) and the Solomon Islands.

Uses *A. silvestris* is a potential source of compounds with anticancer properties. It is an important source of timber.

Observations A medium-sized to sometimes large tree up to 30(–50) m tall; leaflets (5–)13–19, alternate, with 12–21 pairs of secondary veins, smooth and glabrescent above, below sparsely to densely set with peltate scales having a dark brown centre and pale margin; flowers 5-merous, anthers 5, style-head ovoid, longitudinally ridged and with 2 small apical lobes; fruit indehiscent, 1–2(–3)-locular. *A. silvestris* is locally common in primary and secondary evergreen to semi-deciduous forest, up to 2100 m altitude.

Selected sources 247, 541, 805.

Aglaia yzermannii Boerl. & Koord.

Icon. Bogor.: t. 87 (1901).

Synonyms *Aglaia salicifolia* Ridley (1910).

Vernacular names Malaysia: tado ikan, sikjot (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses A preparation of pounded leaves in cold water has been used in Peninsular Malaysia for washing the body after childbirth. The aril of the seed is edible.

Observations A shrub or small tree up to 5 m tall; leaflets 3–5, with 9–15 pairs of secondary veins, glabrous or with a few brown or yellowish-brown scales below; flowers 5-merous, anthers 5; fruit indehiscent, 1–2-locular. In Peninsular Malaysia, *A. yzermannii* is a common rheophyte of riverine forest, up to 100 m altitude. There is only one collected specimen known from Sumatra.

Selected sources 121, 247.

Sri Hayati Widodo

Aglaonema Schott

Wiener Z. Kunst 1829(3): 892 (1829).

ARACEAE

$x = 20$; *A. commutatum*: $n = 40$, $2n = 120$, *A. simplex*: $n = 20$

Origin and geographic distribution *Aglaonema* consists of approximately 25 species, and is native to tropical Asia from north-eastern India and southern China through the whole of Malesia. About 17 species have been found in Malesia, of which *A. simplex* is the most widely distributed. Several species are widely cultivated as an ornamental. The first plants were brought under cultivation in Europe at the beginning of the 19th Century.

Uses Several uses of *Aglaonema* in traditional medicine have been recorded in South-East Asia. In Malaysia, the roots are used as a tonic for children and as anthelmintic, and a decoction of the roots is drunk to treat fever and dropsy. In the Moluccas, heated leaves are used to reduce swellings, but this sometimes results in sores. *A. tenuipes* Engl. (synonym: *A. siamense* Engl.) is used in Laos, Cambodia and Vietnam externally as a poultice for carbuncles, and a decoction of the stem is used as a laxative.

The leaves are reputedly occasionally eaten as a vegetable. *Aglaonema* species are commonly grown as ornamental plants for their variegated foliage and bright red fruits, e.g. *A. commutatum*, *A. nebulosum*, *A. simplex*, *A. nitidum* (Jack) Kunth (synonym: *A. oblongifolium* Schott) and *A. crispum* (Pitcher & Manda) Nicolson (synonym: *A. roebelinii* auct.). In tropical regions they are cultivated in gardens, but they are also commonly grown as an indoor pot plant, also in temperate regions.

Properties A 50% aqueous ethanolic extract of whole *A. commutatum* plants was found to strong-

ly inhibit the enzyme α-glucosidase. Active compounds were identified as α- and β-homonojirimycin. Glycosidase inhibitors are potentially useful as antidiabetic, antiviral, antimetastatic and immunomodulatory agents. They have shown potential as additional therapeutics for diabetes type 2 and HIV-1 infection. However, although related compounds show antihyperglycaemic effect, intraperitoneal administration of α-homonojirimycin had no effect on blood glucose levels in streptozotocin diabetic mice.

Botany Herbs with creeping to erect stem, sometimes rooting at nodes, having distinct, smooth and green internodes. Leaves alternate, ovate-elliptical to lanceolate-narrowly elliptical, often unequal at base, often variegated; petiole usually as long as or slightly shorter than leaf-blade, with petiolar sheath. Inflorescence a spadix, 1–9 together, peduncle deflexing in fruit; spathe ovate, green to yellowish-white; spadix cylindrical to clavate, subsessile to stipitate, female zone below, few-flowered, male zone longer. Flowers small, unisexual; male flowers tightly situated, with a single stamen having a more or less distinct filament, anthers opening with 2 apical pores; female flowers with subglobose ovary, 1-locular, 1-ovulate, style short and thick, stigma broad and disk-like. Fruit an ellipsoid berry, red at maturity, 1-seeded. Seed ellipsoid, without endosperm.
A. commutatum is extremely variable. Several botanical varieties and many cultivars have been described. A hybrid origin of this species has been postulated. This is supported by cytological data (plants tetraploid or hexaploid) and by the fact that plants are pollen-sterile and apomictic. The name *A. oblongifolium* is confusing as it has been used for several species.

Ecology *Aglaonema* thrives well in damp and shady localities. Locally it is amongst the dominant species in the undergrowth of the forest, e.g. in Seram where a density of 680 plants/ha has been recorded. In cultivation, they require a porous soil, preferably composed of equal parts of loam, sand, peat and organic matter. When cultivated indoors, plants are often susceptible to low relative humidity, resulting in brown leaf margins.

Management *Aglaonema* can be easily propagated by terminal or node cuttings of the stem and by divisions of the basal shoot. Tissue culture techniques have also been developed for large-scale propagation as ornamental plants. Several diseases are known to attack cultivated *Aglaonema*, e.g. leaf spot caused by anthracnose fungi. However, the most serious disease is root rot caused by *Pythium splendens*.

Genetic resources Several *Aglaonema* species are widely cultivated, and breeding activities have resulted in numerous cultivars. However, in the wild, many species are restricted to moist lowland rain forest, a habitat under pressure in many regions. Special attention might therefore be wise to prevent genetic erosion.

Prospects *Aglaonema* is well known as an ornamental, but little information is available on the pharmacological value. It is known that glycosidase-inhibiting compounds are present, and this might be of interest for further research.

Literature 53, 407, 671, 678, 684.

Selection of species

Aglaonema commutatum Schott

Syn. Aroid.: 123 (1856).

Synonyms *Aglaonema oblongifolium* Merr. (1923) non Schott, *Aglaonema treubii* auct. non Engl.

Vernacular names Philippines: damping-banal (Tagalog), pamitagen (Mangyan), pauangkilon (Cebu Bisaya).

Distribution The Philippines and north-eastern Sulawesi; *A. commutatum* occasionally escapes from cultivation and is sometimes naturalized.

Uses *A. commutatum* is a source of compounds with potential glycosidase-inhibitory activity. It is commonly cultivated as an ornamental, also as a pot plant.

Observations An erect herb up to 150 cm tall; leaves broadly acute, obtuse or subrounded at base, variegated along lateral veins, margin of petiole sheath usually membranous; spathe elongate, spadix cylindrical, usually much shorter than spathe. *A. commutatum* occurs in primary forest, mainly along streams.

Selected sources 53, 678, 684.

Aglaonema marantifolium Blume

Rumphia 1: 153, pl. 66 (1837).

Synonyms *Aglaonema oblongifolium* auct. non Schott.

Vernacular names Indonesia: anapur ayer, bira ayer (Moluccas).

Distribution The Moluccas and New Guinea.

Uses In the Moluccas, heated leaves have been used to reduce swellings, but this sometimes results in sores.

Observations An erect or ascending herb up to 100 cm tall; leaves obtuse to subrounded at base, not variegated, margin of petiole sheath membranous; spathe elongate, spadix cylindrical, much shorter than spathe. *A. marantifolium* occurs in lowland rain forest in humid and shaded locations.

Selected sources 334, 678.

Aglaonema nebulosum N.E.Br.

Ill. Hort. 31: 67, pl. 24 (1887).

Synonyms *Aglaonema pictum* Ridley (1925) non (Roxb.) Kunth.

Vernacular names Malaysia: mata bisul, mata hudang, selimpat ayer (Peninsular).

Distribution Peninsular Malaysia, Singapore, Borneo.

Uses The roots are used as a tonic for children and as an anthelmintic. The leaves are reputedly eaten as a vegetable. *A. nebulosum* is cultivated as an ornamental, also as a pot plant.

Observations An erect herb up to 60 cm tall; leaves acute to obtuse at base, rarely variegated, margin of petiole sheath membranous; spathe globose, spadix clavate, about as long as spathe. *A. nebulosum* occurs in freshwater swamp forest and peat swamp forest.

Aglaonema simplex Blume – 1, plant habit; 2, spathe and spadix; 3, spadix.

Selected sources 121, 678.

Aglaonema simplex Blume

Rumphia 1: 152, pl. 36D, 65 (1837).

Synonyms *Aglaonema angustifolium* N.E.Br. (1895), *Aglaonema latius* Alderw. (1922).

Vernacular names Indonesia: wetune (Moluccas). Malaysia: sumpuh bulan, sumpuh kering, penggeheh (Peninsular). Thailand: waan ngot hin (Trang).

Distribution Southern Burma (Myanmar), peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Bali, Borneo, Sulawesi, the Moluccas and the Philippines.

Uses In Malaysia, a decoction of the roots is drunk to treat fever and dropsy. *A. simplex* is cultivated as an ornamental, also as a pot plant.

Observations An erect herb up to 120 cm tall; leaves obtuse, rounded or subtruncate at base, not variegated, margin of petiole usually with a membranous margin; spathe elongate, spadix cylindrical, about as long as spathe. *A. simplex* occurs in primary and secondary forest, in shady and humid locations, up to 1500(–2000) m altitude.

Selected sources 121, 678, 731.

Francisca Murti Setyowati

Aidia Lour.

Fl. cochinch.: 143 (1790).

RUBIACEAE

x = unknown; *A. racemosa*: $2n = 22$

Origin and geographic distribution *Aidia* comprises approximately 50 species, and is distributed in tropical Africa (about 5 species) and tropical Asia (some species extending to subtropical and temperate regions of China and Japan). In Malesia about 30 species have been found.

Uses A decoction of *Aidia* roots has been used to cure bowel complaints, and the bark has reputedly been applied as a febrifuge. The bitter bark of *A. cochinchinensis* Lour. has been used in Vietnam to treat malaria, and as a purgative against hives (urticaria). The timber is occasionally used for house construction, walking sticks and handles of implements.

Properties In a screening test with Australian bark and leaf material of *A. racemosa* no alkaloids were found; a test on in-vitro antitumour properties showed negative results. No further information on properties of Asian species is available, but abundant quantities of the carbohydrate mannitol have been found in root bark of the African

species *A. micrantha* (K. Schumann) Bullock ex F. White and *A. ochroleuca* (K. Schumann) Petit.

Botany Small to medium-sized trees, shrubs, lianas or hemi-epiphytes. Leaves opposite, often elliptical, simple and entire; stipules interpetiolar, usually triangular. Inflorescence often appearing leaf-opposed, or pseudo-axillary, pseudo-terminal or from a leafless node, dichasially cymose or cincinnoid, sometimes fasciculate. Flowers bisexual, (4–)5(–9)-merous; calyx toothed; corolla gamopetalous, tube often about as long as or shorter than lobes, pilose inside in upper part, lobes often reflexed; stamens inserted in the upper part of the corolla tube, filaments usually short; ovary inferior, 2-locular, style about as long as the linear to clavate stigma. Fruit berrylike, usually globose, small, often becoming red and ultimately black.
The seeds are probably dispersed by animals; in southern China silver pheasants have been reported to feed on *Aidia* fruits.
In older literature, species now included in *Aidia* were considered to belong to the large genus *Randia*. However, *Randia* has been split up into numerous smaller genera. There has been much disagreement on the delimitation of *Aidia* from related genera. In the most restricted sense, only tree species were included in *Aidia*. Here, a broader view of the genus is followed, including e.g. *Anomanthodia* and *Gynopachis* which are lianescent. Further studies are needed to clarify the generic limits of *Aidia* and related genera.
A. densiflora and *A. racemosa* have been often confused with each other and with *A. cochinchinensis* Lour., which is restricted to Vietnam and Hainan. All three species have been confused with *Fagraea* (*Loganiaceae*).

Ecology The *Aidia* species treated here occur in primary as well as secondary forest. Several South-East Asian species are restricted to drier habitats (e.g. coastal and limestone vegetation, kerangas forest).

Genetic resources *A. densiflora* and *A. racemosa* have large areas of distribution and occur in many forest types including secondary forest. Therefore, they do not seem to be liable to genetic erosion.

Prospects Since too little is known about the properties and biological and pharmacological activities, no judgement can be given on the prospects of the South-East Asian *Aidia* species.

Literature 121, 731, 791.

Selection of species

Aidia densiflora (Wallich) Masam.

Sci. Rep. Kanazawa Univ. 4: 85 (1955).

Synonyms *Randia densiflora* (Wallich) Benth. (1861), *Aidia wallichiana* Tirveng. (1986), *Aidia cochinchinensis* auct. non Lour.

Vernacular names Malaysia: jarum-jarum, gading tulang, mata ular (Peninsular). Thailand: khem chaang (Phitsanulok), khat khao thong, saeo ton (Chumphon).

Distribution India, the Andaman Islands, Burma (Myanmar), Thailand, Peninsular Malaysia, Sumatra, the Riau Archipelago and Borneo.

Uses In Malaysia a decoction of the roots has been used to cure bowel complaints. The timber is used e.g. in house construction.

Observations A small to medium-sized tree up to 20 m tall; leaves glabrous; inflorescence basically a dichasial cyme, flowers on ultimate branches basically 2 at each inflorescence node, bracts widely spaced at each divarication, pedicels densely finely pubescent, filaments glabrous; fruit globose, c. 5 mm in diameter. *A. densiflora* occurs both in primary and secondary forest.

Selected sources 121, 791.

Aidia racemosa (Cav.) Tirveng.

Tirveng. & Sastre, Bull. Mus. Nation. Hist. Nat., B, Adansonia, 4e sér., 8: 262 (1986).

Synonyms *Randia racemosa* (Cav.) Fern.-Vill. (1880), *Aidia spicata* (Valeton) Tirveng. (1986), *Randia cochinchinensis* auct. non (Lour.) Merr.

Vernacular names Malaysia: jarum-jarum, geruseh, mata ular (Peninsular). Philippines: susulin (Tagalog), dolo (Tagbanua), uring (Kuyonon).

Distribution China (Hainan), peninsular Thailand, Peninsular Malaysia, Java, Christmas Island, the Lesser Sunda Islands, the Philippines, Sulawesi, the Moluccas, New Guinea, the Solomon Islands and Australia.

Uses In Malaysia a decoction of the roots has been used to cure bowel complaints. In the Philippines, the bark has reputedly been applied as a febrifuge, especially in agues. The timber is used for house construction, walking sticks and handles of implements.

Observations A small to medium-sized tree up to 15(–25) m tall; leaves glabrous; inflorescence cincinnoid, flowers on ultimate branches basically one at each inflorescence node, axis with numerous bracts, pedicels more or less glabrous, filaments glabrous; fruit subglobose, 4–8 mm in di-

ameter. *A. racemosa* occurs both in primary and secondary forest; in Thailand, Peninsular Malaysia and Java apparently it is restricted to limestone.

Selected sources 121, 760, 791.

Reza Azmi

Ajuga bracteosa Wallich ex Benth.

Wallich, Pl. asiat. rar. 1: 59 (1830).
LABIATAE
$2n = 32, 64$
Synonyms *Ajuga remota* Benth. (1830).
Vernacular names Indonesia: tilad (Sulawesi), sabasasi (Yapen Island).

Origin and geographic distribution *A. bracteosa* is widely distributed, from Afghanistan and India, through Burma (Myanmar), Indo-China and Thailand, to the Philippines, the Talaud Islands, northern and eastern Sulawesi, the Moluccas (Ternate, Halmahera) and Yapen Island.

Uses In the Ayurvedic system of medicine in India *A. bracteosa* is credited with astringent, febrifugal, stimulant, aperient, tonic, diuretic and depurative properties, and it is used to treat gout, rheumatism, palsy and amenorrhoea. The leaf juice is used to purify the blood and against fever, and powdered leaves are applied to burns and boils. In Pakistan, the plant juice is used to treat bile duct problems.

The leaves of an eastern African *Ajuga* species are used as a remedy for fever, toothache, dysentery and high blood pressure.

Properties From the petroleum-ether extract of the plant, ceryl alcohol, β-sitosterol, γ-sitosterol, daucosterol, hexacosan-1-ol, triacontan-1-ol-docosanoate, and cerotic and palmitic acids have been isolated.

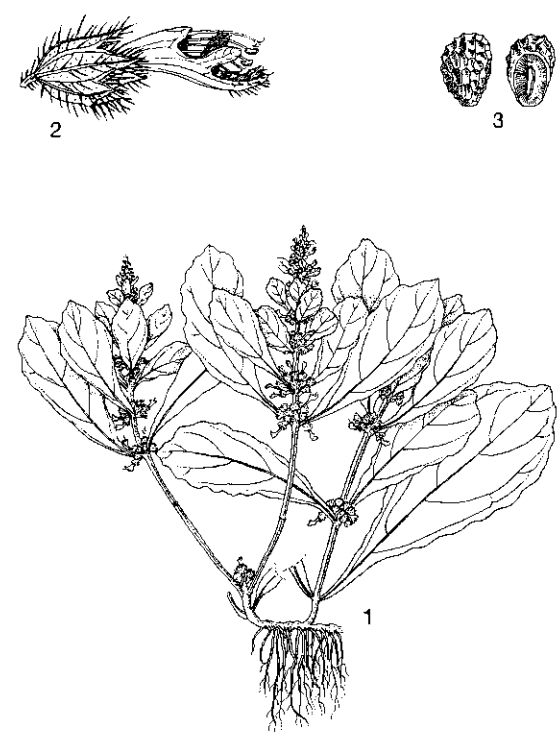
The ethanol (50%) extract of *A. bracteosa* exhibited antispasmodic activity in guinea-pigs. It also showed antitumour activity against sarcoma HS1, but was inactive against Ca-9KB cell lines.

An aqueous extract of the leaves showed diuretic activity in rats almost equal to that of urea. An alkaloidal fraction isolated from the leaves showed stimulant action on isolated perfused frog heart, rabbit auricle and rat ventricle preparations.

In tests with rats, treatment with a leaf extract of an *Ajuga* species from eastern Africa arrested and reversed the progression of an induced hypertensive cardiovascular disease.

Several pharmacologically interesting compounds have been isolated from other *Ajuga* species: phytoecdysteroids in *A. turkestanica* (Regel) Briq. from central Asia showed a marked effect on blood regeneration in haemotoxic phenylhydrazine anaemia in rats and furthermore stimulated bile secretion in rats. In addition, an iridoid glycoside which is a nonsteroidal ecdysteroid agonist, and an iridoid with vasoconstrictor activity is present in the European *A. reptans* L. Other interesting compounds include diterpenoids with antibacterial activity from the Chinese *A. lupulina* Maxim., and a flavone in the Chinese and Japanese *A. decumbens* Thunberg with inhibitory activity on HIV reverse transcriptase. The iridoid glycoside 8-acetylharpagide isolated from *A. decumbens* exhibited potent anti-tumour-promoting activity in mice.

Botany A low, diffuse, much-branched hispid herb, usually less than 20 cm tall, with rhizome and erect to ascending branches. Leaves opposite, simple, oblanceolate to narrowly obovate or subspatulate, 4–8 cm × 2–3 cm, margin undulate; petiole short in lower leaves, absent in upper leaves; stipules absent. Inflorescence an axillary verticillaster. Flowers bisexual, 5-merous; calyx campanulate, oblique, with triangular teeth;



Ajuga bracteosa Wallich ex Benth. – 1, plant habit; 2, flower; 3, nutlets.

corolla gamopetalous, 2-lipped with upper lip very short and lower lip long and 3-lobed, white or pale blue; stamens 4, exserted; ovary superior, shortly 4-lobed, style bifid at the apex. Fruit consisting of 4 dry 1-seeded schizocarpous nutlets enclosed in the persistent calyx; nutlets obovoid, 1.5–2 mm × 1 mm, shallowly rugose-reticulate, yellowish, with large scar.

A. bracteosa is capable of flowering throughout the year.

Ajuga consists of approximately 50 species and occurs mainly in temperate regions of the Old World, with few species extending into tropical regions. Specific delimitation is often difficult in this genus, and differs considerably between taxonomists and floras. Some authors consider *A. bracteosa* a variable species with an extremely large area of distribution including e.g. eastern Africa and Japan, but others distinguish a number of closely related species within the complex. Until recently only *A. bracteosa* was mentioned for the Malesian region, but the closely related *A. taiwanensis* Nakai ex Murata is recorded for the Philippines.

Ecology *A. bracteosa* occurs on stream banks and in shaded ravines, but also in grassland, forest clearings, rice fields and coffee plantations, mostly in damp locations in the lowland, but in the Philippines up to 1700 m altitude.

Genetic resources *A. bracteosa* has a large area of distribution and also occurs in anthropogenic habitats, and is not endangered.

Prospects *A. bracteosa* and related species show interesting pharmacological properties, which deserve more attention. There is much confusion in the literature about the specific delimitations within the *A. bracteosa* complex and other groups of *Ajuga* species, and this can only be solved by a worldwide revision of the genus *Ajuga*.

Literature 182, 247, 690.

Other selected sources 501, 760.

R.H.M.J. Lemmens

Albizia myriophylla Benth.

Lond. Journ. Bot. 3: 90 (1844).

LEGUMINOSAE

$2n$ = unknown

Synonyms *Albizia thorelii* Pierre (1899).

Vernacular names Malaysia: akar manis, akar kulit manis, tebu gajah (Peninsular). Cambodia: voë 'a:èm, ph-'a:èm, sâmbu:ër kâk'. Laos: khua kha:ng hung[1] khuang. Thailand: som poi wan (northern), cha-em thai (central), oi chang (peninsular). Vietnam: d[aa]y cam th[ar]o nam (Tây Ninh), s[oos]ng r[aws]n (Dông Nai).

Origin and geographic distribution *A. myriophylla* occurs from the Himalayas and India, through Burma (Myanmar), Indo-China (Cambodia, Laos and southern Vietnam) and Thailand, to northern Peninsular Malaysia.

Uses In Malaysia an infusion of *A. myriophylla* roots is used internally against fever. A lotion made from the roots is used as a substitute for liquorice (*Glycyrrhiza glabra* L.) and, in combination with other plants, is applied to the head for children with fever. A lotion prepared by boiling the leaves is applied to the head to treat earache. The bark is used in traditional medicine in Indo-China to treat bronchitis and cough, and the leaves are applied to wounds to stop bleeding. The bark is also used as a substitute for liquorice. In Thailand the root is used to alleviate thirst, and as a laxative and mucolytic, and the wood and fruit are used as an expectorant.

Properties Stem and root bark of *A. myriophylla* have a sweet taste, but the quality of sweetness is different from that of glycyrrhizin (from liquorice) or sugars. Lignan glycosides (albizziosides A, B and C) have been isolated from the bark, but these do not taste sweet. A macrocyclic spermidine alkaloid was also isolated from the bark. It is striking that the bark is used for similar complaints as liquorice, such as against bronchitis and cough, although glycyrrhizin does not seem to be the active compound.

Saponins have been demonstrated in many *Albizia* species, including *A. myriophylla*; they are accordingly often used as fish poison. Cytotoxic activity is reported for some species. An example is *A. lebbeck* (L.) Benth., of which the roots and fruits showed anticancer activity, as well as hypoglycaemic and antiprotozoal activity.

Botany A scandent shrub or liana; branches armed with hook-like prickles. Leaves arranged spirally, stipulate, bipinnate with 8–20 pairs of pinnae, rachis and pinnae with extrafloral nectaries; leaflets opposite, 25–60 pairs per pinna, entire. Inflorescence consisting of pedunculate glomerules arranged into a terminal panicle. Flowers sessile, bisexual but the central flower in a glomerule male and enlarged, 5-merous; calyx funnel-shaped to campanulate; corolla funnel-shaped, 3.5–5.5 mm long; stamens numerous, united into a tube, white; ovary superior, stipitate. Fruit an oblong, flat pod, c. 14 cm × 2.5 cm. Seeds orbicular to obovoid, with distinct pleuro-

gram; cotyledons thick, endosperm absent.
Albizia comprises about 150 species and has a pantropical distribution, with centres of speciation in Africa, Madagascar and tropical America. It occurs throughout the Asian tropics and 20 species are indigenous within the Malesian region. Most species have a tree habit; however, few are armed lianas like *A. myriophylla*, and are often confused with lianescent *Acacia* species, but can be distinguished by the stems which are armed by a single, recurved prickle from the base of the leaf-scar (stems armed with prickles at the internodes or paired just below the internodes in *Acacia*), and by the united stamens (more or less free in *Acacia*).

Ecology *A. myriophylla* occurs in a wide range of lowland habitats, often in forest margins, on sandy river banks and in disturbed habitats, up to 300 m altitude in Malaysia, up to 900 m in Indo-China and Thailand.

Genetic resources Although *A. myriophylla* has a limited distribution in Malesia, it is widespread and not uncommon in Indo-China and Thailand. It does not seem easily liable to genetic erosion, the more so because it also occurs in secondary habitats and is not much collected.

Prospects Information on pharmacological activities of *A. myriophylla* is lacking and research is needed to judge its potential importance. The sweetening properties might be of commercial interest, but the identity and safety of the compounds responsible should be determined.

Literature 160, 247, 399, 400.
Other selected sources 121, 249, 250, 671.

R.H.M.J. Lemmens

Alchornea Sw.

Prodr.: 6, 98 (1788).
EUPHORBIACEAE
$x = 9$

Origin and geographic distribution *Alchornea* is a pantropical genus of about 50 species. In South-East Asia, approximately 10 species occur, of which *A. rugosa* is the most widely distributed. Peninsular Malaysia and the Philippines are richest in species, each with about 5 species.

Uses A decoction of leaves and roots of *A. rugosa* has been used in Malaysia to treat fever and ague. In Indonesia, there is mention of the fruits being applied as purgative. The roots and leaves of *A. villosa* have been prescribed in Malaysia to treat itch; this species is reportedly also used as an antidote for poisoning. In Indonesia, the leaf juice has been applied to cure fever and a poultice of leaves to treat headache. Leaves and fruits of *A. parviflora* and *A. sicca* are used in the Philippines as fish poison. The bark of *A. villosa* provides a good fibre; it is very tough.
A. cordifolia (Schumach. & Thonn.) Müll. Arg. is applied extensively in traditional medicine in Africa. It is used to treat cough, bronchial troubles, gonorrhoea, yaws, ulcers, rheumatic pains and fever. The root bark is an ingredient of traditional preparations to treat diarrhoea.

Properties There are only very few reports on properties of Asian *Alchornea*. The 1:1 methanol-dichloromethane extract of an unidentified *Alchornea* species exhibited phorbal ester antagonist activity.
The tropical African *A. cordifolia* has a very broad spectrum of biological activities. An aqueous extract of the root bark exhibited antibacterial, antiamoebic and antispasmodic activities; smooth muscle-relaxing flavonoids have been isolated from the leaves. *A. floribunda* Müll. Arg. from tropical Africa is reputed to have hallucinogenic properties.
Alkaloids are known to occur in bark and leaves of several *Alchornea* species, including *A. rugosa*. These are guanidin-derivatives of the alchornin type. The alkaloid alchorneine is found in *A. floribunda*.

Botany Trees or shrubs, monoecious or dioecious. Leaves alternate, simple, crenate or dentate, short- to long-petiolate, stipulate, often also stipellate. Inflorescence a simple or compound raceme or spike, bracteate. Flowers unisexual, petals and disk absent; male flowers with a calyx of 2–5 segments and 3–8 stamens; female flowers with 4–8 free sepals and a (2–)3-locular ovary crowned by (2–)3 more or less free styles. Fruit a (2–)3-locular capsule, lobed or unlobed, smooth or muricate. Seedling with epigeal germination; hypocotyl elongate; cotyledons thin and leaf-like.
A. sicca flowers in the Philippines from March to June.

Ecology *Alchornea* occurs in lowland forest up to 1000 m altitude, often in secondary forest, forest edges, and also in scrub vegetation.

Genetic resources *Alchornea* often occurs in secondary forest and seems unlikely to be at risk of genetic erosion, the more so because it is not much sought after for timber or other products.

Prospects Although several South-East Asian *Alchornea* species are used medicinally, very little is known about their properties. The interesting

properties of African species, about which much more information is available, warrant research on the Asiatic ones.

Literature 84, 121, 331, 334.

Selection of species

Alchornea parviflora (Benth.) Müll. Arg.

Linnaea 34: 168 (1865).

Distribution The Philippines (Luzon, Palawan, Leyte, Negros).

Uses Leaves and fruits are used as fish poison.

Observations A shrub or small tree; leaves ovate to oblong-ovate, palmately 3-veined, long-petiolate, stipulate; male inflorescence simply racemose, female one simple, many-flowered; flowers small. *A. parviflora* occurs in secondary forest and scrub vegetation at low and medium altitudes.

Selected sources 121, 621.

Alchornea rugosa (Lour.) Müll. Arg.

Linnaea 34: 170 (1865).

Synonyms *Alchornea javanensis* (Blume) Backer & Bakh.f. (1963).

Vernacular names Indonesia: kedung leutik, ki bewok (Sundanese), drejeg (Javanese). Malaysia: julong jantan, akar serimbong, rabu kumbang (Peninsular). Philippines: aguioi (Tagalog). Thailand: khaangpoi (central), sa maakfai (Loei), dap yaang (Chiang Mai). Vietnam: b[oj] n[ej]t, dom d[os]m.

Distribution From Burma (Myanmar), Indo-China, southern China and Thailand, throughout Malesia, to Australia (Queensland).

Uses A decoction of leaves and roots has been used in Malaysia to treat fever and ague. In Indonesia and Vietnam, the fruits have been applied as a purgative. The leaf juice is used in Papua New Guinea as an abortifacient.

Observations A shrub or small, usually many-stemmed tree up to 10 m tall; leaves cuneate-obovate, pinnately veined, with very short petiole, exstipulate; male inflorescence terminal, branched, female one simply racemose. *A. rugosa* occurs in primary and secondary, evergreen and deciduous forest up to 1000 m altitude; it is one of the most common shrubs of *Euphorbiaceae* in Malesia.

Selected sources 19, 20, 21, 22, 62, 121, 331, 334, 621, 990.

Alchornea rugosa (Lour.) Müll. Arg. – 1, branch with male inflorescences; 2, male flower; 3, branch with female inflorescence and fruits; 4, female flower.

Alchornea sicca (Blanco) Merr.

Philipp. Journ. Sci., Bot., 5: 192 (1910).

Synonyms *Alchornea philippinensis* Pax & Hoffm. (1914).

Vernacular names Philippines: balanti (Tagalog).

Distribution The Philippines (Luzon).

Uses Leaves and fruits are used as fish poison.

Observations A shrub up to 2 m tall; leaves ovate, palmately 3-veined, glandular at base; male inflorescence axillary, catkin-like, female one spicate. *A. sicca* occurs locally, especially in thickets along streams in the lowland.

Selected sources 117, 618, 621.

Alchornea villosa (Benth.) Müll. Arg.

Linnaea 34: 168 (1865).

Vernacular names Malaysia: rami bukit, rami hutan, malam petai (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses The roots and leaves have been prescribed

in Malaysia to treat itch; this species is also used as an antidote for poisoning. In Indonesia, the leaf juice has been applied to cure fever and a poultice of leaves to treat headache. The bark provides a good fibre; it is very tough.

Observations A shrub up to 6 m tall; leaves ovate, palmately 3–5-veined from the base, golden hairy beneath, long-petiolate, stipulate; male inflorescence axillary, slender, female one terminal and stout. *A. villosa* is locally common in lowland forest, particularly in secondary forest and edges, up to 300 m altitude.

Selected sources 22, 121, 178, 334, 990.

R.H.M.J. Lemmens

Allomorphia Blume

Flora 14: 522 (1831); Bijdr. Natuurk. Wetensch. 6: 262 (1831).

MELASTOMATACEAE

x = unknown; *A. alata*: $2n$ = 30–32

Origin and geographic distribution *Allomorphia* consists of approximately 20 species, and occurs in tropical Asia: Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra and northern Borneo. Indo-China, Thailand and Peninsular Malaysia are richest in species, each with about 5–7 species.

Uses There is some information on medicinal uses of *Allomorphia* in Peninsular Malaysia. Poultices of leaves have been applied to treat headache, fever and skin diseases, whereas a decoction of the roots is given to women after childbirth.

Properties Almost nothing is known about the biological activities and phytochemistry of *Allomorphia*. Ellagitannins are commonly present, as is the case in many other *Melastomataceae*. A general phytochemical screening showed that *A. bullata* leaves and stems contain some alkaloids and terpenes but no saponins, but the presence of alkaloids could not be demonstrated for *A. alata* or *A. exigua*.

Botany Shrubs or half-shrubby herbs, up to 3 m tall. Leaves opposite, those of a pair equal or slightly unequal, simple and entire, symmetrical, usually membranous, 3–5-veined, with coarsely reticulate fine veins; petiole usually long; stipules absent. Inflorescence a terminal panicle or raceme, with terminal branchlets 3-flowered. Flowers bisexual, 3–4-merous; calyx with cylindrical or obconical tube, toothed; petals inserted at the rim of the calyx limb, free, whitish or yellowish-green; stamens 6 or 8, equal or unequal in length, anthers equal or subequal in shape, without appendages, pinkish or purplish, opening by a single pore; ovary inferior, 3–4-celled, style filiform with minute stigma. Fruit a capsule, urceolate to subglobose, about as long as wide, 6–8-ribbed, dehiscing apically with minute valves, many-seeded. Seeds irregular, beaked.

Allomorphia is closely related to *Oxyspora*, and is reduced by some authors to a synonym of the last genus. In general, *Allomorphia* has smaller inflorescences and flowers, equal or subequal anthers without appendages (in *Oxyspora* dimorphic anthers with appendages), and smaller urceolate or subglobose fruits (in *Oxyspora* ellipsoid or obconical).

Ecology *Allomorphia* occurs particularly in the undergrowth of lowland forest, sometimes also in abandoned plantations near the forest. The species treated here are locally common in Peninsular Malaysia.

Management *Allomorphia* can be grown in gardens under partial shade. For this purpose, seed is sometimes collected from wild plants.

Genetic resources Not much is known about the exact distribution of *Allomorphia* species, but those treated here seem locally common and not particularly endangered.

Prospects Research on properties and phytochemistry is needed in order to evaluate the properties and prospects of *Allomorphia* as medicinal plants. Moreover, a thorough taxonomical study of the genus and related genera is badly needed.

Literature 121, 282, 331, 707, 731.

Selection of species

Allomorphia alata Scort. ex King

Journ. As. Soc. Beng. 69(2): 12 (1900).

Synonyms *Oxyspora curtisii* King (1900), *Allomorphia curtisii* (King) Ridley (1911).

Vernacular names Malaysia: keduduk gajah batu, senduduk hutan, puding hutan (Peninsular). Thailand: ma re hin, mang re hin (peninsular).

Distribution Peninsular Thailand, northern half of Peninsular Malaysia.

Uses A poultice made by bruising the leaves in cold water is applied to treat headache. Leaves, stems and roots have been used to cure stomachache, probably as a poultice.

Observations A small shrub up to 180 cm tall, with winged branches; leaves ovate to elliptical-ovate, 12.5–25 cm × 6–11 cm, bristle-toothed; inflorescence small, few-flowered; calyx tube cylindri-

cal; fruit subglobose. *A. alata* occurs in forest.

Selected sources 121, 609, 789.

Allomorphia bullata (Griffith) Cogn.

A.DC. & C.DC., Monogr. phan. 7: 465 (1891).

Synonyms *Allomorphia magnifica* (Miq.) Guill. (1913), *Allomorphia malaccensis* Ridley (1918), *Oxyspora bullata* (Griffith) J.F. Maxwell (1982).

Vernacular names Malaysia: senduduk hutan, keduduk gajah, pakan rimba (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia, a poultice made from the leaves has reputedly been used to treat leprosy, and a decoction of the roots has been given to women after childbirth. Pounded leaves mixed with salt are applied on sores.

Observations A half-shrub or shrub up to 180 cm tall, with obtusely quadrangular branches; leaves ovate or ovate-oblong, up to 25 cm × 15 cm; inflorescence large, many-flowered; calyx tube urceolate; fruit urceolate. *A. bullata* is common in lowland forest.

Selected sources 66, 121, 609, 789.

Allomorphia exigua (Jack) Blume

Flora 14: 522 (1831); Bijdr. Natuurk. Wetensch. 6: 262 (1831).

Synonyms *Oxyspora exigua* (Jack) J.F. Maxwell (1982).

Vernacular names Malaysia: keduduk hutan, keduduk gajah, senduduk gajah (Peninsular). Thailand: kamao khao (Surat Thani).

Distribution Peninsular Thailand and northern Peninsular Malaysia.

Uses A decoction of the roots is given to women after childbirth, and the leaves are used for poulticing the abdomen against remittent fever.

Observations A small shrub up to 60 cm tall, with obtusely quadrangular branches; leaves lanceolate, 8.5–15 cm × 3–6 cm; inflorescence small, few-flowered; calyx urceolate; fruit urceolate. *A. exigua* is found in rocky locations in the forest.

Selected sources 121, 609, 789.

H.C. Ong

Alocasia (Schott) G. Don

Sweet, Hort. Brit., ed. 3: 631 (1839).

ARACEAE

$x = 14$; *A. longiloba*: $2n = 28$, *A. macrorrhizos*: $2n = 24, 28, 42$

Origin and geographic distribution *Alocasia* consists of about 65 species and has an Indo-Malesian distribution. In Malesia, 57 species are indigenous; Borneo is the main centre of diversity with about 23 species, 20 of which are endemic, followed by the Philippines with 14 species, all endemic. *A. macrorrhizos* is planted and naturalized pantropically, and *A. cucullata* (Lour.) G. Don is widely cultivated in tropical Asia.

A. macrorrhizos was an important food plant, even a staple food, in various regions, e.g. in India and the Pacific islands, but this declined as *Colocasia* was introduced. Due to its ability to become naturalized and its value as a food in times of famine, *A. macrorrhizos* can be commonly found in regions where extensive cultivation was formerly practised. It is still the principal aroid food plant on a few western Polynesian islands.

Uses Several medicinal applications of *Alocasia* have been reported for South-East Asia. Boiled stems of *A. macrorrhizos* are used as a laxative, chopped-up roots and leaves as a rubefacient, and juice from the petiole against cough. The plants are applied for stimulating the skin, e.g. in cases of fever and to remove blotches. The rhizome is sometimes used as a poultice to treat furuncles. The pounded stems are applied as a paste to snakebites and scorpion stings. The irritant juice of *A. longiloba* is included in dart poisons, as an addition to the really active poison. *A. cucullata* is used to treat snakebites in China.

The rhizomes, stems and leaves, mainly of *A. macrorrhizos*, are used as food, vegetable and forage. The rhizome is a source of very white, easily digested starch or flour. Several species are important as ornamentals.

Properties The tissues contain calcium oxalate crystals, which produce irritation of the skin and inflammations of the oral cavity and mucous membranes. Sapotoxin is also present, and the toxic effects include gastroenteritis and paralysis of the nerve centres. Hydrocyanic acid is often present. A few cases of fatal poisoning following ingestion of *A. cucullata* fruits have been recorded; the clinical manifestations were similar to these of cyanogenic glycoside poisoning. The poisonous substances can be removed by repeated cooking, but the rhizomes and bases of petioles of *A. macrorrhizos* which are sometimes used for food usually contain few poisonous substances.

A lectin has been isolated from the rhizome of *A. macrorrhizos*, which showed potent mitogenic activity on human peripheral blood lymphocytes in the [3H]-thymidine uptake assay. It was a T-cell mitogen and did not induce any appreciable DNA synthesis in B-enriched lymphocytes. This species

also contains a protein which inhibits both the enzymes trypsin and chymotrypsin. The seed extract showed antifungal activity. There is also a report on HIV-1 protease inhibitory activity.

Botany Small to large perennial herbs, with elongate rhizomes. Leaves alternate, simple, sometimes deeply pinnatifid, sagittate to hastate, sometimes peltate, sometimes partly purplish and/or with whitish veins; petiole long, with sheath in basal part. Inflorescence a spadix shorter than or subequal to the spathe, with a zone of female flowers at base, followed by a zone of sterile flowers, then a zone of male flowers and ending in a well-developed appendix. Fruit a red to orange berry, several-seeded, infructescence enclosed in the persistent spathe. Seeds 3–5 mm in diameter, albuminous.

A. longiloba is a variable species, or perhaps a complex of species. Many of the species described in the past are based on cultivated forms, and should be regarded as cultivars or cultivar groups.

Ecology *A. longiloba* and *A. macrorrhizos* prefer moist conditions and occur in a wide altitudinal range, up to 2000 m altitude.

Management Any part of the stem of *Alocasia*, as well as suckers, can be used as planting material. *A. macrorrhizos* is usually planted at the beginning of the rainy season, in either full sun or partial shade. When cultivated for the starch, plants are allowed to grow for 10 months to several years before the stems are harvested.

Genetic resources Several *Alocasia* species are only known from a few collections and/or localities; this applies particularly to approximately 8 species endemic to Borneo. Several species with ornamental value are on the one hand potentially threatened by unsustainable collecting from the wild, and on the other hand are open to ex situ conservation through ornamental horticulture, sometimes even sustained by tissue culture. *A. longiloba* is widely distributed and locally common and seems not threatened, although some forms of this variable species with ornamental value fall in the group indicated above. *A. macrorrhizos* seems to be distributed directly by human activity and is perhaps merely a cultigen.

Germplasm collections of *Alocasia* exist in several parts of the world, the most important being located in Bangi (Selangor, Malaysia; National University) with 53 accessions, Hanoi (Vietnam; National Genebank) with 33 accessions, and Apia (Samoa; IRETA University) with 108 accessions.

Prospects The trypsin and chymotrypsin inhibitor found in *A. macrorrhizos* might be of interest for conferring insect resistance in transgenic plants. Some other compounds also deserve more attention, e.g. the lymphocyte-stimulating lectins, as well as the toxic principles, which are occasionally responsible for poisoning in humans.

Literature 245, 325, 445, 566.

Selection of species

Alocasia longiloba Miq.

Bot. Zeit. 14: 561 (1856); Fl. Ned. Ind. 3: 207 (1856).

Synonyms *Alocasia lowii* Hook. (1863), *Alocasia denudata* Engl. (1879), *Alocasia watsoniana* Masters (1893).

Vernacular names Malaysia: birah kijang, birah hitam, keladi rimau (Peninsular). Thailand: klaa-dee kae-la (Malay, Pattani), kaeo naamaa (Bangkok), ka choh nok (Ranong). Vietnam: r[as]y, th[uf]y d[af]i, r[as]y l[as] d[af]i.

Distribution Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and Sulawesi.

Uses In Malaysia, the sap is used in dart poison, as an addition to really active poison. *A. longiloba* is planted as ornamental.

Observations A small to large herb up to 150 cm tall, with rhizome up to 60 cm long and up to 8 cm in diameter; leaves usually peltate, 25–65(–85) cm × 14–40 cm, petiole often strikingly obliquely mottled chocolate brown; spadix 6–13 cm long. *A. longiloba* occurs in rain forest and swamp forest at low and medium altitudes, sometimes up to 2000 m, but also in regrowth and on exposed cliffs and ravines.

Selected sources 121, 325, 331.

Alocasia macrorrhizos (L.) G. Don

Sweet, Hort. Brit., ed. 3: 631 (1839).

Synonyms *Alocasia indica* (Lour.) Spach (1846).

Vernacular names Giant taro, giant alocasia, elephant ear (En). Grande tayove (Fr). Indonesia: bira (general), sente (Javanese), mael (Timor). Malaysia: birah negeri, keladi sebaring. Papua New Guinea: abir, pia, via. Philippines: biga (general), bira (Ilokano), badiang (Tagalog, Bisaya). Burma (Myanmar): pein-mohawaya. Cambodia: k'da:t haôra:. Laos: kaph'uk. Thailand: kradaat (Bangkok), kradaat dam (Kanchanaburi), horaa (Songkhla, Yala). Vietnam: r[as]y, r[as]y [aw]n.

Distribution It is unclear where *A. macrorrhizos* is indigenous. It does not appear to be wild in Malesia, but has been introduced and is often nat-

Alocasia macrorrhizos (L.) G. Don – 1, plant habit; 2, spathe and spadix; 3, spadix.

uralized in the Malesian region and Oceania, and elsewhere in the tropics. Perhaps it should be considered a cultigen.

Uses Boiled stems are used as a laxative, chopped-up roots and leaves as a rubefacient, and juice from the petiole against cough. In Papua New Guinea, young leaves and sap are used externally to treat headache, and leaves cooked in coconut milk are eaten to treat sexual insufficiency. In Thailand, the rhizome is applied to snakebites and wounds. The rhizome is a source of starch or flour. *A. macrorrhizos* is often planted as an ornamental.

Observations A very large herb up to 400 cm tall, with erect or decumbent stem; leaves not peltate, over 80 cm × 60 cm, petiole up to 130 cm long, not mottled; spadix 13–20 cm long. *A. macrorrhizos* occurs along roadsides, in waste places and gardens, mostly in wet locations at low and medium altitudes.

Selected sources 47, 91, 121, 245, 325, 327, 331, 347, 445, 566, 760, 1020.

Hadi Sutarno

Amischotolype Hassk.

Flora 46: 391 (1863).
COMMELINACEAE
$x = 9, 10$

Origin and geographic distribution *Amischotolype* comprises approximately 15 species, and occurs in tropical Africa (1 species) and tropical Asia, from India to southern China and New Guinea.

Uses Some records exist of medicinal applications of *Amischotolype* roots in Peninsular Malaysia: an infusion or decoction is drunk to treat rheumatism and fever, and both are applied as a poultice against headache.
Young shoots are sometimes cooked and eaten as a vegetable, e.g. those of *A. mollissima* (Blume) Hassk. in Indonesia.

Properties The steroid ecdysterone (commisterone) has been isolated from whole *A. mollissima* plants.

Botany Robust perennial herbs, often with stems creeping at base and erect higher up. Leaves arranged spirally, simple and entire, lanceolate, petiolate and with cylindrical, usually hairy leaf-sheaths at base. Inflorescence an axillary, dense, often head-like cyme. Flowers bisexual, regular, 3-merous, subsessile to shortly pedicellate; sepals free, subequal, keeled to boat-shaped, accrescent after anthesis; petals free, subequal, about as long as sepals; stamens 6, all fertile, subequal, filaments often bearded; ovary superior, sessile, 3-celled. Fruit a 3-celled capsule, opening loculicidally with 3 valves, each cell 1–2-seeded. Seeds ellipsoid, embedded in a red aril, with linear hilum.
The *Amischotolype* species treated here are often better known under the name *Forrestia*. However, this name is incorrect because it was published earlier as a genus name in *Rhamnaceae* (a synonym of *Ceanothus*).

Ecology *Amischotolype* occurs in the understorey of lowland and lower montane forest.

Genetic resources The *Amischotolype* species treated here are all recorded as endemic to Peninsular Malaysia, although *A. griffithii* has recently been collected in Borneo. They seem easily liable to genetic erosion, but their status is still unclear as long as *Amischotolype* remains so poorly studied taxonomically and, as a consequence, the exact areas of distribution of the species are unclear.

Prospects Very little information is available on all aspects of *Amischotolype*. More research on phytochemistry and pharmacological properties

as well as on botany is still needed before the prospects as medicinal plants can be judged.

Literature 331, 853.

Selection of species

Amischotolype gracilis (Ridley) I.M. Turner

Gard. Bull. Sing. 45(1): 53 (1993).

Synonyms *Forrestia gracilis* Ridley (1903).

Vernacular names Malaysia: setawar betina, tebu kera, buah anku (Peninsular).

Distribution Peninsular Malaysia.

Uses An infusion or decoction of the roots is drunk to treat rheumatism.

Observations A herb up to 100 cm tall, with slender, c. 0.5 cm thick stems shortly creeping at base; leaves c. 20 cm × 5 cm, glabrous above, velvety beneath, red-hairy at edges; inflorescence small, few-flowered. *A. gracilis* is common in lowland forest.

Selected sources 121, 789.

Amischotolype griffithii (C.B. Clarke) I.M. Turner

Novon 6(2): 221 (1996).

Synonyms *Forrestia griffithii* C.B. Clarke (1881).

Vernacular names Malaysia: setawar hutan, setawar jantan, pokok sampu landak (Peninsular).

Distribution Peninsular Malaysia and Borneo (Brunei).

Uses In Peninsular Malaysia, a decoction of the roots is drunk against fever.

Observations A herb up to 100 cm tall, with c. 2.5 cm thick stems creeping at base; leaves c. 22.5 cm × 7.5 cm, hairy all over; inflorescence small, c. 1.5 cm in diameter, compact, subglabrous. *A. griffithii* occurs in lowland forest.

Selected sources 121, 789.

Amischotolype irritans (Ridley) I.M. Turner

Novon 6(2): 221 (1996).

Synonyms *Forrestia irritans* Ridley (1903).

Vernacular names Malaysia: setawar gajah (Peninsular).

Distribution Peninsular Malaysia.

Uses A poultice of the roots is applied to treat headache.

Observations A tall herb with thick stems creeping at base; leaves c. 22.5 cm × 7.5 cm, hairy all over; inflorescence c. 3 cm in diameter, compact, covered with red spiny hairs. *A. irritans* is rather uncommon in hill forest.

Selected sources 121, 789.

Noorma Wati Haron

Ammannia baccifera L.

Sp. pl. 1: 120 (1753).

LYTHRACEAE

$n = 12$

Vernacular names Blistering ammannia (En). Philippines: bias-pugo (Tagalog), apoy-apoyan (Pangasinan, Tagalog), parapit-angit (Pampangan). Thailand: kaeo raknaa (Ratchaburi), mafai nok khum (Bangkok), yaa raknaa (northern). Vietnam: m[uf]I ch[os].

Origin and geographic distribution *A. baccifera* has a very large distribution comprising Africa, Afghanistan, Pakistan, India, Sri Lanka, Indo-China, China, Thailand, throughout Malesia (except Borneo, as far as is known) and Australia; recently introduced into the Caribbean (Guadeloupe, Jamaica).

Uses In the Philippines, *A. baccifera* is used in place of cantharides as a blistering plaster. In Pakistan and India, bruised fresh leaves are used for raising blisters against rheumatic pains and fever. *A. auriculata* Willd. is used for similar purposes. The leaves or the ash of *A. baccifera*, mixed with oil, are applied externally to cure herpetic eruptions and other skin diseases, and as remedy for ringworm and parasitic skin affections. An infusion made from entire plants is claimed to have aphrodisiac activity.

Properties *A. baccifera* is intensely acrid. Food contaminated with the leaf extract may produce severe burning pain in the abdomen. Betulinic acid, daucosterol, ellagic acid, n-hentricontane, lupeol, quercetin and triacontane-1,30-diol have been found in chemical studies.

Tests with rats showed anti-urolithic activity for an ethanolic extract of *A. baccifera*. A dose of 2 g/kg/day of the extract was effective in reducing the formation of urinary stones as well as in dissolving pre-formed ones. An aqueous ethanol extract showed hypotensive activity in dogs and mice. Extracts showed antibacterial activity against several plant pathogenic and human pathogenic bacteria; extracts obtained from stems, leaves and inflorescences were more effective than those from roots and seeds.

A compound with strong piscicidal activity, α-

naphthoquinone, was isolated from *A. baccifera*. Leaves are used to reduce sexual libido in animals.

Botany An erect, annual or short-lived perennial herb up to 100 cm tall, glabrous, much-branched. Leaves decussately opposite, lanceolate to oblanceolate, 1–5(–7) cm × 0.5–1(–1.5) cm, usually attenuate at base, acute to subobtuse at apex, entire, glabrous, subsessile; stipules absent. Inflorescence an axillary, dense, more or less sessile cyme. Flowers sessile or subsessile, 4(–5)-merous, with 2 small bracteoles at base; hypanthium persistent in fruit; sepals inserted on the hypanthium, persistent in fruit; petals absent; stamens inserted on the hypanthium, equal in length; ovary superior, style absent or very short, stigma capitate. Fruit a globose capsule, 1–1.5(–2) mm in diameter, slightly exceeding the hypanthium, irregularly circumscissile, many-seeded. Seeds obovoid, concave-convex, up to 0.5 mm long.

Seeds may remain viable for many years. They float in water due to their convex-concave shape and by a large aerenchymatous float on the concave side. Under conditions of high humidity, light intensity and temperature, germination may start within one week, with the majority of seeds germinating in two weeks.

Ammannia baccifera L. – 1, plant habit; 2, flower; 3, fruit; 4, seed.

Ammannia consists of about 25 species and is cosmopolitan, with the greatest diversity in Africa (16 species). It is often difficult to identify specimens: they appear to be intermediate between the accepted species. A possible reason for this may be that the plants are predominantly autogamous, but with at least a low level of outcrossing. Apparently they sometimes hybridize. *Ammannia* is related to *Rotala* and *Nesaea*, which differ in the fruits having dense transverse striations and opening with 2–5 septicidal valves in *Rotala* and dehiscing first by a small apical operculum and then irregularly in *Nesaea*. *A. baccifera* is a variable species.

Ecology *A. baccifera* occurs in wet locations, very often as a weed in rice fields in the lowland, up to 1200 m altitude. Like other *Ammannia* species, it can be a problematic weed in rice fields.

Management Maximum alkaloid synthesis was found in plants at the fruiting stage, under moderate light intensity and with a photoperiod of 16 hours. The application of NPK-fertilizer enhanced the alkaloid content. For controlling *A. baccifera* as a weed of rice, 1 kg/ha of oxadiazon has been applied successfully in India, and in Taiwan bensulfuron-methyl showed good results at 0.5 kg/ha. High rates of 2,4-D are recommended in Indonesia. The chrysomelid beetle *Altica cyanea* was found feeding on *A. baccifera* in rice fields in India, defoliating the plants completely, but no damage to the rice crop was observed. Apparently the beetle may be a biological control agent.

Genetic resources Efforts are being directed towards eradication of *A. baccifera* as a noxious weed of rice, and not towards protection.

Prospects Some interesting properties of *A. baccifera* deserve more attention, particularly the antibacterial activity, the anti-urolithic activity, and the reputed effectiveness against skin diseases.

Literature 289, 470, 752, 760, 879.

Other selected sources 121, 394, 593, 666.

R.H.M.J. Lemmens

Amorphophallus konjac Koch

Wochenschr. Gärtn. Pflanzenk. 1: 262 (1858).

ARACEAE

$2n = 26$ (24, 36)

Synonyms *Amorphophallus rivieri* Durieu ex Carrière (1870), *Hydrosme rivieri* (Durieu ex Car-

rière) Engl. var. *konjac* (Koch) Engl. (1879), *Amorphophallus mairei* H. Lév. (1915).

Vernacular names Devil's tongue, konjac (En). Philippines: pungapung (Tagalog), bulangan (Mangyan). Vietnam: c[ur] n[uw]a, khoai n[uw]a.

Origin and geographic distribution *A. konjac* originates from southern and south-eastern China, Vietnam and possibly Laos. It occurs wild and cultivated and easily escapes from cultivation. Its cultivation is most important in China and Japan ('konnyaku'), but it is also known in Indo-China and the Philippines, and occasionally elsewhere (e.g. Hawaii).

Uses The flour resulting from milling dried *A. konjac* tubers is recommended as an adjunct in low-calorie diets and to control the blood cholesterol level. The tuber is used in traditional medicine in Vietnam as a poultice against furuncles.

The tubers of *A. konjac* can be made edible in times of food scarcity, usually after peeling, slicing and repeated washing and boiling in water to remove toxic and irritating substances. In Japan, they are used to prepare a traditional dish ('ito konnyaku') which is gel-like in appearance and texture and is made by adding slaked lime to a colloidal solution of the flour in water, and then heating this. The glucomannan in the tubers has film-forming characteristics useful in preparing stabilizers and emulsifiers for food, drinks, cosmetics and in drilling fluids. Glucomannan is also a good sieving additive for capillary electrophoresis. The tubers can also be used to prepare acid and alcohol.

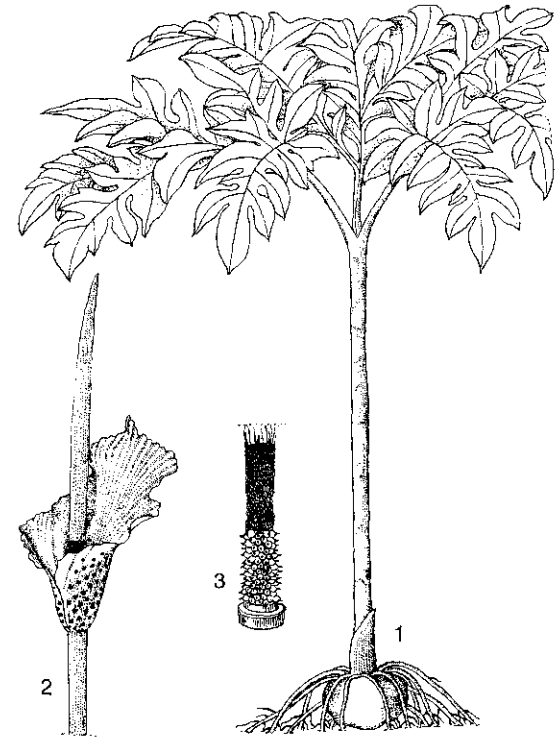
The tubers of *A. paeoniifolius* (Dennst.) Nicolson (synonym: *A. campanulatus* Decne.) are used in traditional medicine in India. They are, however, far more important as a tuber crop. They are considered aperient, carminative and expectorant, and are also applied externally as an irritant to treat acute rheumatism; the seeds are used for the same purpose. The tubers are administered internally to treat dysentery and haemorrhoids. In the Philippines, the tubers are considered caustic, and are also used as antirheumatic poultice. In India, the roots are used against ophthalmia, and applied to boils and as an emmenagogue. The fermented juice of the petioles is used to cure diarrhoea in India and Papua New Guinea. The tuber is given in Thailand as a food supplement for diabetic patients.

Some *Amorphophallus* species are used as poisonous plants. In Peninsular Malaysia, the juice of *A. paeoniifolius* and *A. prainii* Hook.f. mixed with latex from *Antiaris toxicaria* Lesch., is sometimes used as dart poison.

Properties In tests with mice *A. konjac* powder exerted a positive effect on the rate of induced lung cancer, and it prolonged the survival time of the mice. There were no noticeable adverse reactions of the powder. The powder markedly lowered the cholesterol levels in the serum and liver of rats eating hypercholesterolemic diets. Some aromatic compounds (e.g. serotonin) with peroxynitrite scavenging activity have been isolated from the powder. The tubers of *A. paeoniifolius* exhibit antiprotease activity.

The carbohydrates of the tubers consist of starch, but mainly (more than 50%) of a glucomannan, a polysaccharide of mannose and glucose, which, in combination with water becomes very viscous and is therefore attractive for many industrial processes. Fresh *Amorphophallus* tubers are irritant due to the presence of calcium oxalate.

Botany A perennial herb with subterranean tuber up to 30 cm in diameter and 20 cm long, weighing up to 10(–13) kg. Leaves usually solitary, tripartite, up to 2 m in diameter, each of the 3 segments highly dissected; leaflets elliptical,



Amorphophallus konjac Koch – 1, plant with leaf; 2, spathe and spadix; 3, lower part of spadix.

3–10 cm × 2–6 cm; petiole up to 100 cm × 8 cm, smooth or with scattered punctiform warts at the base, dirty whitish-pinkish with large green spots and smaller white dots. Inflorescence a spadix 15–110 cm long, female in lower part, becoming male higher up via a transitional zone, with a well-developed asexual part at the top, spadix partly enveloped by the spathe 10–60 cm × 10–55 cm, spathe limb erect, undulate or folded longitudinally with spreading margins, outside dark purplish-brown with scattered blackish-green spots, inside dark brown, glossy. Fruit unknown.

The plants normally start flowering when 4 years old. Seed does not develop.

Because *A. konjac* has been cultivated in China for about 2000 years and also naturalizes easily after escaping from cultivation, it is not clear which characters belong to the true wild plant. It can best be subclassified into cultivar groups and cultivars.

Amorphophallus originates from and is mainly distributed in the Old World, especially in the tropics from Africa to the Pacific Islands, but also extends to temperate areas in China and Japan. The total number of species is approximately 170.

Ecology *A. konjac* usually grows in secondary vegetation, in forest margins and thickets, village groves, usually under some shade, up to 2500 m altitude. The optimum average temperature ranges from 20–25°C. In China, it develops best when soil moisture is at 75% of the field capacity, preferably dropping to 60% when the tuber is maturing.

Management *A. konjac* can be propagated from tubers or tuber parts and by tissue culture. Planting holes of 60 cm × 60 cm × 45 cm are recommended, the bottom filled with a mixture of soil, manure and fertilizer. Planting is done at the beginning of the rainy season. In estate farming, *A. konjac* is interplanted with cereals such as maize and sorghum, or grown under shade trees. Mulching is recommended. In Japan, a permanent cropping system exists, in which young and old plants are grown mixed together like a semi-natural vegetation, in which only older tubers are harvested at the end of the growing season. In this system, a minimum input of chemical fertilizers, herbicides and pesticides is combined with large amounts of mulch, and remarkably few diseases and pests occur. In China and Japan, the tubers cultivated for food are harvested one year after planting, when they are small but sweet and juicy. For industrial purposes, they are harvested after 3 years.

Genetic resources Germplasm collections of *A. konjac* are available in the Institute of Botany (Kunming, China) and the Gunma Agricultural Experiment Station (Konnyaku Branch, Gunma-ken, Japan).

Prospects Studies in animals and humans indicate a potential use for the glucomannans in the tubers, particularly as anti-atherosclerosis agents. Complementary studies are needed, also to define quality criteria for the drug. It is unlikely that *A. konjac* will gain more prominence in agriculture as a food crop. However, in Thailand the market is expanding due to low-calorie value of the tubers and because the product decreases fat and cholesterol absorption.

Literature 118, 245, 369, 580, 683.

Other selected sources 121, 671.

R.H.M.J. Lemmens

Ampelocissus Planchon

Vigne amér. 8: 371 (1884).

VITACEAE

$x = 20$

Origin and geographic distribution *Ampelocissus* consists of about 100 species and occurs in all tropical regions. Tropical Africa and Asia are richest in species. At least several dozens of species have been recorded for Malesia, and about 8 for Vietnam.

Uses Some *Ampelocissus* species are used in traditional medicine in Peninsular Malaysia and Vietnam, mainly in decoctions of the roots or leaves which are used externally in poultices to treat wounds, oedema, orchitis, rheumatism, lumbago, and during childbirth. Sometimes a root or leaf decoction is used internally, e.g. to treat venereal diseases or cholera.

Some other *Ampelocissus* species are used in traditional medicine in India: the sliced and dried tuberous rootstocks of *A. araneosa* (Dalz. & Gibson) Planchon possess astringent and cooling properties; the root juice of *A. indica* (L.) Planchon (synonym: *A. arnottiana* (Wight & Arnott) Planchon), mixed with coconut oil, is employed as a depurative, aperient and diuretic, and to treat eye diseases and ulcers; the juice of tender leaves of *A. latifolia* (Roxb.) Planchon is used to treat toothache and ulcers, whereas a decoction of the roots is taken against chronic dysentery, and the roots and bark of *A. tomentosa* (Heyne ex Roth) Planchon are used to treat swellings and haemorrhoids. In China, the tuberous rootstocks of *A. artemisiaefolia* Planchon are applied externally to sores, wounds, burns and fractures.

Properties Very little is known about the phytochemistry and biological activities of *Ampelocissus*. Ellagic acid, kaempferol and myrcetin have been isolated from *A. cinnamomea* leaves. The flavonoids kaempferol and quercetin and several phenolic acids have been identified in leaves of some Indian species (*A. latifolia* and *A. rugosa* (Wallich) Planchon); however, proanthocyanidins, which are often present in other *Vitaceae*, were lacking in the leaves. Poultices made from the leaves or roots seem to act as slight irritants, promoting the local blood flow and thus accelerating healing.

Botany Perennial climbing herbs or lianas, sometimes erect shrubs, with tuberous rootstock, climbing by tendrils on the peduncles. Leaves alternate, simple and entire to more or less deeply lobed or digitately 3–11-foliolate, margin shallowly serrate or entire; stipules triangular, inconspicuous, caducous. Inflorescence consisting of cymes or heads forming a lax to condensed leaf-opposed panicle. Flowers usually bisexual, 4–5-merous; calyx cup-shaped, more or less distinctly lobed; petals free, spreading; stamens inserted on the receptacle, opposite the petals; disk adnate to and entirely surrounding the ovary, 5–10-ridged; ovary superior, 2-locular, style short, conical, stigma minute. Fruit a fleshy berry, 2–4-seeded. Seeds elliptical, flattened, with marked longitudinal keel or ridge on one side and a median furrow or pit on the other side.

Ampelocissus is often difficult to distinguish from other *Vitaceae* genera. It is characterized by paniculate inflorescences bearing a tendril and by a disk adnate to the ovary. However, authors mention different characters as being characteristic, depending on the region.

Ecology *Ampelocissus* species are climbers in lowland forest, and can be locally common. They are often found at forest edges or in gaps in the forest, where they may cover the trees completely.

Genetic resources The *Ampelocissus* species treated here are common, at least locally, and do not seem to be under threat of genetic erosion.

Prospects Too little is known about the properties and phytochemistry of *Ampelocissus* species to judge their potential as medicinal plants. Research could be worthwhile, as the related grape (*Vitis vinifera* L.) has interesting pharmacological activities (particularly the procyanidins present in the seeds) such as vascular protective activity. *Ampelocissus* is, like other genera in *Vitaceae*, in urgent need of a taxonomic revision.

Literature 121, 182, 943.

Selection of species

Ampelocissus arachnoidea Planchon

A.DC. & C.DC., Monogr. phan. 5(2): 375 (1887).

Vernacular names Vietnam: nho r[uwf]ng, h[oof] nho nh[eej]n.

Distribution Cambodia, Vietnam and Java.

Uses In Cambodia, the roots are used to treat venereal diseases. The fruits are edible, but acid and astringent, and without much flavour; they are sometimes used as a substitute for vinegar.

Observations A climber or creeper up to 10 m long, with tuberous rootstock; leaves simple, suborbicular, 3–5-angular or lobed, deeply cordate at base, coarsely toothed, densely arachnoid beneath; inflorescence erect, ovoid, dense; flowers small, usually 5-merous; fruit globose, dark red. *A. arachnoidea* occurs in open forest and brushwood, up to 400 m altitude.

Selected sources 62, 971.

Ampelocissus cinnamomea (Wallich) Planchon

A.DC. & C.DC., Monogr. phan. 5(2): 403 (1887).

Synonyms *Vitis cinnamomea* Wallich (1824).

Vernacular names Malaysia: akar puding rimba, akar charek puteri, akar sebengkak (Peninsular).

Distribution Peninsular Malaysia, Singapore.

Uses In Peninsular Malaysia, a decoction of the leaves is used internally and externally to treat cholera and oedema of the legs, and a poultice of crushed leaves is applied to wounds and sore legs, and on the abdomen during childbirth. Young leaves are used in betel-quid. The roots have been used to dye cotton a brownish colour.

Observations A climber with rather slender, whitish or reddish-woolly stem; leaves simple, ovate-cordate, sometimes 3-lobed, toothed, densely red-tomentose beneath; inflorescence slender, woolly; flowers small, 4-merous; fruit globose to ellipsoid, reddish to purplish. *A. cinnamomea* is locally common in lowland forest.

Selected sources 121, 528, 789.

Ampelocissus gracilis (Wallich) Planchon

A.DC. & C.DC., Monogr. phan. 5(2): 407 (1887).

Synonyms *Vitis gracilis* Wallich (1824).

Vernacular names Malaysia: akar iang-iang rimba, akar keladi tanah (Peninsular).

Distribution Peninsular Malaysia, Singapore, Sumatra, Borneo.

Uses A poultice made from the roots is used to treat orchitis.

Observations A climber with slender, whitish to reddish-woolly stem; leaves simple, ovate, with cuspidate teeth, sparsely pubescent beneath; inflorescence very slender, reddish-woolly; flowers very small, 4-merous; fruit ovoid to oblong. *A. gracilis* is common in lowland forest.

Selected sources 121, 789.

Ampelocissus polythyrsa (Miq.) Gagnep.

Bull. Soc. hist. nat. Autun 23: 20 (1911).

Synonyms *Vitis polystachya* Wallich (1828; nom. nud.), *Vitis polythyrsa* Miq. (1863), *Ampelocissus polystachya* Planchon (1887).

Vernacular names Malaysia: akar chabang tujoh, akar charek biawak (Peninsular). Vietnam: h[oor] nho nhi[eef]u ch[uf]m.

Distribution Cambodia, Vietnam, Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia, a poultice made from a root decoction is used to treat rheumatism and lumbago.

Observations A liana with thick, corky stem; leaves 5–9-foliolate, leaflets elliptical-oblong, toothed, glabrous; inflorescence large, sparsely hairy; flowers 4-merous; fruit globose-oblong, greenish to purplish. *A. polythyrsa* is locally common in lowland forest.

Selected sources 121, 334, 789.

Nguyen Huu Hien

Amydrium zippelianum (Schott) Nicolson

Blumea 16: 126 (1968).

ARACEAE

$2n$ = unknown

Synonyms *Epipremnum zippelianum* (Schott) Engl. (1880), *Epipremnopsis zippeliana* (Schott) Alderw. (1920), *Amydrium magnificum* (Engl.) Nicolson (1968).

Vernacular names Papua New Guinea: ganona, waliwaboya (Milne Bay).

Origin and geographic distribution *A. zippelianum* is distributed in the Philippines, Sulawesi, the Talaud Islands, Halmahera and New Guinea.

Uses There are records of *A. zippelianum* being used to treat coughs, cuts and swellings in Papua New Guinea (Milne Bay region).

A. sinensis (Engl.) H. Li is used in traditional medicine in China to treat traumatic injury, fractures and angina pectoris, and has sedative properties. It has also been found in northern Vietnam.

Botany A low climber with stem up to 3.5 cm in diameter. Leaves distichously alternate, simple, ovate to rotund in outline, 70–125 cm × 60–90 cm, cordate at base, acute to acuminate at apex, deeply laciniate, venation clearly reticulate; petiole 25–85 cm long, geniculate at both ends, with a short deciduous sheath; stipules absent. Inflorescence a sessile to distinctly stipitate spadix, 3–8 cm × 1–2 cm when flowering, up to 22 cm × 5.5 cm when fruiting, enclosed in a reflexing and quickly deciduous yellowish spathe. Flowers bisexual; tepals absent; stamens 4; ovary superior, 1-locular. Fruit a fleshy berry, whitish-green to orange, 1–2-seeded. Seeds subglobose, endosperm present. *Amydrium* consists of 5 species and occurs in China, Thailand and throughout Malesia, where 3 species have been recorded. It is classified in the subfamily *Monsteroideae* and tribe *Monstereae*, together with e.g. *Monstera* from tropical America, and the closely related genera *Epipremnum*, *Rhaphidophora* and *Scindapsus* which also occur in tropical Asia. *Amydrium* is characterized by the virtual absence of trichosclereids (abundant in other genera), a completely reticulate venation, and a 1-locular ovary with a single, deeply intrusive placenta.

Ecology *A. zippelianum* occurs mainly in primary rain forest, sometimes also in disturbed forest, in shady locations, up to 1800 m altitude. It climbs on trees and rocks.

Management *A. zippelianum* can be propagated by stem cuttings. Stem sections 10–15 cm long can, after removal of leaves, be placed on a seed tray filled with an open, humus-rich soil mix at a minimum temperature of 22°C. Rooting takes place in about 2 weeks, and new growth begins from the nodes in about 4 weeks. Once growing strongly, the stem section can be cut into pieces, each bearing a rooted portion, and planted individually. In China, *A. sinensis* is sometimes propagated by stem cuttings too.

Genetic resources *A. zippelianum* has a fairly large area of distribution, and is locally rather common. However, as it is more or less confined to lowland tropical rain forest, it may become endangered because this type of forest is under much pressure in many regions.

A. sinensis is found scattered in southern China and northern Vietnam. It is confined to humid for-

est and collected for medicinal purposes, and could easily become endangered.

Prospects The absence of information on its phytochemistry and properties makes it impossible to determine the potential of *A. zippelianum* as a medicinal.

Literature 103, 347, 677.

Other selected sources 672.

Nguyen Van Dzu

Anadendrum microstachyum (de Vriese & Miq.) Backer & Alderw.

Bull. Jard. Bot. Buitenzorg, ser. 3, 1: 371 (1920).
ARACEAE
$2n = 60$

Synonyms *Anadendrum montanum* Schott (1857).

Vernacular names Malaysia: akar meroyan sembang, akar segunja, daun ketam (Peninsular). Thailand: krak (Phangnga), khieo hua duan (Chanthaburi), thao thakhaap (Trat). Vietnam: r[as]y th[uw][ow]ng th[uj] n[us]i.

Origin and geographic distribution *A. microstachyum* is found in Indo-China, southern China, southern Burma (Myanmar), Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi and the Philippines (Mindanao).

Uses In Peninsular Malaysia, hot and oiled leaves of *A. microstachyum* have been applied to the abdomen to treat remittent fever and after childbirth, and a decoction of leaves and roots has been used internally during childbirth. The leaves are sometimes eaten in curries, and the roots as a vegetable.

Botany A climbing herb up to 10 m long, creeping by means of adhesive roots. Leaves alternate, distichous, obliquely ovate-oblong, (7.5–)9–25 cm × 3.5–11.5 cm, entire, with reticulate fine venation; petiole (3.5–)5–25 cm long, with sheath nearly to apex, geniculate apically; stipules absent. Inflorescence a spadix 1–3.5(–5) cm × 0.5 cm, stipitate, cylindrical, enclosed in an overtopping, greenish-white, caducous spathe. Flowers bisexual, with a cup-like perianth; stamens 4; ovary superior, subquadrangular, 1-locular. Fruit a berry, subglobose, distinctly truncate apically, orange-red, 1-seeded. Seed subglobose, with smooth glossy testa; endosperm absent.

Anadendrum is classified in the subfamily *Monsteroideae* as the only genus of the tribe *Anadendreae*. It consists of approximately 7 species and is restricted to tropical Asia, to the same area as *A. microstachyum*. *A. montanum* is here considered a synonym of *A. microstachyum*. *Calla montana* Blume is apparently the basionym for *Rhaphidophora montana* (Blume) Schott, not for *Anadendrum montanum* Schott, but further clarification is required.

Ecology *A. microstachyum* is a hemi-epiphyte climbing on trees, sometimes on rocks, usually in humid tropical rain forest, but also in secondary forest and teak forest, in Java up to 1300 m altitude. It is common in many places.

Genetic resources *A. microstachyum* has a large area of distribution, is common in many regions, and also occurs in secondary forest. It seems safe to state that it is not liable to genetic erosion.

Prospects The absence of information on its phytochemistry and properties makes it impossible to determine the potential of *A. microstachyum* as a medicinal plant.

Literature 121, 611.

Other selected sources 62.

R.H.M.J. Lemmens

Anaxagorea A. St.-Hil.

Bull. Sci. Soc. Philom. Paris 1825: 91 (1825).
ANNONACEAE
$x = 8$; *A. javanica*: $2n = 16$

Origin and geographic distribution *Anaxagorea* consists of about 25 species, most of which are confined to tropical America. In South-East Asia, 3 (perhaps 4) species have been found, all also in Malesia.

Uses A number of uses in traditional medicine have been recorded for *Anaxagorea* in South-East Asia: leaves are applied topically to treat rheumatism, and a decoction of the roots is given as a protective medicine after childbirth. In Thailand the heartwood is used as a blood tonic and to treat muscle pain. Seeds are used as camphor to preserve clothes. The wood of larger plants is occasionally used, e.g. for rafters, and the bark as cordage.

In tropical America an infusion of bark and wood is sometimes used against cough, the bark to treat headache and rheumatism, for cleaning the teeth, as a deodorant and as cordage, and the wood occasionally for construction work.

Properties The occurrence of cyanogenic glycosides has been recorded in *A. luzonensis* leaves. 8-Isopentenylnaringenin was isolated from a methanolic extract of *A. luzonensis*. This prenyl-

flavonoid compound is a non-steroidal oestrogen agonist with a more potent activity than genistein (from *Leguminosae* such as *Pueraria montana* (Lour.) Merr.). In-vivo tests with ovariectomized rats showed that 8-isopentenylnaringenin acts as an oestrogen agonist in the uterus as well as in bone. Several xanthones and flavonoids were isolated from the bark and heartwood. Several of these showed antioxidant activity.

From some tropical American *Anaxagorea* species, the aporphine alkaloids asimilobine and anaxagoreine have been isolated.

Botany Shrubs to small trees; twigs terete, densely brownish-puberulous but often soon glabrescent. Leaves alternate, distichous, simple and entire, petiolate; stipules absent. Inflorescence terminal, leaf-opposed, in axils of leaves, on short axillary shoots or cauliflorous, short-pedunculate or sessile. Flowers with apically thickened pedicels, bisexual, regular, (2–)3-merous, white, greenish-white or yellowish-white; sepals ovate to broadly ovate; petals in 1 or 2 whorls, fleshy; stamens numerous, innermost often staminodial; carpels several to numerous, superior. Fruit consisting of several to many monocarps, these stipitate and more or less distinctly beaked, densely puberulous but often later glabrescent, greenish, dehiscing along the ventral suture, 2-seeded. Seeds with outer side convex, inner side flat, smooth, shiny black.

The fragrant flowers are probably pollinated by insects. The fleshy petals, which are often appressed, may form a small pollination chamber. The seeds can be ejected through the ventral slit of the monocarps for several metres by an exploding mechanism when the pressure caused by the drying and shrinking wall is high enough.

Anaxagorea is one of the comparatively few genera of *Annonaceae* with dehiscent, pod-like monocarps, and is clearly distinct from all other genera.

Ecology *Anaxagorea* occurs in lowland rain forest, often primary forest but sometimes also in secondary forest, up to 600(–1100) m altitude.

Genetic resources *A. javanica* and *A. luzonensis* are both widespread and locally common, and consequently not likely to be endangered. However, a third species, *A. borneensis* (Becc.) J. Sinclair, is only known from Borneo and may therefore be more at risk of genetic erosion.

Prospects Plant-derived oestrogens may exert beneficial effects in the treatment of cardiovascular diseases, osteoporosis and menopause. Non-steroidal oestrogens such as 8-isopentenylnaringenin isolated from *A. luzonensis* wood may open the way to design drugs that selectively block the unwanted effects of oestrogen (particularly the development of breast and uterine cancer) and that mimic its beneficial effects.

Literature 486, 582, 583, 634.

Selection of species

Anaxagorea javanica Blume

Fl. Javae 66, t. 32, 36A (1830).

Synonyms *Anaxagorea scortechinii* King (1892).

Vernacular names Malaysia: kekapur, sekobang kechil, pali monyet (Peninsular). Thailand: champuun (Bangkok, peninsular).

Distribution Thailand, Peninsular Malaysia, Singapore, Sumatra, western Java and Borneo; possibly also the southern Philippines.

Uses In Peninsular Malaysia, a decoction of the roots has been given after childbirth as a protective medicine, whereas the seeds are used to preserve clothes, in the same way as camphor. The wood is occasionally used for rafters, and the bark as cordage.

Observations A shrub or small tree up to 8(–15) m tall; leaves oblong to obovate, 10–22(–29) cm × 3–12 cm; flowers with outer petals mostly more than 10 mm long, inner stamens staminodial, carpels 7 or more; monocarps with beak up to 1 mm long. *A. javanica* occurs in lowland forest, primary as well as secondary, up to 500(–1100) m altitude. It is a variable species subdivided into 3 varieties; probably collections from the Philippines described as *A. radiata* Robinson also belong to this species.

Selected sources 121, 583.

Anaxagorea luzonensis A. Gray

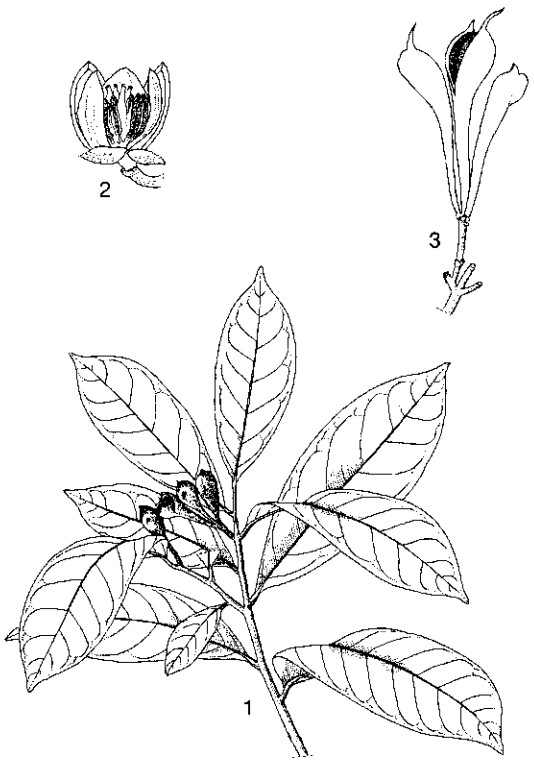
U.S. Expl. Exped., Phan. 1: 27 (1854).

Synonyms *Anaxagorea zeylanica* Hook. & Thomson (1855).

Vernacular names Philippines: dalairo (Tagalog), bagang-aso (Bikol), bobonoyang (Cebu Bisaya). Thailand: kam-langwua thaloeng (Prachuap Khiri Khan), chamaep (Trat), puun (Surat Thani). Vietnam: qu[ar] d[aaf]u ng[oox]ng.

Distribution Sri Lanka, the Andaman Islands, Burma (Myanmar), Indo-China, Cambodia, Vietnam, Hainan, Thailand, central Java, eastern Borneo, eastern Sulawesi, the Moluccas and the Philippines.

Uses In the Philippines fresh leaves are used topically to treat rheumatism in the joints. In



Anaxagorea luzonensis A. Gray – 1, fruiting twig; 2, flower; 3, fruit.

Thailand chips of the heartwood are traded on local markets for use as a blood tonic and to treat muscle pain.

Observations A shrub up to 1.5(–4) m tall; leaves elliptical, (3.5–)6–21 cm × 2–8 cm; flowers with outer petals mostly less than 10 mm long, staminodes absent, carpels up to 5; monocarps with beak over 1 mm long. *A. luzonensis* occurs in lowland forest, primary as well as secondary, up to 600 m altitude.

Selected sources 284, 486, 583, 634, 760.

R.H.M.J. Lemmens

Ancistrocladus tectorius (Lour.) Merr.

Lingnan Sci. Journ. 6: 329 (1930).

ANCISTROCLADACEAE

$2n$ = unknown

Synonyms *Ancistrocladus extensus* Wallich ex Planchon (1849), *Ancistrocladus pinangianus* Wallich ex Planchon (1849).

Vernacular names Indonesia: akar bebulus, belulus (Bangka), trung bulus (Belitung). Malaysia: akar julong hitam, jenjulong akar, lidah sapi (Peninsular). Thailand: kra-maa (Khmer, Saraburi), khon maa (central), li-daa saa-pee (Malay, peninsular). Vietnam: trung qu[aa]n.

Origin and geographic distribution Burma (Myanmar), Indo-China, southern China, Hainan, the Andaman Islands, Thailand, Peninsular Malaysia, the Riau and Lingga Archipelago, Bangka, Belitung, southern Sumatra and western Borneo.

Uses In Peninsular Malaysia and Thailand, a decoction of *A. tectorius* roots is used to treat dysentery and malaria. In Peninsular Malaysia, a decoction of the roots is drunk to improve blood circulation. In Thailand, leaves are used to treat kidney diseases, young leaves are eaten as flavouring, whereas old ones are used for thatching. The stems are sometimes used, e.g. for roofing boats and for arrows.

A. abbreviatus Airy Shaw, endemic in West Africa, is widely used in folk medicine, e.g. against malaria and elephantiasis, and as a laxative; some other species are also used in traditional medicine in Africa.

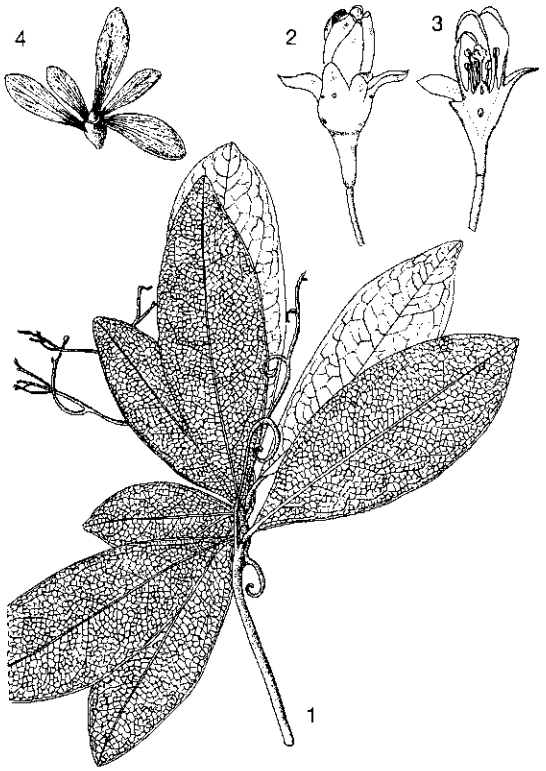
Properties Several isoquinoline alkaloids have been isolated from *A. tectorius*. Tests with bark and leaf extracts confirmed its antimalarial activity. The naphthylisoquinoline alkaloid-containing extracts showed potent growth-inhibiting activity on *Plasmodium falciparum* and *P. berghei* in vitro.

Several interesting alkaloids have been isolated from *A. korupensis* D.W. Thomas & Gereau, native to Cameroon and Nigeria. Michellamines showed more potent antioxidants in assays than several compounds being considered clinically as chemoprevention agents. These compounds and korundamine A demonstrated in-vitro anticytopathic activity against HIV-1. Korundamine A and korupensamines exhibited in-vitro antimalarial activity against *Plasmodium falciparum*. Extracts and pure naphthylisoquinoline alkaloids derived from the African species *A. abbreviatus* and *A. barteri* Scott-Elliot also showed in-vitro antimalarial activity. Furthermore, the triterpene betulinic acid was isolated from the Indian *A. heyneanus* Wallich ex J. Graham; it was found to exhibit moderate to good in-vitro antimalarial activity against *Plasmodium falciparum*. In addition, the naphthylisoquinoline alkaloid dioncophylline A isolated from *A. abbreviatus* showed molluscicidal and fungicidal activities.

Botany A liana or scandent shrub with tendril-like shoots provided with curved, ultimately woody hooks mostly arranged unilaterally. Leaves

alternate, usually crowded above some older hooks, simple and entire, mostly elliptical-obovate, 9–30 cm × 3–10 cm, glabrous, minutely pitted, venation reticulate, sessile; stipules absent. Inflorescence usually between the crowded leaves, dichotomously branched with divaricate, up to 15 cm long branches. Flowers often crowded at the tips of the inflorescence branches, bisexual, regular, 5-merous, small; pedicel articulate; calyx with short tube and 5 unequal lobes enlarged and wing-like in fruit, some or all lobes with prominent glands; petals united at base, obliquely ovate, 3–3.5 mm long; stamens 10, alternately unequal, filaments broadened at base; ovary inferior, 1-celled, protruding into a nipple-shaped elongation bearing 3 articulated styles. Fruit a nut crowned by the much enlarged unequal calyx lobes up to 5 cm × 2 cm. Seed obconical with flat apex, c. 5 mm long; endosperm ruminate. Seedling with epigeal germination; cotyledons thin, leaf-like.

The hook-like structures are modified peduncles. The hooks sometimes have enlarged tips, which are flowers with smaller perianth and reduced stamens and ovary. The leafy branches arise from the axil of hooks.



Ancistrocladus tectorius (Lour.) Merr. – 1, branch with inflorescence; 2, flower; 3, flower in longitudinal section; 4, fruit.

Ancistrocladus consists of approximately 22 species, 13 of which occur in tropical Africa and 9 in tropical Asia. The affinity of the genus is unclear and it is classified in a separate family. *Dipterocarpaceae* have most often been suggested as related, mainly because of the rather similar fruits. The occurrence of similar naphthylisoquinoline alkaloids in the African family *Dioncophyllaceae* has been reason to suggest a phylogenetic link with *Ancistrocladaceae*. This is also supported by comparative studies of the wood.

Ecology *A. tectorius* occurs in mixed forest and scrub vegetation in the lowland, often near the sea, sometimes close to the beach, mostly on siliceous soils.

Genetic resources *A. tectorius* is rather widespread and is not very demanding as far as habitat is concerned. It does not seem to be easily liable to genetic erosion.

Prospects The naphthylisoquinoline alkaloids present in *Ancistrocladus* proved to be pharmacologically very interesting. Several of these have potent antimalarial activity, indicating a confirmation of the use in traditional medicine against malaria, and, in *A. korupensis* from Africa, also anti-HIV activity. However, organic and aqueous extracts of *A. tectorius* have been shown to be inactive in in-vitro anti-HIV assays.

Literature 108, 247, 260, 457.

Other selected sources 121, 282, 596, 643, 705, 731, 800.

H.C. Ong

Anneslea fragrans Wallich

Pl. asiat. rar. 1: 5, t. 5 (1829).

THEACEAE

$2n$ = unknown

Vernacular names Cambodia: sau phi. Thailand: saraphi, hak (northern), ban ma (north-eastern). Vietnam: lu[uw][ow]ng x[uw][ow]ng, ch[ef] b[es]o.

Origin and geographic distribution Burma (Myanmar), Indo-China, southern China, Hainan, Thailand and Peninsular Malaysia.

Uses In Cambodia, the bark, mixed with other drugs, has been applied to treat dysentery and as a vermifuge, and the leaves have been used in a complex mixture which was considered a good remedy for fever. In China, the bark is used to

treat diarrhoea and dysentery, and in Vietnam and China against liver inflammation.

Botany A small to medium-sized tree up to 25 m tall, with columnar bole, not buttressed; outer bark reddish, smooth or shallowly grid-cracked, inner bark fibrous, brown. Leaves alternate, simple and entire, lanceolate to oblanceolate or obovate, 6–15 cm × 2.5–5.5 cm, cuneate at base, usually acute at apex, leathery; petiole 2–3 cm long; stipules absent. Inflorescence terminal, umbellike. Flowers bisexual, regular, 5-merous, with 2 bracteoles subtending the calyx; calyx with unequal, up to 1.5 cm long lobes, persistent; petals shortly connate at base, up to 2 cm long, constricted below the middle; stamens numerous, anthers linear, with prolonged connective; ovary semi-inferior to inferior, 2–3-celled, style filiform, persistent. Fruit berry-like, globular to ovoid, c. 2 cm in diameter, crowned by the calyx lobes, with several seeds.

Anneslea consists of 3–7 species, depending on the species concept, and has the same area of distribution as *A. fragrans*. In addition *A. steenisii* Kobuski occurs in the mountains of northern Sumatra and *A. lanceolata* (Hayata) Kanehira in Taiwan.

A. fragrans is a variable species within which several varieties have been distinguished. In Malesia (Peninsular Malaysia) only var. *crassipes* (Hook.f. ex Choisy) Pierre (synonym: *A. crassipes* Hook.f. ex Choisy) has been found.

Ecology *A. fragrans* occurs scattered or in small groups in open deciduous or evergreen forest, particularly at the summit or on ridges of hills and mountains, at 800–2000 m altitude.

Genetic resources *A. fragrans* is fairly widely distributed, and often grows in inaccessible locations in mountainous regions. It is therefore unlikely to be endangered by habitat destruction.

Prospects Too little is known about the properties and phytochemistry of *A. fragrans* to judge its potential as a medicinal plant.

Literature 494, 732.

Other selected sources 121, 249, 990.

R.H.M.J. Lemmens

Anredera Juss.

Gen. pl.: 84 (1789).

BASELLACEAE

x = unknown; *A. cordifolia*: $2n = 24$

Origin and geographic distribution *Anredera* consists of approximately 10 species, and originates from the warmer parts of America. *A. scandens* was introduced as an ornamental in the Philippines already at the beginning of the 19th Century.

Uses In the Philippines, the tuberous roots of *A. scandens* are used topically to hasten the ripening of boils. They are applied traditionally in Mexico for the treatment of broken bones and flesh wounds. Chopped leaves of *A. cordifolia* in boiling water are used in folk medicine in Colombia and Taiwan to treat diabetes and as an analgesic. In Laos, the entire plant is applied in cases of arthritis, diarrhoea and to wounds.

Properties Triterpenoid saponins such as boussingoside A1 are responsible for the hypoglycaemic activity of *A. cordifolia* extracts, as has been demonstrated in experiments with rats and mice with induced diabetes. In addition to several boussingosides, other triterpenes including larreagenin A, oleanolic derivatives and ursolic acid have been isolated.

Significant wound healing and anti-inflammatory properties have been found in *Anredera* species used as a medicinal plant in tropical America; extracts had no effect on cell proliferation and did not exhibit mutagenic activity. Ethanolic extracts of *A. cordifolia* showed inhibitory effects on spasmogen-induced contractions of isolated gastric fundus preparations of rats. An aqueous extract of dried *A. cordifolia* buds showed antihepatotoxic activity in rats at a dose of 30 mg/kg. A retrochalcone was isolated from *A. scandens* roots.

Botany Branched perennial climbing herbs with annual or short-lived shoots arising from a fleshy rhizome or tuberous roots; shoots up to 6 m long. Leaves alternate, simple and entire, slightly fleshy, sessile or shortly petiolate; stipules absent. Inflorescence an axillary raceme or spike, simple or branched. Flowers bisexual, sometimes functionally unisexual, regular, sweet-scented; pedicel articulate, with 2 pairs of bracteoles at the apex, lower pair small, connate, forming a cuplet, or free and caducous, upper pair tepaloid, convex or boat-shaped, often keeled or even winged on the back; perianth consisting of 5 segments connate at base, patent and thin in anthesis, later thickening and enclosing the fruit; stamens 5, inserted on the tepals; ovary superior, 1-celled, style splitting to various degrees into 3 arms, each with an oblong to club-shaped papillose stigma. Fruit a globose utricle enclosed by the perianth, indehiscent, 1-seeded. Seed lens-shaped, with semi-circular to horseshoe-shaped embryo.

Anredera does not produce seeds in Malesia. It can be confused with *Basella*, the only other genus

of *Basellaceae* occurring in Malesia, which differs in its very fleshy perianth enclosing the fruit. *B. alba* L., which is primarily a popular vegetable, is also used in traditional medicine.

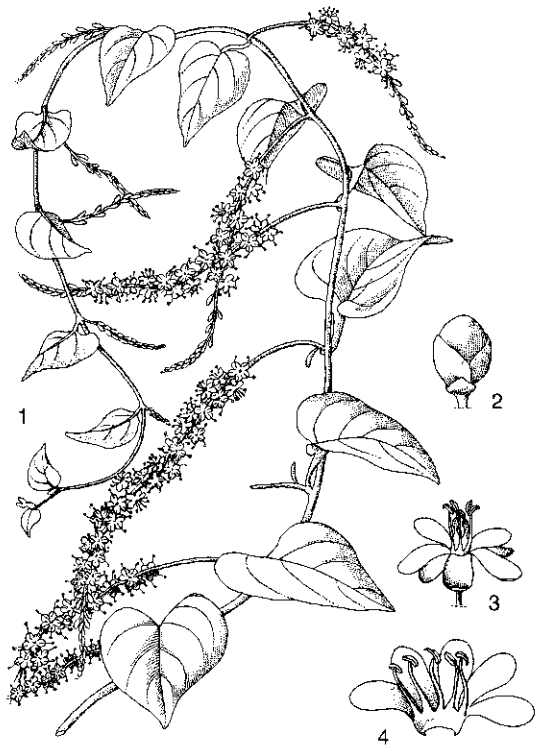
Ecology *A. scandens* apparently needs a dry season for its development and grows badly in perhumid climates.

Management *Anredera* can be propagated vegetatively by small tubercles found in the axils of the leaves. Leaf spots caused by *Alternaria alternata* have been observed on cultivated *A. cordifolia*.

Genetic resources Both *Anredera* species treated here are widely cultivated throughout the world, but they are only locally present in Malesia as a result of a few introductions. The genetic diversity is therefore likely to be limited, the more so since they do not produce seeds in this region and are only vegetatively propagated.

Prospects The hypoglycaemic and anti-inflammatory activities of *Anredera* extracts deserve more attention.

Literature 233, 247, 567.



Anredera cordifolia (Ten.) v. Steenis – 1, flowering twig; 2, flower bud; 3, flower; 4, opened perianth and stamens.

Selection of species

Anredera cordifolia (Ten.) v. Steenis

Fl. Males., ser. 1, 5(3): 303 (1957).

Synonyms *Boussingaultia cordifolia* Ten. (1853), *Boussingaultia gracilis* Miers (1864), *Boussingaultia baselloides* auct. non Humb., Bonpl. & Kunth.

Vernacular names Madeira vine, mignonette vine (Am). Vietnam: m[uf]ng t[ow]i c[ur].

Distribution Native to tropical South America, introduced in many tropical countries, e.g. in Vietnam and Java.

Uses Chopped leaves in boiling water are used in folk medicine in Colombia and Taiwan to treat diabetes and as an analgesic.

Observations A perennial climber with thick rhizome and short-lived shoots up to 6 m long; leaves ovate to subcordate, 1–11 cm × 1–8 cm; flowers with lower bracteoles connate and forming a cuplet, upper bracteoles flattened, not keeled, perianth white, patent in anthesis. *A. cordifolia* is planted as an ornamental in the lowlands of Java.

Selected sources 233, 247, 556, 561, 567.

Anredera scandens (L.) Moq.

DC., Prodr. 13(2): 230 (1849).

Vernacular names Philippines: malabato, olibato (Tagalog).

Distribution Native to tropical America, introduced and naturalized in the Philippines.

Uses In the Philippines, the tuberous roots are applied topically to hasten ripening of boils. They are used traditionally in Mexico for the treatment of broken bones and flesh wounds.

Observations A perennial climber with large tuberous roots and short-lived shoots up to 5 m long; leaves ovate to ovate-oblong, 1.5–8.5 cm × 1–6 cm; flowers with lower bracteoles free, caducous, upper bracteoles boat-shaped, broadly winged on the back, perianth greenish-white, little opening in anthesis. *A. scandens* is planted as an ornamental and naturalized in the lowlands of the Philippines.

Selected sources 126, 247, 760.

R.H.M.J. Lemmens

Antidesma montanum Blume

Bijdr. fl. Ned. Ind. 17: 1124 (1827).
EUPHORBIACEAE
$2n$ = unknown
Synonyms *Antidesma nitidum* Tul. (1851).
Vernacular names Indonesia: ande-ande, kenyan pasir, wunen (Javanese). Malaysia: gunchiak, gunchian, berunai (Peninsular). Thailand: mamao khon (Chiang Mai), mamao hin (Chumphon), mao polo (Trang, Surat Thani). Vietnam: ch[of]i m[of]i n[us]i, ch[of]i m[of]g[aa]n l[ox]m.
Origin and geographic distribution *A. montanum* occurs from Burma (Myanmar), Indo-China and Thailand to western Malesia (Peninsular Malaysia, Sumatra, Java, the Lesser Sunda Islands, the Philippines and Sulawesi).
Uses In Peninsular Malaysia grated roots of *A. montanum* in water have been used internally to treat measles, chickenpox and malaria, and the leaves externally against headache and thrush in children. In Thailand roots and stems are used as a diuretic. The fruits are reportedly edible.
The leaves of other *Antidesma* species are also used medicinally in South-East Asia, e.g. those of *A. ghaesembilla* Gaertner which serve in poultices to treat headache, scurf and swellings, and in an infusion against fever, those *of A. cuspidatum* Müll. Arg. to treat flatulence, and those of *A. bunius* (L.) Sprengel which are acid and diaphoretic and used as stimulant and to treat syphilis. These species are primarily used for their timber and, in the case of *A. bunius*, also for their edible fruits. In Java, leaves of *A. bunius* are also commonly applied in traditional veterinary medicine for sheep and goats. *A. neurocarpum* Miq. and *A. tetrandrum* Blume play a role in magic rituals in Siberut.
Properties No information is available on the phytochemistry or pharmacological properties of *A. montanum*, except the presence of the peptide alkaloids aralionine B and myrianthine B. Triterpenes have been found in several other *Antidesma* species, e.g. *A. bunius*. The alkaloid scutianine has been isolated from a Philippine *Antidesma* species (probably *A. microcarpum* Elmer); in animal models, this compound has exhibited anti-inflammatory activity. Seed extracts of *A. bunius* show molluscicidal activity.
Botany A shrub or small tree up to 15 m tall, with finely puberulous stems. Leaves alternate and distichous, simple and entire, elliptical-oblong, 7–20 cm × 3–8 cm, acuminate, membranous, conspicuously pinnately veined, hairy only on the veins; petiole 3–7(–12) mm long; stipules subulate, caducous. Male inflorescence branched, slender, female inflorescence often simple. Flowers small, unisexual, solitary in the axil of bracts; calyx 3–4(–5)-lobed, lobes short and broad, often irregularly dentate; petals absent; male flowers with 3–4 stamens inserted between the lobed disk, rudiment of pistil glabrous; female flowers with superior, glabrous, 1(–2)-locular ovary, 3 styles and annular disk. Fruit a small drupe, globose, ellipsoid or obovoid, 5–8 mm long, glabrous, dark red at maturity, often white-pustulate when dry. Seedling with epigeal germination; cotyledons emergent, leafy; hypocotyl elongated.
Antidesma comprises about 200 species distributed in the Old World tropics, but mainly in tropical Asia. Some authors separate the genus from the *Euphorbiaceae* and place it in a separate family, the *Stilaginaceae*. It is often difficult to identify the individual species.
Ecology *A. montanum* occurs in primary as well as secondary forest, riverine forest and shrubby vegetation up to 1000 m altitude, and is common. It is recorded from many different soils, including clay, sandstone, limestone and peat.
Genetic resources It is unlikely that *A. montanum* will become threatened because it is common in its large area of distribution and is not discriminating in habitat.
Prospects Research is needed to confirm the reputed beneficial effects of *A. montanum* in traditional medicine.
Literature 45, 121.
Other selected sources 19, 20, 22, 23, 24, 62, 990.

R.H.M.J. Lemmens

Apostasia nuda R.Br.

Wallich, Pl. asiat. rar. 1: 76 (1830).
ORCHIDACEAE
$2n$ = 48
Synonyms *Apostasia brunonis* Griff. (1851), *Apostasia lobbii* Reichenb. f. (1872), *Adactylus nudus* (R.Br.) Rolfe (1896).
Vernacular names Indonesia: si sarsar bulung, si marsari-sari, duhut bane-bane (Sumatra). Malaysia: pokok pelampas budak, kenching pelandok, menkuang tikus (Peninsular). Singapore: carmion. Vietnam: c[oor] lan tr[aaf]n.
Origin and geographic distribution *A. nuda* occurs in Burma (Myanmar), Cambodia, southern Vietnam, peninsular Thailand, Peninsular Malay-

sia, Sumatra, Bangka, western Java and Borneo.

Uses In Peninsular Malaysia, a decoction of *A. nuda* roots has been used as a poultice to treat diarrhoea, and a decoction of the fruits to treat sore eyes. *A. wallichii* R.Br. has reportedly been used against diabetes in Peninsular Malaysia.

Botany An erect, completely glabrous terrestrial herb with scaly rhizome and aerial roots from the lower part; stem often branched, up to 60(–70) cm tall. Leaves alternate, distinctly spaced, linear-lanceolate, (13–)17–27(–45) cm × 0.5–1.5 cm, tapering into an apical filiform tubular prolongation, veins numerous. Inflorescence a terminal branched and pendulous raceme, with a tuft of sterile bracts at base. Flowers slightly zygomorphic, 3-merous; pedicel short, irregularly ribbed; sepals and petals recurved, keeled and cuspidate, white or yellow; stamens 2, on a column formed by the base of the filaments and of the style; ovary inferior, cylindrical and triangular in cross-section, 3-locular, style free in upper part, stigma distinct. Fruit a thin-walled capsule with numerous seeds. Seeds regularly alveolate to nearly smooth, with apical appendage.

A. nuda can be found flowering and fruiting throughout the year.

Apostasia consists of 7 species and is distributed from Nepal and Sri Lanka to Japan and Queensland (Australia); 6 species occur in Malesia. *Apostasia* is often considered as belonging to *Orchidaceae*. However, it differs by the 2 anthers borne on separate filaments and the free style and stigma, and is placed by some authors in a separate family *Apostasiaceae* together with *Neuwiedia*. There is still considerable disagreement in literature whether *Apostasia* and *Neuwiedia* should be considered to represent a separate, primitive group (tribe or subfamily) in *Orchidaceae*, or a separate family. The possession of predominantly simple perforation plates in root vessels seems to point to a position as a sister group to the orchids and not to an ancestral position. *Apostasia* resembles *Curculigo* (*Hypoxidaceae*), but it does not seem closely related.

Ecology *A. nuda* occurs in the undergrowth of primary forest, mostly on hills and mountain slopes at 100–1300 m altitude.

Genetic resources *Apostasia* species are restricted to a type of habitat that is under increasing pressure: the undergrowth of lowland primary rain forest. Therefore, they may easily become endangered, especially the species with limited distribution (e.g. *A. latifolia* Rolfe and *A. parvula* Schltr.) and those which are rare (e.g. *A. elliptica* J.J. Smith). *A. nuda* may already be suffering from genetic erosion in parts of its fairly large area of distribution.

Prospects Research is needed to confirm the reputed beneficial effects of *A. nuda* in traditional medicine of Peninsular Malaysia.

Literature 121, 203.

Other selected sources 249, 334, 440, 890.

Diah Sulistiarini

Aquilaria cumingiana (Decne.) Ridley

Journ. Straits Br. Roy. As. Soc. 35: 80 (1901).

THYMELAEACEAE

$2n$ = unknown

Synonyms *Gyrinopsis cumingiana* Decne. (1843).

Vernacular names Indonesia: giba kolano (Halmahera). Philippines: palisan (Tagalog), bago (Manobo), binukat (Aklan Bisaya).

Origin and geographic distribution *A. cumingiana* occurs in the Philippines, southern Borneo (Sampit region) and the Moluccas (Morotai and Halmahera).

Uses In the Philippines the bark and roots of *A. cumingiana* are applied to wounds to stop bleeding, whereas bark, wood and fruits are used as a substitute for quinine.

A. malaccensis Lamk (synonym: *A. agallocha* Roxb.) is more commonly used medicinally. However, its most important product is the famous agar wood: resin-containing heartwood produced from old and diseased trees, which is highly esteemed as incense for ceremonial purposes. The incense is also used against cancer, especially of the thyroid gland, and in China as a sedative against abdominal complaints, asthma, colics and diarrhoea, and as an aphrodisiac, carminative and insect repellent. Grated wood enters into various preparations used especially during and after childbirth, and to treat rheumatism, smallpox and abdominal pains. It is used as a blood and heart tonic in Thailand. Wood of *A. crassna* Pierre ex H. Lecomte is considered to be stomachic and tranquillizing in traditional medicine in Vietnam, and is prescribed as a powder, aqueous preparation or tincture against gastralgia, nausea, vomiting and anxiety.

Properties No information is available on phytochemistry or pharmacological properties of *A. cumingiana*.

A benzene extract of *A. malaccensis* wood showed neuroleptic properties in tests with mice; jinkoh-

eremol and agarospirol were identified as the active principles. Tests with rats suggest that an aqueous extract inhibits the immediate hypersensitivity reaction by inhibition of histamine release from mast cells. A hot water extract of the wood exhibited smooth muscle relaxant activity on acetylcholine and histamine induced motility activities.

Cytotoxic compounds have also been demonstrated in the bark and wood of *A. malaccensis*. A wood extract exhibited significant activity in the Eagles' carcinoma of the nasopharynx test system. A bark extract showed distinct activity in the P-388 lymphocytic leukaemia system in vitro, but was inactive against the same system in vivo; the cytotoxic compounds from the bark were identified as 1,3-dibehenyl-2-ferulyl glyceride and 12-O-n-deca-2,4,6-trienoylphorbol-13-acetate. An alcoholic extract of the wood has been reported to exhibit mild cardiotonic activity. Decoctions of the wood of *A. malaccensis* are said to have antimicrobial properties, e.g. against *Mycobacterium tuberculosis* and *Shigella flexneri*.

Botany A shrub or small tree up to 5 m tall; bark grey, mottled, smooth, bast consisting of silky fibres; young branches initially densely pubescent but glabrescent. Leaves alternate, simple and entire, oblong-lanceolate to elliptical-oblong or ovate-oblong, 14–18 cm × 5.5–8.5 cm, usually cuneate at base, acute or acuminate at apex, chartaceous to subcoriaceous, usually glabrous, pinnately veined with 12–18 pairs of veins; petiole 4–6 mm long; stipules absent. Inflorescence usually axillary, often simple and umbelliform; peduncle c. 5 mm long. Flowers bisexual, regular, usually 5-merous, 13–16 mm long, whitish; pedicel c. 3 mm long, articulated at base; calyx tube cylindrical, puberulous, lobes 2–3 mm long; petaloid appendages usually 10, united into a ring and inserted near apex of the calyx tube; stamens usually 10, inserted near petaloid appendages, sessile; ovary superior, short-stiped, 2-loculate, style short, stigma capitate. Fruit a globose to ellipsoid loculicidal capsule, protruding laterally from the split floral tube, c. 2 cm long, orange-red, 1–2-seeded. Seeds broadly ovoid, plano-convex, c. 1 cm long, with a short appendage.

Aquilaria consists of approximately 15 species and occurs in tropical and part of subtropical Asia. It is most closely related to *Gyrinops*, which differs in its 5 stamens.

Ecology *A. cumingiana* occurs in primary forest at low and medium altitudes.

Genetic resources The extremely high prices paid for high quality agar wood and for the essential oil and the indiscriminate felling of diseased and healthy trees threaten natural stands of several *Aquilaria* species including *A. malaccensis* with extinction. *A. malaccensis* is listed in Appendix II of the Convention on International Trade in Endangered Species of wild fauna and flora (CITES). *A. cumingiana* with its shrubby habit does not seem to be exploited for this purpose, but its preference for lowland primary forest and the high pressure on this type of habitat in its area of distribution warrant attention for protection measures.

Prospects Research is needed to confirm the reputed medicinal properties of *A. cumingiana*. This seems worthwhile in the light of the pharmacological activity demonstrated in other *Aquilaria* species.

Literature 247, 760.

Other selected sources 300, 482, 671, 699, 711, 1058.

Cheksum S. Tawan

Aralidium pinnatifidum (Jungh. & de Vriese) Miq.

Fl. Ned. Ind. 1(1): 763 (1856).

ARALIDIACEAE

$2n$ = c. 40

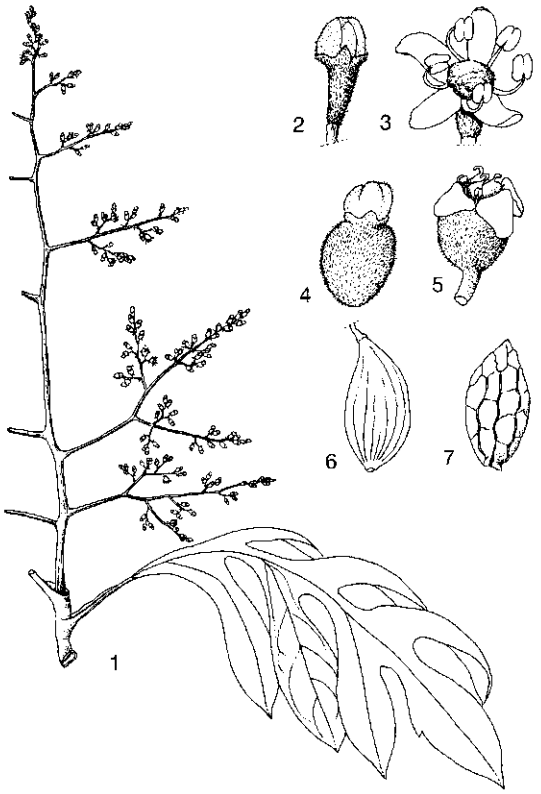
Vernacular names Brunei: daun tutchol antu (Iban). Indonesia: kayu attarodan (Sumatra, Batak), segentut (Gayo), medung (general). Malaysia: balai, sebalai, hempedu buaya (Peninsular). Thailand: khot nok kuut (Phangnga), phrommakhot (Nakhon Si Thammarat, Trang), phapuu nga (Yala).

Origin and geographic distribution *A. pinnatifidum* is distributed in peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia, the leaves of *A. pinnatifidum* are reputedly used as a poultice to treat boils and are used as a diaphoretic against fever. A decoction of the leaves is said to be useful in a foment for treating rheumatism. A decoction of the roots is drunk or a piece of the stem is placed in the mouth to induce bowel movement. Smoke from burning leaves is used to repel insects from rice fields. *A. pinnatifidum* is listed among plants used as dart poison. The dull red and hard wood is sometimes used for construction, but it is only available in smaller dimensions. It may be useful for flooring and furniture.

Properties The iridoid glucosides griselinoside and aralidioside have been isolated from *A. pinnatifidum*. Flavonoid constituents are absent in the leaves. A general phytochemical screening showed the presence of alkaloids and terpenes in the leaves.
The wood is dull red, hard and with fine grain. It often splits badly during drying.

Botany A small dioecious tree up to 10 m tall, rarely up to 20 m tall, with bole up to 25 cm in diameter; buds enclosed in long-shedding leaf-bases. Leaves arranged spirally, pinnately incised, frequently as deep as the midrib, with lobes oblong-acuminate and decurrent on the midrib, occasionally blade entire and broadly ovate, c. 30 cm long, glabrous; petiole 5–12 cm long, clasping the stem; stipules absent. Inflorescence a terminal or occasionally axillary panicle, up to 50 cm long, pendulous, many-flowered. Flowers small, unisexual, 5-merous, creamy or red-tinged, fragrant; pedicel articulated; calyx and petals densely puberulent, petals imbricate; male flowers with persistent petals, 5 stamens and rudimentary ovary; female flowers with caducous petals, 5 staminodes and inferior, 1-celled ovary, styles 3–4. Fruit drupe-like, usually obliquely ellipsoid, up to 4.5 cm long, purplish or black and juicy when ripe, 1-seeded. Seed broadly ellipsoid, up to 2.5 cm long, with deep ruminations at the surface.
A. pinnatifidum can be found flowering and fruiting throughout the year. It is the single species of a genus which was often included in *Araliaceae* or *Cornaceae*. However, it has several unique features. For that reason, it was suggested that it be placed separately in *Griseliniaceae* because it seemed to be related to *Griselinia*. After a multidisciplinary study however it was concluded that the establishment of a separate family *Aralidiaceae* was most appropriate. *A. pinnatifidum* can be mistaken for *Artocarpus* species, which have similar leaves.



Aralidium pinnatifidum (Jungh. & de Vriese) Miq. – 1, flowering branch; 2, bud of male flower; 3, male flower; 4, bud of female flower; 5, female flower; 6, fruit; 7, seed.

Ecology *A. pinnatifidum* occurs frequently in primary rain forest, but is also commonly found in open bamboo forest and secondary regrowth, up to 1250 m altitude, in Borneo up to 1800 m.

Management *A. pinnatifidum* can be cultivated easily; it has no special requirements and grows well under partial shade or under open but cool conditions, such as forest edges.

Genetic resources Concerns about *A. pinnatifidum* being endangered seem to be unnecessary because it is common in many regions, even in secondary regrowth, and is not often gathered.

Prospects Little is known about the constituents of *A. pinnatifidum*, and nothing about its pharmacological properties. Compounds such as flavonoids, which often have interesting pharmacological activities, are very poorly represented. It is still uncertain whether the traditional uses bear any relation to active constituents.

Literature 121, 247.

Other selected sources 282, 427, 705, 731, 744.

H.C. Ong

Ardisia Sw.

Prodr.: 3, 48 (1788).
MYRSINACEAE
$x = 23$; *A. crenata*, *A. solanacea*: $2n = 46$

Origin and geographic distribution *Ardisia* comprises almost 400 species and shows a pantropical distribution. It occurs throughout South-East Asia with western Malesia as the main cen-

tre of diversity. For southern Vietnam 48 species have been recorded, Thailand has some 72 species, Peninsular Malaysia 75, Borneo 92 and New Guinea 31.

Uses Common uses of *Ardisia* in traditional medicine in South-East Asia include the external treatment of skin diseases, wounds and rheumatism and internal application against stomachache and fever. For these purposes, usually a decoction of the roots or leaves is used.

The wood is occasionally used for posts in local house building, e.g. that of *A. copelandii* Mez and *A. lanceolata* Roxb. The fruits of some species are edible, e.g. those of *A. crenata* and *A. lurida* Blume. Young shoots and leaves of *A. elliptica* Thunberg and *A. laevigata* Blume are sometimes eaten raw or cooked as a vegetable, whereas in the Philippines flowers and fruits of *A. squamulosa* Presl are cooked as a flavouring with fish. The bark of *A. serrata* (Cav.) Pers. is occasionally used for tanning, and the fruits of *A. solanacea* for dyeing a yellowish colour. Some *Ardisia* species are planted as an ornamental. *A. japonica* (Hornst.) Blume from China and Japan is used in traditional medicine to treat coughs and uterine bleeding.

Properties Root extracts of *A. oxyphylla* showed significant activity against *Entamoeba histolytica* and *Trichomonas vaginalis* in vitro. The active compound was identified as the benzoquinone rapanone.

A methanol extract of leaves and twigs of the Philippine *A. iwahigensis* Elmer, as well as the alkenylphenol ardisenone isolated from it, demonstrated moderate cytotoxicity against several human cancer cell lines in culture. Ardisiphenols A–C, isolated from *A. sanguinolenta* fruits, showed scavenging activity and cytotoxicity against murine breast cancer cell lines. A benzoquinonoid compound with antimetastatic and antitumour effects was isolated from *A. crenata* in Korea.

Bergenin derivatives and other triterpenoid saponins have been isolated from *A. crenata* roots. The triterpenoid saponins ardisicrenoside C and D showed inhibitory activity on cAMP phosphodiesterase, whereas an aqueous acetic acid extract of the roots showed utero-contracting activity in rats, with ardisiacrispin A and B as the active compounds. A cyclic depsipeptide isolated from *A. crenata* inhibits platelet aggregation, decreases blood pressure and has hypotensive and cytotoxic activities.

Ethanolic extracts of *A. solanacea* leaves, stems and seeds showed distinct activity against many gram-positive and gram-negative bacteria. This species is rich in bergenin, and shows anti-acetylcholine activity.

The methanol extract of aerial parts of *A. japonica* showed moderate anti-human immunodeficiency virus (HIV) activity in vitro. Several triterpenoid saponins have been isolated, but only bergenin and norbergenin showed weak anti-HIV activity. Two alkenyl-1,4-benzoquinones, ardisianones A and B, and maesanin isolated from its roots are 5-lipoxygenase inhibitors. Two benzenoids with antituberculosis activity, ardisinols I and II, were isolated from *A. japonica*.

Several 1,4-benzoquinone derivatives named ardisiaquinones have been isolated from the Japanese *A. sieboldii* Miq.; these showed inhibitory effect on 5-lipoxygenase, with ardisiaquinone A as the most potent enzyme inhibitor. Two saponins isolated from *A. pusilla* A.DC. from China and Japan showed marked immunomodulatory and antitumour activities.

Botany Shrubs or small trees, rarely subshrubs or medium-sized trees up to 12(–35) m tall; branches often flattened-triangular at base. Leaves alternate, occasionally subopposite or subverticellate, simple, entire to toothed, dotted with glands, sometimes scaly; stipules absent. Inflorescence an axillary or terminal raceme, panicle, cyme, corymb or umbel. Flowers bisexual, (4–)5-merous; calyx deeply split, often dotted with glands; corolla usually with very short tube, lobes overlapping to the right; stamens inserted to the corolla tube by very short filaments; ovary superior, 1-locular, style slender, stigma minute. Fruit a globose drupe, usually red-purple to black when mature, 1-seeded. Seed globose. Seedling with epigeal germination; cotyledons emergent, rudimentary or leafy; hypocotyl elongated; leaves arranged spirally, involute.

In recent years many new species have been described in *Ardisia*. It is subdivided into 17 subgenera. The genera *Tetrardisia* and *Afrardisia* from Africa were recently included in *Ardisia*. Self-compatibility is widespread in *Ardisia*.

Ecology Most *Ardisia* species are shrubs or treelets growing in the understorey of lowland evergreen forest, but some can be found up to 2500 m altitude.

Management Propagation of some *Ardisia* species (e.g. *A. crenata*) by stem and root cuttings has been practised successfully.

Genetic resources As can be expected in such a large genus, some species are widely distributed and common, whereas others are endemic to small areas and uncommon (e.g. *A. crassa*). Those

species which are in demand for medicinal purposes are usually the more common ones (e.g. *A. crenata*, *A. sanguinolenta*).

Prospects *Ardisia* has been shown to possess very interesting pharmacological properties, mainly due to the presence of benzoquinone derivatives and triterpenoid saponins. Several of these properties seem to justify more research.

Literature 121, 249, 262, 365, 542, 747, 883, 967, 1052.

Selection of species

Ardisia crassa C.B. Clarke

Hook.f., Fl. Brit. India 3: 518 (1882).

Vernacular names Malaysia: pokok pelandok paya, sepuri tanah (Peninsular).

Distribution Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia boiled roots are applied as a plaster to treat rheumatism.

Observations A shrub or small tree; leaves elliptical, 10–22.5 cm × 4–6 cm, glabrous, secondary veins 20–25 pairs; inflorescence a condensed, almost capitate cyme; corolla pinkish; fruit c. 6 mm in diameter. *A. crassa* is uncommon in lowland forest.

Selected sources 121, 789, 895, 990.

Ardisia crenata Sims

Curtis' Bot. Mag. 45: pl. 1950 (1818).

Synonyms *Ardisia crispa* A.DC. (1834).

Vernacular names Village ardisia, coralberry, spiceberry (En). Indonesia: mata ayam (Bangka), popinoh (Lampung). Malaysia: mata ayam, mata pelandok. Philippines: atarolon, tagpo (Tagalog). Cambodia: ping chap. Thailand: chamkhruea (northern), tinchamkhok (north-eastern), tappla (south-eastern). Vietnam: tr[oj]ng d[ux]a, c[ow]m ngu[ooj]i r[aw]ng.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, southern Korea, southern Japan, Peninsular Malaysia, Sumatra, Java and the Philippines.

Uses The juice is used externally against skin diseases and earache and internally against fever, cough and diarrhoea. *A. crenata* is also used to treat infections of the respiratory tract and menstrual disorders. The small fruits are edible and said to be sweet. Leaves are eaten as a vegetable in salads. It is commonly planted as an ornamental; it is popular because of its bright red fruits.

Observations A shrub up to 2(–3) m tall; leaves elliptical-lanceolate or oblanceolate, 6–15 cm × 2–4 cm, glabrous, with many glandular dots and distinct marginal glands, secondary veins 12–18 pairs, indistinct; inflorescence subumbellate or corymbose, terminal on branchlets; corolla 4–6 mm long, white or pinkish; fruit 6–8 mm in diameter, bright red. *A. crenata* is common in lowland forest, often in humid locations, up to 1200 m altitude.

Selected sources 62, 121, 249, 334, 412, 429, 430, 448, 633, 967, 990.

Ardisia crenata Sims – 1, root system; 2, flowering branchlet; 3, fruiting branch.

Ardisia fuliginosa Blume

Bijdr. fl. Ned. Ind.: 692 (1826).

Distribution Sumatra, Java, Borneo and the Lesser Sunda Islands.

Uses Dried sap from the stem is heated together with coconut milk and *Curcuma* rhizomes and used in western Java to treat scabies.

Observations A shrub or small tree up to 5 m tall; leaves elliptical to lanceolate or obovate-lanceolate, 8–24 cm × 2.5–10 cm, glabrescent but often pubescent on veins below, secondary veins 9–12 pairs; inflorescence a short axillary raceme;

corolla 2.5–5 mm long, whitish or pinkish; fruit c. 5 mm in diameter. *A. fuliginosa* occurs in forest up to 1750 m altitude.

Selected sources 62, 334, 378, 896.

Ardisia humilis Vahl

Symb. bot. 3: 40 (1794).

Vernacular names Indonesia: lampeni (Sundanese), lempeni (Javanese), jambulan pante (Malay, Manado).

Distribution Sumatra, Java, Sulawesi and the Moluccas.

Uses In western Java the leaves are used to treat scabies. The fruits are administered as a vermifuge and cardiotonic.

Observations A shrub or small tree up to 5(–10) m tall; leaves obovate to narrowly oblong, 6.5–16.5 cm × 2.5–7.5 cm, with numerous glandular dots, secondary veins numerous; inflorescence an axillary raceme, often umbelliform; corolla c. 10 mm long, reddish-violet; fruit 6–8 mm in diameter. Several other *Ardisia* species have been confused with *A. humilis*. This makes it difficult to interpret the literature and to deduce the exact area of distribution. *A. humilis* is locally fairly common, especially near the sea, in periodically dry localities such as teak forest, village groves and brushwood, up to 500 m altitude.

Selected sources 62, 334.

Ardisia odontophylla Wallich ex A.DC.

Trans. Linn. Soc. 17: 125, t. 6 (1834).

Vernacular names Malaysia: pasal, sumpuh lumpok (Peninsular).

Distribution North-eastern India, Peninsular Malaysia, Java and Borneo.

Uses In Peninsular Malaysia a decoction of the roots is used externally to treat rheumatism, and a decoction of the leaves internally to treat stomach-ache.

Observations A subshrub up to 50 cm tall; leaves elliptical to obovate, 8–16 cm × 4–7 cm, glabrous but brown hairy on the veins below; inflorescence axillary, umbelliform, few-flowered; corolla c. 5 mm long, violet or pink; fruit c. 6 mm in diameter. *A. odontophylla* is rare in Java.

Selected sources 62, 121, 334, 990.

Ardisia oxyphylla Wallich ex A.DC.

Trans. Linn. Soc. 17: 119 (1834).

Vernacular names Malaysia: mata itek, temuras, bujong samalam bukit (Peninsular). Thailand: ta kai (peninsular).

Distribution Burma (Myanmar), south-western and peninsular Thailand, Peninsular Malaysia and Borneo.

Uses In Peninsular Malaysia the leaves are used as a poultice to treat swellings and ulcers. In Thailand the bark is used to treat dysentery, and bark and wood to treat menstrual disorders.

Observations A shrub up to 3 m tall, sometimes a small tree up to 6 m tall, completely glabrous; leaves elliptical to oblong-oblanceolate, 8–23 cm × 3.5–7 cm, with numerous black glandular dots, secondary veins numerous and fine; inflorescence a short usually axillary raceme; corolla 6–7 mm long, reddish-purple; fruit c. 7 mm in diameter, with numerous black dots. *A. oxyphylla* occurs in evergreen forest up to 1400 m altitude.

Selected sources 121, 249, 840, 990.

Ardisia ridleyi King & Gamble

Journ. As. Soc. Beng. 74(2): 148 (1906).

Vernacular names Malaysia: lutut ayam, peluruh, pingarut (Peninsular).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore and Sumatra.

Uses In Peninsular Malaysia a decoction of the plant is used internally to treat fever and after childbirth.

Observations A shrub or small tree up to 5 m tall; leaves oblong-lanceolate, 8–20 cm × 3.5–4.5 cm, with scattered minute rusty scales and sparsely scattered glandular dots, secondary veins 10–14 pairs; inflorescence an umbellate raceme, terminal on branchlets; corolla c. 4 mm long, pinkish; fruit 7–8 mm in diameter, sparsely striate and gland-dotted. *A. ridleyi* occurs in lowland evergreen forest up to 1200 m altitude; it is uncommon.

Selected sources 121, 249, 990.

Ardisia sanguinolenta Blume

Bijdr. fl. Ned. Ind. 13: 685 (1826).

Synonyms *Ardisia colorata* Roxb. (1824) non Link.

Vernacular names Indonesia: lampeni gede (Sundanese). Malaysia: mata pelandok, kayu mata buah, sumpoh lumpok (Peninsular). Thailand: ma cham kong (northern), kraduk kai (south-eastern), ai ram yai (peninsular). Vietnam: c[ow]m ngu[ooj]i m[af]u.

Distribution India, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Singapore and Java.

Uses In Peninsular Malaysia a decoction of the root is used to treat diarrhoea and cough, and after childbirth. The plant is possibly also used for poulticing in cases of rheumatism or lumbago. A

decoction of the leaves is administered to treat colic. In Thailand several plant parts play a role in traditional medicine: roots to treat gonorrhoea, stems as an antileprotic, leaves to treat liver diseases, and fruits to treat diarrhoea and fever. In India similar uses have been recorded.

Observations A shrub or small tree up to 8 m tall; leaves narrowly elliptical to oblong-lanceolate, 13–28 cm × 3–8 cm, glabrous or sparsely and minutely rusty-lepidote below, with many glandular dots, secondary veins 15–30 pairs; inflorescence a terminal, pyramidal panicle; corolla 2.5–4 mm long, pale pink; fruit 4–6.5 mm in diameter. *A. sanguinolenta* occurs in lowland evergreen forest up to 1000 m altitude, frequently along streams and in damp grassy sites; it is common.

Selected sources 121, 249, 334, 378, 900, 990.

Ardisia solanacea Roxb.

Fl. ind., ed. 1832, 1: 580 (1832).

Vernacular names Malaysia: mata itek (Peninsular). Vietnam: c[ow]m ngu[ooj]i c[af].

Distribution Nepal, India, Burma (Myanmar), Indo-China, western China and Peninsular Malaysia; cultivated in these areas, and also in Pakistan and Sri Lanka.

Uses In India the roots are used against fever, dropsy, diarrhoea and rheumatism, the bark to treat concussion or bruises. The fruits are used for a yellow dye. *A. solanacea* is also planted as an ornamental.

Observations A shrub or small tree up to 5 m tall; leaves oblanceolate to obovate, 10–18 cm × 4.5–7.5 cm, glabrous, secondary veins 12–20 pairs; inflorescence corymbose-racemose or umbellate, terminal on axillary branchlets; corolla c. 10 mm long, pink; fruit 7–10 mm in diameter, black when ripe. *A. solanacea* occurs in lowland evergreen forest up to 1000 m altitude; it is uncommon in Peninsular Malaysia.

Selected sources 121, 182, 469, 542, 803, 990.

Ardisia villosa Roxb.

Fl. ind. 2: 274 (1824).

Vernacular names Malaysia: mata pelandok gajah, seluntas orang tinggi, kayu unggu bisa (Peninsular). Thailand: kamlang chang phueak (northern), phang krasa hin, phirang kasa (southeastern). Vietnam: c[ow]m ngu[ooj]i l[oo]ng.

Distribution Burma (Myanmar), Indo-China, China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines.

Uses In Peninsular Malaysia the roots are reputedly used against fever and cough, and a bath in water that has been boiled with the leaves is said to be a cure for dropsy.

Observations A small shrub up to 1.5 m tall; leaves elliptical to elliptical-lanceolate or obovate-oblong, 4–20 cm × 1.5–7 cm, densely villous below (rarely glabrous), with numerous black glandular dots, secondary veins 10–15 pairs; inflorescence usually terminal on branches, umbellate; corolla 5–7 mm long, pink to violet, rarely white; fruit 5–10 mm in diameter. *A. villosa* occurs in evergreen forest and dry dipterocarp forest up to 1850 m altitude; it is common.

Selected sources 62, 121, 249, 378, 990.

R.H.M.J. Lemmens

Arenga Labill.

DC., Bull. Sci. Soc. Philom. Paris 2: 162 (1800).

PALMAE

$x = 16$; *A. porphyrocarpa*: $n = 16$

Origin and geographic distribution *Arenga* comprises about 20 species and occurs from India to southern China, Taiwan and the Ryukyu Islands, and throughout the Malesian region to northern Australia.

Uses Root decoctions and the palm heart (the white, tender tissues of the youngest, unopened leaves at the stem apex) of *A. hastata* and *A. porphyrocarpa* are used in traditional medicine in Indonesia and Malaysia, to treat fever, loss of appetite and as a diuretic.

The best-known *Arenga* species is *A. pinnata* (Wurmb) Merr. (sugar palm), all parts of which are used, and for a multitude of products. It is also used for medicinal purposes: roots are considered stomachic and pectoral, petioles haemostatic, cicatrizant and diuretic, and fresh, unfermented sap is purgative. Pulped fruits are used as a fish poison. The main product, however, is the palm sugar obtained from the juice tapped from inflorescence stalks and widely used in all kinds of dishes, sweets, drinks and preserves. It can be fermented to make vinegar or palm wine. Other food products are starch, extracted from the pith of the trunk, palm heart and endosperm of immature seeds boiled with sugar. Fibres, obtained from the trunk, roots and leaf stalks and sheaths, are used for matting, sieves, roofs, brushes and brooms, and for tinder. The leaves serve to construct temporary shelters, and the wood of the trunk is used for flooring, furniture, tool handles and as fuelwood. Several other taller *Arenga* species are used for similar purposes as *A. pinnata*.

Properties The flesh of *Arenga* fruits is filled with abundant, irritant needlelike oxalate crystals.

Botany Shrubby or tree palms, small to large, solitary or clustered, usually unarmed; stem often with persistent fibrous leaf bases and sheaths. Leaves arranged spirally, imparipinnate, with usually well developed petiole; sheath eventually disintegrating into a mass of blackish fibres. Inflorescence axillary, often bursting through the leaf sheath, bisexual or unisexual, usually branched to 1–2 orders; peduncle with distinct bracts. Flowers unisexual, 3-merous; sepals rounded, imbricate, leathery; petals connate at base, valvate, leathery; male flowers usually with numerous stamens having short filaments and elongate anthers; female flowers with a globose, 3-celled ovary bearing 2–3 stigmas and few or lacking staminodes. Fruit a globose to ellipsoid berry, often somewhat angled, 1–3-seeded. Seeds planoconvex, smooth, black, with endosperm and lateral embryo.

Arenga is classified in the tribe *Caryoteae*, together with *Caryota* and *Wallichia*, all from tropical Asia. It shows an astonishing range of forms and flowering behaviour.

Ecology Most *Arenga* species are found in primary forest up to 1700 m altitude. *A. hastata* and *A. porphyrocarpa* are both forest undergrowth palmlets of lowland forest.

Genetic resources *A. hastata* and *A. porphyrocarpa* both seem to have limited areas of distribution. Especially *A. hastata* may easily become endangered as it is uncommon in lowland forest of Peninsular Malaysia. *A. porphyrocarpa* is locally common in disturbed forest and seems less liable to genetic erosion. Germplasm collection of *Arenga* is urgently needed as many species have become very rare.

Prospects There is no information on the pharmacological properties of *Arenga*, and research is needed to evaluate its applications in traditional medicine. *Arenga* species, including the 2 treated here, have potential ornamental value.

Literature 121, 245, 334, 941.

Selection of species

Arenga hastata (Becc.) Whitmore

Principes 14: 124 (1970).

Synonyms *Didymosperma hastatum* Becc. (1889).

Distribution Peninsular Malaysia.

Uses A root decoction is administered to treat fever, internally for adults and in a bath for children. The roasted palm heart is eaten as a cure for loss of appetite.

Observations An erect dwarf palm up to 2 m tall, growing in clumps, not dying after flowering; leaves with about 10 leaf-segments up to 20 cm × 7.5 cm; inflorescence a simple spike c. 17.5 cm long, on a peduncle about as long, bisexual, developing from the base of the plant towards the apex; male flowers with oblong petal lobes c. 2.5 mm long and about 15 stamens. *A. hastata* occurs in lowland forest, and is rather uncommon.

Selected sources 121, 220, 789.

Arenga porphyrocarpa (Blume ex Mart.) H.E. Moore

Principes 4: 114 (1960).

Synonyms *Didymosperma porphyrocarpum* (Blume ex Mart.) H. Wendl. & Drude ex Hook.f. (1883).

Vernacular names Indonesia: ki hura (Sundanese).

Distribution Sumatra, western and central Java.

Uses A root decoction and the palm heart are taken to treat urinary troubles.

Observations An erect dwarf palm up to 3 m tall, growing in clumps, dying after flowering; leaves 5–8 on each stem, erecto-patent, up to 240 cm long including petiole, with 9–13(–17) leaf-segments 15–45 cm × 5–13 cm; inflorescence consisting of 5–7 spikes 13–30 cm long, peduncle 8–25 cm long, bisexual or unisexual, developing from the apex of the plant towards the base; male flowers with oblong petal lobes c. 6 mm long and 16–20 stamens; fruit narrowly obovoid, 1.5–2 cm long, red-purple turning orange, smooth and shining. *A. porphyrocarpa* occurs in mixed, disturbed forest and shrubby grassland up to 400 m altitude, locally numerous.

Selected sources 62, 220, 334.

Sri Endreswari

Argostemma Wallich

Roxb., Fl. ind. 2: 324 (1824).

RUBIACEAE

$x = 11$

Origin and geographic distribution *Argostemma* is a large, complex palaeotropical genus with about 220 described species, but the actual number of species is probably approximately 100. Peninsular Malaysia and Borneo are rich in

species (about 30 each), whereas Java has only 5 species. Only two species occur outside tropical Asia, both in West Africa.

Uses There are some records on the use of *Argostemma* roots and leaves to treat fever, both externally and internally.

Botany Creeping to erect herbs, often succulent; stem usually unbranched or slightly branched, with short internodes. Leaves opposite or sometimes verticillate, those of a pair or verticel often unequal, sometimes rosulate; petiole short or absent; stipules interpetiolar. Inflorescence usually terminal, cymose, corymbiform to umbelliform. Flowers bisexual, 4–5(–6)-merous, regular (rarely zygomorphous); calyx with a very short tube, lobes succulent in fruit; corolla gamopetalous, rotate or subcampanulate, white, often with greenish spots at base, lobes usually much longer than tube; stamens inserted near the base of the corolla tube, filaments free, anthers coherent into an anther tube, longitudinally dehiscent, or sometimes free (then opening by apical pores); ovary inferior, 2-celled, style filiform. Fruit a succulent capsule crowned with limb of calyx, opening by an apical operculum, many-seeded. Seeds minute, angular or ovoid, usually with reticulate testa.

The flowers are very characteristic: bright white and often *Solanum*-like because of the large, fused anthers and corolla often with short tube and reflexed lobes. This flower type is widespread in both dicotyledons and monocotyledons, and adapted to insect pollination. The powdery pollen is released in small portions by vibrating movements of visiting insects, which dust their bodies. *Argostemma* belongs to the tribe *Argostemmateae*, together with the small genus *Neurocalyx* which is endemic to Sri Lanka and southern India.

Ecology *Argostemma* is mostly found in damp, shady locations in lowland to lower montane forest.

Genetic resources Many *Argostemma* species are endemic to restricted areas and consequently they seem easily liable to genetic erosion or even extinction.

Prospects Research on phytochemistry and pharmacological properties of *Argostemma* is needed to judge whether the use in traditional medicine has some scientific basis. A taxonomic revision of the genus is lacking. Recent surveys of the species in Borneo and Thailand (incomplete) are available, but for other regions in South-East Asia one has to rely on old publications.

Literature 111, 757, 886.

Selection of species

Argostemma klossii Ridley

Journ. Straits Branch Roy. Asiat. Soc. 61: 13 (1912).

Vernacular names Malaysia: sumpu kering (Peninsular).

Distribution Peninsular Malaysia.

Uses Boiled leaves and roots have been used in Peninsular Malaysia as a poultice to treat malaria.

Observations A small erect herb up to 12.5 cm tall, stem hairy; leaves of each pair very unequal, elliptical-lanceolate, c. 5 cm long, whitish beneath; corolla c. 6 mm in diameter, anther tube about as long as corolla; fruit hairy. *A. klossii* occurs locally in rain forest in the mountains.

Selected sources 121, 789.

Argostemma montanum Blume ex DC.

Prodr. 4: 418 (1830).

Vernacular names Indonesia: reundeu badak, reundeu bulu, cocok bubu (Sundanese).

Distribution Java.

Uses The leaves have reportedly been used internally to treat fever.

Observations An erect herb, creeping at the base, up to 50 cm tall, often branched; leaves of each pair equal or unequal, ovate-elliptical-oblong, 1.5–8 cm × 1–4 cm, very pale beneath; corolla 8–15 mm long, anther tube narrow, with ridge-like connective. *A. montanum* occurs in shady localities in the forest, usually in humus-rich soils, at 400–2250 m altitude. It is locally common in western Java.

Selected sources 62, 334.

R.H.M.J. Lemmens

Argyreia Lour.

Fl. cochinch.: 95, 134 (1790).

CONVOLVULACEAE

$x = 14, 15$; *A. nervosa*: $2n = 30$

Origin and geographic distribution *Argyreia* comprises about 100 species, and occurs in tropical Asia and Madagascar (4 species). In the Malesian region, about 45 species have been found. Peninsular Malaysia, Sumatra and the Philippines are richest in species, with 13, 12 and 10, respectively. Most species are narrow endemics, but *A. capitiformis* (Poir.) v. Ooststroom (synonym: *A. capitata* (Vahl) Choisy) and *A. mollis* are widely distributed. *A. nervosa* is native to In-

dia, but widely planted in South-East Asia.

Uses *Argyreia* is used occasionally in traditional medicine in South-East Asia; most commonly a decoction of the roots or leaves is applied externally to treat rheumatism, wounds, abscesses, boils and skin diseases. In India, *A. nervosa* is a well-known medicinal plant used for similar purposes, and also as tonic, diuretic and aphrodisiac. However, it is planted as an ornamental in South-East Asia and elsewhere in the tropics.

The leaves of *A. capitiformis* are used externally to treat trauma in China.

A decoction of the leaves of *A. acuta* Lour. is used in Vietnam as a diuretic, emmenagogue and antitussive, and is also applied to abscesses. *A. acuta* roots and stems are used against fever, cough, leucorrhoea and carbuncles. Dried aerial parts of *A. populifolia* Choisy are considered astringent and antiseptic in Sri Lanka.

Properties The chemical compounds isolated from *A. nervosa* belong to the ergot (ergoline type) alkaloids, lipids, flavonoids, steroids and triterpenoids. Activities of several parts of *A. nervosa* plants in India include anti-ulcer, antitumour, antidiabetic, hypoglycaemic, hypotensive, spasmolytic, antifilarial, antimicrobial and central nervous system depressant activities. Ergoline alkaloids have hallucinogenic activity. Hexadecanyl p-hydroxycinnamate and scopoletin have been isolated from the roots; these compounds showed antifungal activity, and were highly active against *Alternaria alternata*. The main component of the oil from seeds of *A. nervosa* is oleic acid (about 27.5%). This oil showed moderate activity against several gram-positive and gram-negative bacteria and phytopathogenic fungi. The seeds also contain ergot alkaloid constituents, with ergine and isoergine in the highest concentration (up to 0.2%). The hypotensive activity of the seeds is due to this mixture of alkaloids, which also includes e.g. ergometrine. Biosynthetically, the ergot alkaloids are derived from the amino acid tryptophan, containing an indole residue. Aqueous and alcoholic extracts of *A. nervosa* leaves showed in-vitro antifilarial activity against *Setaria cervi*, a parasitic worm of cattle.

Several flavonoids have been isolated from the roots of *A. mollis*, as well as the tropane alkaloids calystegin B1 and B2, loline alkaloids and simple pyrrolidine alkaloids.

Botany Lianas or shrubs with twining branches. Leaves arranged spirally, simple and entire, glabrous or hairy, petiolate; stipules absent. Inflorescence an axillary cyme, loose or compact, few- to many-flowered; bracts minute to large. Flowers bisexual, regular, 5-merous; sepals free, imbricate, often hairy outside, persistent; corolla campanulate, funnel-shaped or tubular, limb nearly entire to deeply lobed, usually with 5 hairy bands outside, purple, red, pink or white; stamens inserted on the corolla, included or exserted, with filiform filaments often dilated at base; ovary superior, 2- or 4-celled, style filiform, stigma biglobular. Fruit an ellipsoid to globose berry, fleshy, leathery or mealy, purple, red, orange or yellow, few-seeded. Seeds glabrous, with endosperm.

Argyreia belongs to the tribe *Ipomoeeae*, and differs from the largest genus in this tribe, *Ipomoea*, in the woody stems, the usually hairy corolla and the indehiscent fruit.

Ecology *Argyreia* occurs most commonly in forest margins, secondary forest and brushwood at low to medium altitudes, up to 1500(–1700) m.

Management As an ornamental, *A. nervosa* is propagated by seed or softwood/greenwood cuttings. Special attention is given to training because rapid growth will lead to an impenetrable tangle if it becomes enmeshed in other plants.

Genetic resources Most *Argyreia* species have small areas of distribution, and consequently may easily become endangered. Only few species are widely distributed, e.g. *A. mollis*, or widely planted, e.g. *A. nervosa*.

Prospects *Argyreia* is comparatively little used in traditional medicine in South-East Asia. *A. nervosa* is a well-known medicinal plant in India, and research on its pharmacological properties has shown interesting results. Although it is only planted as an ornamental in the Malesian region, *A. nervosa* may have good prospects as a medicinal plant, similar to those of indigenous *Argyreia* species, which will probably have similar biological activities.

Literature 36, 247, 671, 887.

Selection of species

Argyreia maingayi (C.B. Clarke) Hoogland

Blumea 7: 185 (1952).

Synonyms *Lettsomia maingayi* C.B. Clarke (1883).

Vernacular names Malaysia: akar terong-terong, akar bunga butang, akar ulan gajah (Peninsular).

Distribution Peninsular Malaysia.

Uses A decoction of the roots is used externally

to treat pain in the bones. The fruits are edible, but only slightly sweet.

Observations A liana with fulvous-hirsute twining stems, later becoming glabrescent; leaves ovate, 9–20 cm × 3.5–11 cm, rounded or shortly attenuate at base, beneath hirsute on veins only; bracts large, up to 4 cm long, persistent; sepals long-acuminate, corolla with limb subentire, 4.5–6 cm long, white with pink, red or purple stripe on the middle of each lobe; fruit ovoid, c. 12 mm long, pinkish. *A. maingayi* occurs in forest up to 1000 m altitude, also in swampy and riverine forest.

Selected sources 121, 247.

Argyreia mollis (Burm.f.) Choisy

Mém. Soc. Phys. Genève 6: 421 (1833).

Vernacular names Indonesia: areuy tatapayan (Sundanese), kendal sapi (Javanese), butetulupan (Bali). Thailand: khruea phuu ngoen (Prachin Buri), yaan taan (Songkhla). Vietnam: b[aj]c thau l[oo]ng m[eef]m.

Distribution The Andaman Islands, southern Burma (Myanmar), Indo-China, Hainan, southern Thailand, Peninsular Malaysia, Sumatra, Java and Bali.

Uses In Java a decoction of the roots, together with *Alyxia*, *Anethum* and *Callicarpa* leaves, is used as a stomachic. The juice is applied to treat mild forms of eye inflammation. Leaves mixed with several other plants are applied to boils. The stems are sometimes used for binding.

Observations A liana up to 10 m long with densely appressed-pilose twining stems, later glabrescent; leaves elliptical to narrowly oblong, 4–15 cm × 1.5–7 cm, acute to rounded at base, densely silvery tomentose beneath; bracts small, caducous; corolla shallowly lobed, 5–6.5 cm long, pale violet or pink with white base, rarely entirely white; fruit subglobose, c. 10 mm in diameter, red or orange-red. *A. mollis* is locally common in secondary forest, teak forest and brushwood, sometimes in hedges, up to 1500 m altitude.

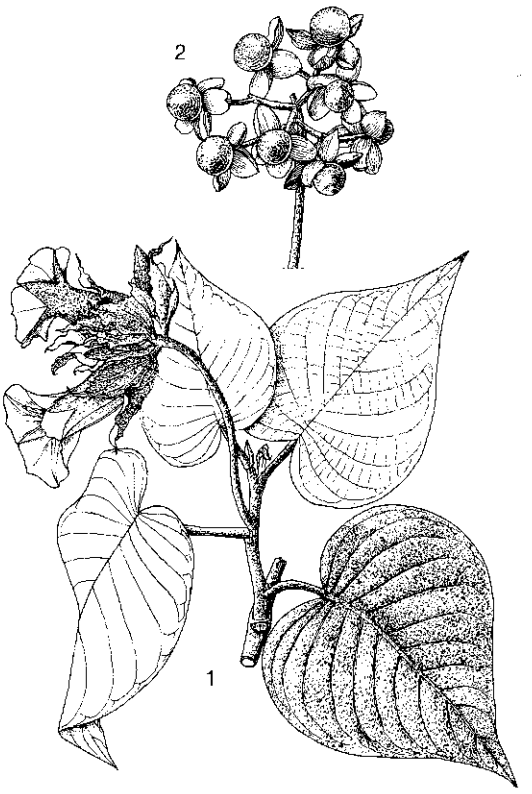
Selected sources 121, 247, 334, 598.

Argyreia nervosa (Burm.f.) Bojer

Hortus maurit.: 224 (1837).

Synonyms *Argyreia speciosa* (L.f.) Sweet (1826).

Vernacular names Elephant climber, elephant creeper (En). Indonesia: areuy bohol keboh (Sundanese). Philippines: sedang-dahon (Tagalog), hojas de seda (Sp). Thailand: bai rabaat, phak rabaat (central), mueang mon (Bangkok). Vietnam: th[ar]o b[aj]c g[aa]n.



Argyreia nervosa (Burm.f.) Bojer – 1, flowering branch; 2, infructescence.

Distribution Native to India; cultivated in many tropical countries, also throughout South-East Asia, and sometimes escaped.

Uses In Thailand the roots are used as tonic, diuretic and aphrodisiac, and to treat allergic dermatitis, arthritis and obesity, the leaves are applied to wounds, abscesses and skin diseases, and leaf juice to treat inflamed ears. In India the root is considered alterative and tonic, and is used to treat rheumatism and diseases of the nervous system. The leaves are applied as a local stimulant, rubefacient and antiphlogistic, although they act as vesicant, and are used to treat wounds and skin diseases. *A. nervosa* is often cultivated as an ornamental.

Observations A liana up to 10(–15) m long, with densely tomentose twining stems; leaves ovate to orbicular, 10–30 cm × 8–25 cm, sometimes even larger, deeply cordate at base, densely tomentose beneath; bracts large, 3.5–5 cm long, caducous; corolla with limb shallowly lobed, c. 6 cm long, pink-purple; fruit globose, c. 20 mm in diameter, yellowish-brown.

Selected sources 76, 173, 247, 760, 849, 887, 933.

Argyreia rubicunda Wallich ex Choisy

Mém. Soc. Phys. Genève 6: 426 (1833).

Synonyms *Lettsomia rubicunda* (Wallich ex Choisy) C.B. Clarke (1883).

Vernacular names Malaysia: akar pera bentak, akar saga molek (Peninsular). Vietnam: b[aj]c than do d[or].

Distribution Peninsular Malaysia and Vietnam.

Uses In Peninsular Malaysia bruised leaves are applied to the forehead to treat headache, and at the same time a little juice is taken internally.

Observations A liana with densely tomentose twining stems; leaves elliptical, 8–16 cm × 4–10 cm, rounded at base, tomentose beneath; bracts small, caducous; corolla deeply lobed, pink; fruit ovoid, c. 15 mm long, pinkish-white to purplish-red. *A. rubicunda* is an uncommon climber in the forest.

Selected sources 121, 247.

Trimurti H. Wardini

Asystasia Blume

Bijdr. fl. Ned. Ind.: 796 (1826).

ACANTHACEAE

$x = 13$; *A. gangetica* subsp. *gangetica*: $2n = 52$, *A. gangetica* subsp. *micrantha*: $2n = 26$

Origin and geographic distribution *Asystasia* comprises about 70 species, and is distributed in the tropics of the Old World. Few species occur in South-East Asia. *A. gangetica* is the most widely distributed species; it is planted as an ornamental and has become a pantropical weed.

Uses *A. gangetica* is used in traditional medicine to treat swellings, sores, wounds, piles and rheumatism, and as a vermifuge. Also analgesic properties have been attributed to it. The leafy shoots are used in different parts of the world as a vegetable. *A. nemorum* has been applied to treat dry cough and eye infections.

A. dalzelliana Santapau is used in traditional medicine in India, especially for treating boils and swellings. *Asystasia* is grazed and easily digested by sheep, goats and cattle. Some species, particularly *A. gangetica*, are cultivated as an ornamental.

Properties The presence of flavonoids has been demonstrated in some species, including *A. gangetica*. The leaves of *A. gangetica* do not have high levels of minerals and vitamins, but they show a high protein content; they are poor in tannins and oxalates. Both *A. gangetica* and *A. nemorum* showed a good complement of amino acids and satisfactory amounts of minerals, sugars, lipids and fibre, whereas antinutritional factors, such as trypsin and chymotrypsin inhibitors and cyanide, were not detected.

Botany Erect or straggling herbs; stems thickened above the nodes. Leaves decussately opposite, simple and entire, with minute cystoliths, shortly to distinctly petiolate; stipules absent, but leaves connected by transverse ridges. Inflorescence an axillary and/or terminal, lax, spiciform raceme, often with secund flowers; bracts and bracteoles small. Flowers bisexual, 5-merous; calyx deeply partite, with narrow, subequal segments; corolla with cylindrical tube widened in upper part, limb spreading with imbricate, subequal, broadly ovate lobes, white or yellowish to pale blue or violet; stamens 4, inserted in the widened part of the corolla tube, didynamous, basally connate in pairs; ovary superior, 2-celled, style slender, with shortly 2-lobed stigma. Fruit a clavate to ellipsoid, stalked capsule, 4-seeded (sometimes less). Seeds ovate-orbicular, compressed, with sinuately incised margins, rugose or tuberculate, supported by hooked retinaculas.

The flowers are pollinated by insects, especially bees. It takes about one month from floral initiation to seed dispersal. The seeds are thrown as far as 6 m by an explosive mechanism on hot afternoons.

Two subspecies can be distinguished in *A. gangetica*: subsp. *gangetica* with pale cream, rosy cream, yellowish to pale or dark purple corolla with tube 2.5–3.5 cm long and spreading lobes, lower not pleated, and subsp. *micrantha* (Nees) Ensermu (synonym: *A. intrusa* (Forssk.) Nees) with pure white corolla with a large violet spur on lower part, tube 1.5–2 cm long and reflexed lobes, lower strongly pleated. Both subspecies can act as weeds, but subsp. *micrantha* is more serious as it is more vigorous and tends to become decumbent, producing a dense carpet of rooting stems and foliage, which smothers the rest of the ground vegetation.

Ecology *A. gangetica* and *A. nemorum* occur in anthropogenic habitats such as roadsides, hedges, thickets, river banks and plantations, usually in more or less shaded localities in the lowland. *A. gangetica* can be a noxious weed (particularly subsp. *micrantha*), especially in pineapple and oil palm, but also in cocoa, rubber and sugar cane plantations.

Management *Asystasia* can be propagated by seed, cuttings or by division of rooted stems. In-vitro propagation was successful for *A. dalzelliana* in India. It was regenerated on a Murashige and Skoog medium using callus cultures; rooting of regenerated shoots was achieved on the medium supplemented with 8 mg/l of indole-acetic acid, and the young plants were successfully transferred to soil. Control of weedy forms of *A. gangetica* can be achieved by controlled cattle grazing.

Genetic resources Both *Asystasia* species treated here are not likely to be at risk of genetic erosion. More attention to the different forms of *A. gangetica* may be desirable, focusing on medicinal properties, weedy characteristics and ornamental value.

Prospects *Asystasia* species are interesting medicinal plants, which are used in traditional medicine in different parts of the world. *A. gangetica* may have good prospects as a healthy vegetable, and perhaps also as an auxiliary plant in agriculture and as a forage species. However, the spreading of some forms as a serious weed needs attention.

Literature 236, 473, 760, 899, 908.

Selection of species

Asystasia gangetica (L.) T. Anderson

Thwaites, Enum. pl. zeyl.: 235 (1860).

Synonyms *Asystasia coromandeliana* Nees (1832).

Vernacular names Malaysia: rumput bunga putih, rumput hantu, rumput nyonya (Peninsular). Philippines: asistasia (Tagalog). Thailand: baayaa, yaayaa (Bangkok), phakkuut nao (Chiang Mai). Vietnam: bi[ees] hoa, th[aaj]p v[aj]n th[as]c.

Distribution Native to Africa, India and Sri Lanka. In Malesia, cultivated as an ornamental, e.g. in Peninsular Malaysia, Java and the Philippines, and locally copiously naturalized; also planted and naturalized in Thailand and Vietnam.

Uses In the Philippines the leaves and flowers are used as an intestinal astringent and also eaten as a pot herb. In India, the sap is applied to swellings; it is also used as a vermifuge and to treat rheumatism. In Africa, an infusion of the plant is used to ease pain during childbirth, and the sap is applied to sores, wounds and piles, and in embrocations to treat stiff neck and enlarged spleen. Powdered roots are considered analgesic, and used in treating stomach-ache and as an emetic for treating snakebites. A leaf decoction is used to treat fever-aches, epilepsy and urethral discharge. The leaves are used for infant dietary preparations in India. They are occasionally eaten in Africa. *A. gangetica* is planted as an ornamental. It provides excellent feed for cattle, goats and sheep.

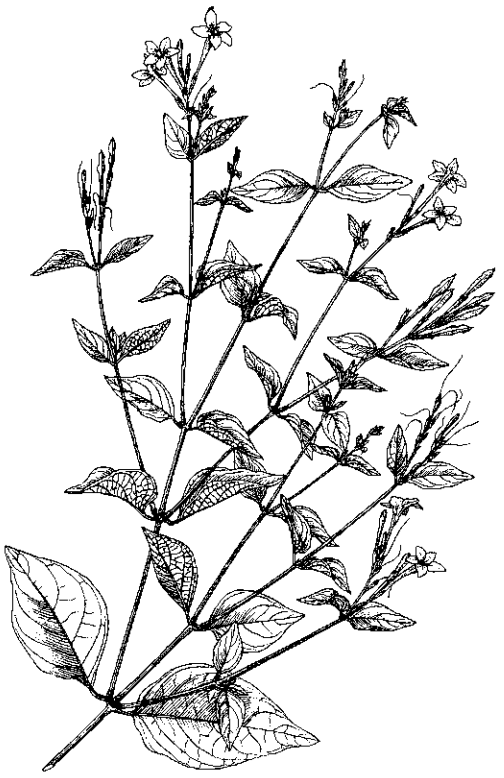
Observations An erect, ascending or climbing herb up to 125 cm tall; leaves ovate, 3–7.5 cm × 1.5–5 cm, not or hardly decurrent at base, petiole 1–3 cm long; flowers well-spaced in the inflorescence, calyx 5–9 mm long, corolla 2–3.5 cm long, 10–25 mm across at the mouth, ovary covered with long hairs nearly all over; fruit 2.5–4 cm long, covered with ordinary hairs and short glandular hairs. *A. gangetica* occurs in roadsides, hedges, thickets, riverbanks and plantations usually in light to moderate shade, up to 300 m altitude.

Selected sources 62, 120, 121, 236, 473, 760, 782, 908, 1034.

Asystasia nemorum Nees

Wallich, Pl. asiat. rar. 3: 90 (1832).

Synonyms *Asystasia blumei* Nees (1847), *Asystasia intrusa* auct. non (Forssk.) Nees.



Asystasia nemorum Nees – part of flowering and fruiting plant.

Vernacular names Indonesia: daun moreto, cili utan, luja koi (Moluccas).

Distribution Native to central Malesia (Java to the Moluccas); introduced, probably as a medicinal plant, into Peninsular Malaysia and Singapore over a century ago, but now probably vanished.

Uses According to an old record, the whole plant, rubbed with alum and the juice of *Citrus hystrix* DC., is used to treat cough with tightness of the chest in the Moluccas, whereas the leaf juice is applied to infected eyes.

Observations An erect, widely branched herb up to 150 cm tall; leaves ovate-oblong-lanceolate, 3.5–10 cm × 2–5.5 cm, decurrent into the petiole 1–3.5 cm long; flowers crowded towards the apex of the inflorescence, calyx 4.5–7 mm long, corolla 2–3 cm long, 4–8 mm across at the mouth, ovary apically pubescent, otherwise glabrous or minutely glandular; fruit 2–3 cm long. *A. nemorum* occurs in shaded localities, e.g. in village-groves.

Selected sources 62, 121, 334, 473, 1034.

Sri Endreswari

Baliospermum montanum (Willd.) Müll. Arg.

DC., Prodr. 15(2): 1125 (1866).

EUPHORBIACEAE

$n = 22$, $2n = 28$

Synonyms *Baliospermum axillare* Blume (1825), *Baliospermum solanifolium* (Geiseler) Suresh (1988).

Vernacular names Indonesia: kasingsat (Sundanese), srintil, adal-adal (Javanese). Malaysia: akar kara nasi, terap kompong, maharaja lela (Peninsular). Burma (Myanmar): natcho. Thailand: tong taek (central), thon di (central, Trang), nong pom (Loei). Vietnam: c[aar]m t[uwr] n[us]i, c[oj] t[uw]a.

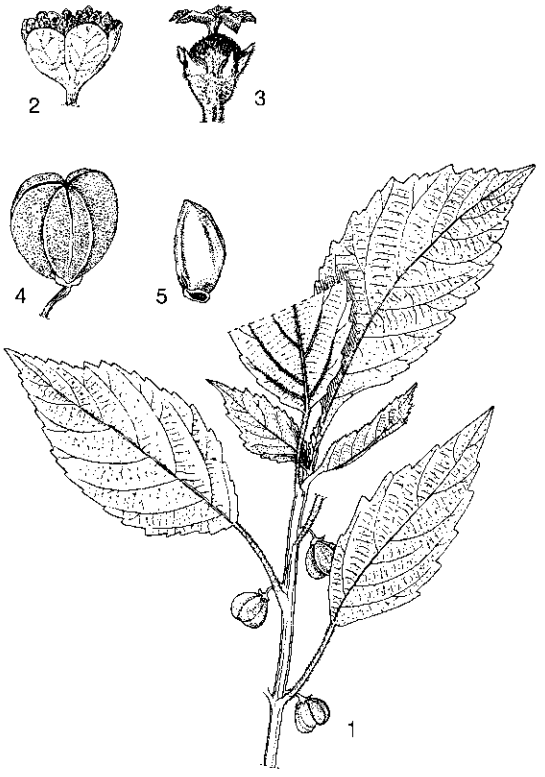
Origin and geographic distribution *B. montanum* occurs in Pakistan, India, Bhutan, Bangladesh, the Andaman Islands, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java and Sumbawa.

Uses *B. montanum* has been used in traditional medicine throughout its area of distribution since ancient times. The leaves are purgative; in Peninsular Malaysia and Thailand, they are drunk in decoction. They are also used as a poultice on wounds. In Thailand and India, an infusion of the leaves is applied to treat asthma. The roots are purgative, but also anthelmintic and diuretic. They are used in Thailand and India to treat dropsy, anasarca, jaundice, skin and abdominal complaints, wounds, inflammations, anaemia and leucoderma. The seeds are known to be extremely purgative, but in overdose they are a highly narcotic poison. They are used externally as a stimulant and rubefacient, and to treat snakebites. The seed oil is a powerful hydragogue cathartic, and is applied externally to treat rheumatism.

Properties Anti-tumour activity has been observed for extracts of the roots. As active constituents, 5 phorbol ester derivatives exhibiting anticancer activity have been isolated, e.g. montanin and baliospermin. Nitrite-treated hot water extracts of *B. montanum* showed moderate mutagenicity for *Salmonella typhimurium* strains using the Ames assay.

The seeds yield about 33% oil, which contains 2.8% axillarenic acid.

Botany A monoecious or sometimes dioecious bushy shrub up to 2 m tall, often of somewhat herbaceous texture; young branchlets angled and striate, scattered appressed yellow-pubescent,



Baliospermum montanum (Willd.) Müll. Arg. – 1, twig with fruits; 2, male flower; 3, female flower; 4, fruit; 5, seed.

soon glabrescent, often reddish. Leaves alternate, simple, elliptical to oblong, broadly ovate, obovate or ovate-lanceolate, 5–25(–38) cm × 2.5–13(–18) cm, sometimes 3–5-lobed, slightly cordate to cuneate at base, acuminate at apex, coarsely dentate at margins, pinnately veined, sometimes prominently 3-veined from base; petiole 1–11(–17) cm long, with 2 glands at apex; stipules gland-like. Inflorescence an axillary cyme up to 4 cm long, arranged on leafy branches, unisexual or bisexual; bracts up to 1.5 mm long. Flowers unisexual, pedicelled, with 5 imbricate, pale green to reddish perianth lobes (petals absent) and lobed-crenate disk; male flowers c. 2.5 mm in diameter, with 14–25 free stamens; female flowers with superior, subglobose, 3-lobed and 3-celled ovary, styles 3, connate at base, having prominent bifid stigmas. Fruit a subglobose, 3-lobed capsule up to 13 mm in diameter, 3-seeded. Seeds ovoid, up to 9 mm long, grey, marbled, shiny, carunculate, with fleshy endosperm.

B. montanum can be found flowering throughout the year.

Baliospermum comprises 2 species. *B. calycinum* Müll. Arg. is an extremely variable species, in which until recently several separate species were distinguished; it occurs from the eastern Himalayas to Burma (Myanmar), Vietnam, southern China and Thailand. *Baliospermum* is related to *Blachia*, which lacks the foliar glands, and has umbelliform inflorescences and sepals as well as petals.

Ecology In Java, *B. montanum* occurs in open forest such as teak forest, brushwood and grassland, up to 250 m altitude. In Peninsular Malaysia, it is found in lowland forest; it is uncommon there. It has been found only once in northern Sumatra. It is more common in India, Burma (Myanmar) and Thailand, where it occurs in moist or dry evergreen forest, bamboo forest and scrub vegetation up to 700 m altitude (in India and Burma (Myanmar) up to 1300 m).

Genetic resources In the Malesian region, *B. montanum* is generally not common. It is much more widely found in Thailand, Burma (Myanmar) and India. There seems no reason to consider it at risk of genetic erosion.

Prospects In mainland South-East Asia, *B. montanum* is regarded as a fairly important medicinal plant. The widely divergent uses of different plant parts in that region and the promising results of the few pharmacological studies carried out so far indicate that additional research would be worthwhile, also for the Malesian region.

Literature 133, 173, 336, 693.

Other selected sources 19, 22, 23, 62, 121, 383, 990.

Wongsatit Chuakul,
Noppamas Soonthornchareonnon
& Orawan Ruangsomboon

Bauhinia L.

Sp. pl. 1: 374 (1753); Gen. pl. ed. 5: 177 (1754).

LEGUMINOSAE

$x = 13, 14$; *B. malabarica*, *B. purpurea*, *B. tomentosa*, *B. vahlii*: $2n = 28$, *B. variegata*: $2n = 28, 32$

Origin and geographic distribution *Bauhinia* is a pantropical genus of approximately 300 species. In all 69 species are recorded for South-East Asia.

Uses Throughout South-East Asia various parts of numerous *Bauhinia* species are used in poulticing to reduce swelling and bruises, and to ripen ulcerations and boils. Decoctions of various plant parts are taken internally as a febrifugal, antidiarrhoeal and antidysenteric remedy. In the Philippines *B. binata* Blanco is used against blood spitting, bleeding in general and dysentery. In Sarawak a decoction of the root of *B. kockiana* Korth. is drunk to treat gonorrhoea and body pains resulting from sickness. In Ternate (Indonesia) mention is made of a decoction of the root of *B. lingua* DC. as a bath with febrifugal properties. *B. malabarica* Roxb., known for its low-grade timber applications, is used in folk medicine as well. Pounded bark is applied in Timor for poulticing wounds. In the Philippines an infusion of fresh flowers or a decoction of the bark is known to be antidysenteric. The leaves are topically applied to the head in fevers accompanied by headaches. In India a decoction of the root bark is a common remedy for liver troubles. In Riau Province (Sumatra) leaves of an unidentified *Bauhinia* were rolled into cigarettes and the smoke inhaled to treat polyps in the nasal tract.

B. pullei Craib, known from Thailand and Cambodia, is used in traditional Thai medicine. A decoction or powder of the stem is applied as a detoxifying agent. The seeds are used as an anthelmintic, diaphoretic and antipyretic.The root juice of *B. vahlii* Wight & Arnott is applied to cuts and wounds in traditional Nepalese medicine. The root of *B. viridescens* Desv. is used in Vietnamese folk medicine to treat colitis.

The bright flowers of *Bauhinia* make them attractive ornamentals or roadside trees. *B. purpurea*

apart from being an ornamental is well known as the source of Bauhinia purpurea agglutin (BPA), a lectin with an affinity to galactose and lactose, widely applied in biochemical, immunochemical and histochemical studies. The bark of *Bauhinia* is used to make rope and stems of smaller lianescent species are used for binding. Some *Bauhinia* species reputed for their fibre application are used medicinally as well. In Johor (Peninsular Malaysia) leaf juice of *B. integrifolia* Roxb. (synonyms: *B. cummingiana* (Benth.) Fern.-Vill., *B. flammifera* Ridley) is used for stomach disorders; in the Philippines a decoction of the roots is administered as a post-partum medicine and to treat coughs. In Java sap from the stem or dried and powdered leaves of *B. scandens* L. are taken as a cough medicine. The young leaves and flowers of various *Bauhinia* species are eaten as a side dish with rice, or used to flavour meat and fish. Leaves of some species are used as wrappers, for lining or even as plates. Sometimes the seeds are edible.

Properties The bark of various *Bauhinia* species contains considerable amounts of tannin. Medicinal uses of bark can be largely attributed to the presence of these tannins. Flavonoids are a common feature of *Bauhinia*. *B. malabarica*, *B. valhii* and *B. variegata* contain quercetol glycosides in every organ, and kaempferol glycosides in the flowers.

A methanol extract of the roots of *B. vahlii* showed cytotoxicity against the Vero cell line at 100 µg/ml, and herpes simplex virus-1 (HSV-1) was inactivated at 25 µg/ml. Root extracts of *B. malabarica* showed moderate in-vitro antimalarial activity with EC_{50} values of 0.9–18 µg/ml. Racemosol and demethylracemosol (stilbenes) isolated from the root extract exhibited cytotoxicity against KB (EC_{50} at 15.0 µg/ml and 5.6 µg/ml, respectively) and BC (EC_{50} at 6.1 µg/ml and 3.6 µg/ml, respectively) cell lines.

Administration of *B. purpurea* bark extract to female mice at 2.5 mg/kg body weight for 20 days significantly stimulated thyroid function without hepatotoxic effects. An ethanol extract of the leaves showed significant antidiarrhoeal effects in castor oil-induced diarrhoea and gastro-intestinal motility test models in rats.

Administration of a methanol extract of *B. racemosa* Lamk flower buds (at 2.0 g/kg body weight) had a significant anti-ulcerogenic effect on aspirin-induced gastric ulcers in rats.

In a general screening experiment an ethanol extract of *B. variegata* stem bark showed activity with respect to gross effect, hypothermia and antagonism of amphetamine hyperactivity. In another experiment crude organic and aqueous extracts of dried flowers and leaves showed antibacterial activity.

Botany Trees or shrubs, unarmed or with intrastipular spines or lianas usually with simple tendrils; branches terete or angular. Leaves alternate, simple, entire, 2-lobate or 2-foliolate; stipules various, deciduous or persistent, intrastipular trichomes variously developed. Inflorescence racemose, corymbose or paniculate, or flowers solitary. Flowers usually bisexual; hypanthium short-cupulate to long-tubular; calyx spathaceous or irregularly deeply divided into 2–5 lobes or shallowly 5-lobed or 5-dentate; petals (1–)5(–6), subequal to greatly unequal, white, various shades of red to purple or yellow; fertile stamens 0–10, staminodes often present; ovary superior, stiped, 1-celled. Fruit a flat suborbicular to elliptical, obovate or linear pod, woody or thin-valved, dehiscent or indehiscent. Seeds orbicular to elliptical; endosperm present or absent. Seedling with epigeal germination; cotyledons emergent; hypocotyl elongated.

Bauhinia can be found flowering and fruiting throughout the year, but some species have a distinct seasonality. Ectomycorrhizae are known to be present in some *Bauhinia* species.

B. malabarica differs from other South-East Asian *Bauhinia* particularly in being dioecious.

Ecology *Bauhinia* is found in most types of vegetation ranging from evergreen lowland rain forest to mountain forest up to 2000(–3000) m altitude and savanna, scrub and dry deciduous forest to swamp forest, on various soils.

Management *Bauhinia* can be propagated by seed, layering or grafting. Cuttings of semi-ripe wood with leaves removed will root in moist sand. *Bauhinia* should preferably be grown in full sun in fertile, moisture-retentive but well-drained soils.

Genetic resources The *Bauhinia* species treated here generally have either a rather large natural distribution or are widely cultivated and do not seem to be seriously threatened by genetic erosion.

Prospects *Bauhinia* species show cytotoxic and antimicrobial activity, that may partly support their traditional uses. The stimulatory effect on thyroid function without hepatotoxic effects of *B. purpurea* bark is very interesting. However, further research is needed to evaluate possible future applications.

Literature 28, 241, 247, 487, 670, 719, 883, 916.

Selection of species

Bauhinia acuminata L.

Sp. pl. 1: 375 (1753).

Synonyms *Bauhinia linnaei* Ali (1966).

Vernacular names Indonesia: panawar saribu (Sundanese), galela (Halmahera), kupu-kupu (Malay). Malaysia: bunga perak (Peninsular), bunga kertas (Kedayan, Sabah), tangkop (Murut, Sabah). Philippines: bambang (Tagalog), kulibambang (Iloko). Thailand: kaa-chae kuu-do (peninsular), kaalong, som sieo (central). Vietnam: m[os]ng b[of] tr[aws]ng.

Distribution Indigenous to the dry monsoon area of continental South-East Asia, and the drier parts of Java, Borneo, the Philippines and Timor. Widely cultivated throughout South-East Asia and a frequent escape from gardens.

Uses In West Java a cold extract of the root is drunk as a cough medicine. In Perak (Malaysia) the pounded leaves are used for poulticing ulcerations of the nose. In Thailand roots are used to treat cough, and flowers to treat headache and hypertension. *B. acuminata* is widely planted as an ornamental.

Observations A shrub up to 3 m tall, young branches glabrescent; leaves ovate to suborbicular, up to 15(–20) cm × 15(–20) cm, bifid up to 1/3(–1/2), base subtruncate, apex of lobes acute, 9–11-veined, stipules linear, 1 cm long, tardily caducous; inflorescence a lateral or terminal raceme, 3–10-flowered; flower buds fusiform, thinly hairy to glabrous, c. 4 cm long, hypanthium turbinate, calyx spathaceous, petals oblong, 4–6 cm long, claws short, white, stamens 10, all fertile; fruit linear, septate, 11 cm × 1.5 cm, glabrous, 5–11-seeded, dehiscent; seeds orbicular, up to 7 mm in diameter. *B. acuminata* is found in dry dipterocarp forest, teak forest and brushwood, also on limestone at lower elevations.

Selected sources 121, 178, 206, 247, 249, 250, 334.

Bauhinia audax (de Wit) Cusset

Adansonia n.s. 6: 278 (1966).

Synonyms *Bauhinia calycina* Ridley (1912) non Pierre ex Gagnep.

Vernacular names Malaysia: keretup hitam, kelapong, tapak kuda (Peninsular).

Distribution The southern part of Peninsular Malaysia (Selangor, Negri Sembilan, Malacca, Johor).

Uses The boiled roots are used as a poultice to treat dropsy.

Observations A liana, young parts glabrescent; leaves broadly ovate to suborbicular up to 8 cm × 8 cm, bifid up to 1/3–1/2, base deeply cordate, apex of lobes obtuse, 9–11-veined, stipules very early caducous; inflorescence a terminal raceme, 10–12-flowered; flower buds fusiform, appressed rusty puberulous, 4–5 cm long, hypanthium campanulate, calyx splitting into 5 free sepals, petals narrowly lanceolate, 2.5–3.5 cm long, clawed, greenish, fertile stamens 3 and staminodes 2; fruit strap-shaped, up to 20 cm × 6 cm, beaked, smooth, 4–7-seeded, dehiscent; seeds orbicular, flattened, up to 2 cm in diameter. *B. audax* is found in evergreen forest at low altitudes.

Selected sources 121, 206, 247.

Bauhinia fulva Blume ex Korth.

Verh. nat. gesch. Ned. Bezitt., Bot. 4: 91 (1841).

Synonyms *Phanera fulva* (Blume ex Korth.) Benth. (1852).

Vernacular names Indonesia: areuy kupu-kupu (Sundanese), kupu-kupu (Javanese).

Distribution Sumatra and Java.

Uses In Java a decoction of the pounded root is used as a febrifuge, antidiarrhoeal and cough medicine.

Observations A liana up to 15 m long, young branches densely woolly hairy, glabrescent; leaves broadly ovate to orbicular, up to 20 cm × 20 cm, bifid up to 1/3–1/2, base deeply cordate, apex of lobes rounded to acute, 11–13-veined, stipules broadly lanceolate, caducous; inflorescence a terminal or lateral simple or compound, dense corymb; flower buds ovoid, greyish-brown pubescent, 0.5–1 cm long, hypanthium turbinate, calyx splitting into 2–3(–5) free sepals, petals obovate, unequal, 1–2.2 cm long, claws 0.3–0.5 cm long, white, fertile stamens 3, staminodes 2; fruit oblong, up to 20 cm × 5 cm, velvety brown, 4–7-seeded, dehiscent; seeds orbicular, flat, up to 2 cm in diameter. *B. fulva* is found in open forest and secondary regrowth, also on limestone, from sea-level up to 1000 m altitude, most commonly at 600–1000 m.

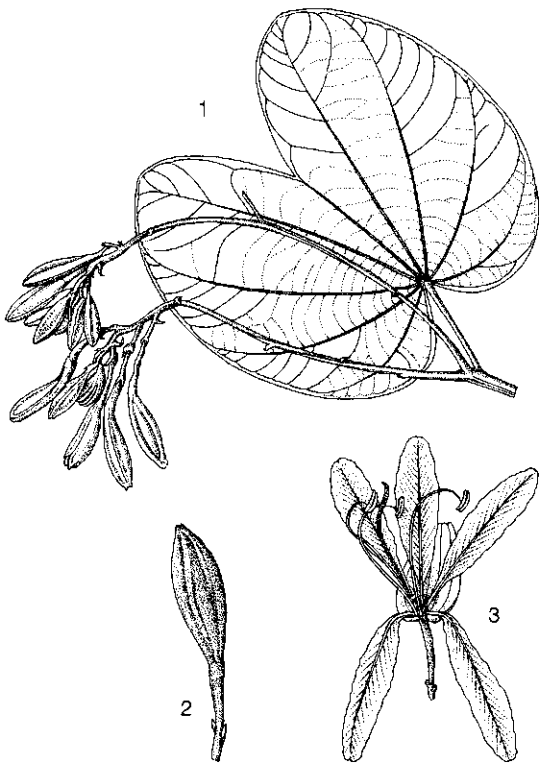
Selected sources 206, 247, 334.

Bauhinia purpurea L.

Sp. pl. 1: 375 (1753).

Synonyms *Bauhinia triandra* Roxb. (1832), *Bauhinia castrata* Blanco (1837), *Phanera purpurea* (L.) Benth. (1852).

Vernacular names Orchid tree, purple bauhinia (En). Indonesia: aroy kupu-kupu (Sundanese), suwoto (Javanese). Malaysia: tapak kuda



Bauhinia purpurea L. – 1, twig with flower buds; 2, flower bud; 3, flower.

(Peninsular), lupit (Sabah). Philippines: alibangbang (Tagalog). Thailand: sieo dok daeng, sieo waan (northern). Vietnam: m[os]ng b[of] t[is]m.

Distribution Native to tropical Asia, cultivated throughout the tropics, including South-East Asia; it occurs occasionally as an escape from cultivation.

Uses In Peninsular Malaysia and Thailand the leaves are used for poulticing sores and boils. In India, the bark is extensively applied in glandular diseases and as a poison antidote. It is well known for its astringent, anthelmintic, carminative and diuretic effects and is used in diarrhoea. The leaves are administered as a cough medicine. The flowers are said to be laxative and used in curries and pickles.

Observations A shrub or small tree up to 10 m tall, young branches glabrescent; leaves suborbicular, up to 12 cm × 12 cm, bifid up to 1/3–1/2, base rounded to cordate, apex of lobes rounded to acute, 9–13-veined, stipules minute, 1–2 mm long; inflorescence a 6–10-flowered raceme; flower buds club-shaped, velvety, 3–4 cm long, hypanthium turbinate, calyx splitting spathaceous, petals narrowly lanceolate, 3–5 cm long, claws 0.5–1 cm long, pink to dark purple; fertile stamens 3, staminodes 5–6; fruit strap-shaped, not septate, 20–25 cm × 1.5–2.5 cm, c. 10-seeded, glabrous, dehiscent; seeds orbicular, up to 15 mm in diameter.

Selected sources 121, 178, 206, 247, 654, 719, 731, 965.

Bauhinia semibifida Roxb.

Fl. ind., ed. 2 (Carey ed.), 2: 330 (1832).

Synonyms *Phanera semibifida* (Roxb.) Benth. (1852), *Phanera sumatrana* Miq. (1858), *Bauhinia borneensis* Merr. (1916).

Vernacular names Indonesia: kupu (Kalimantan), ganggang katup (Lingga), khaka kaia (Seram).

Distribution Peninsular Malaysia, Sumatra, Borneo, the Philippines, Sulawesi and the Moluccas.

Uses In the Lingga Islands (Indonesia) roots pounded in water are used to treat venereal diseases. In Central Seram (Indonesia), a decoction of the stem is applied to treat diarrhoea, and leaves are rubbed on the skin to reduce swellings and bruises.

Observations A scandent shrub or liana with a few tendrils, young branches brownish pubescent; leaves obovate-orbicular, 4–11 cm × 4–11 cm, bifid up to 1/4–2/5, base cordate, apex of lobes obtuse to acute, stipules auriculate or orbicular up to 5 mm × 2 mm; inflorescence a terminal or lateral raceme; flower buds club-shaped, 1–2.5 cm long, pubescent, hypanthium tubular, dilated at base, calyx early splitting into 5 reflexed, strap-shaped sepals, petals elliptical to oblong, unequal, 2–3(–3.5) cm long, claws 0.2–0.5 cm long, white turning yellow, fertile stamens 3, staminodes 2–3; fruit strap-shaped, 10–20 cm × 3–4 cm, beak 0.5–1 cm, glabrous, c. 6-seeded; seeds flat, varying in size. *B. semibifida* is highly variable and several varieties are distinguished; var. *semibifida* is the most widespread. It is found in forest margins at 200–2000 m altitude.

Selected sources 79, 206, 247.

Bauhinia tomentosa L.

Sp. pl. 1: 375 (1753).

Synonyms *Bauhinia pubescens* DC. (1827).

Vernacular names Indonesia: kupu-kupu (Javanese), tali kancu (Sundanese). Philippines: baho-baho (Tagalog). Thailand: chongkho dok luean (Bangkok). Vietnam: m[os]ng b[of] v[af]ng.

Distribution Originating from Africa and con-

tinental Asia, *B. tomentosa* is only found in cultivation throughout South-East Asia.

Uses In Madura a poultice of the leaves is used to treat ulcers. In India, the bruised bark is externally applied to tumours and wounds. A decoction of the root bark is administered against inflammation of the liver. A decoction of the root bark is also used as a vermifuge. An infusion is used as an astringent gargle. Dried flower buds are prescribed in dysenteric affections. The fruit is diuretic and the seeds are credited with tonic and aphrodisiac action. The plant is also used in veterinary medicine. In Java the leaves are eaten as a vegetable.

Observations A shrub or small tree up to 8 m tall, young branches brownish pubescent; leaves suborbicular, 4–8 cm × 4–8 cm, bifid for up to 1/3–1/2, base truncate to shallowly cordate, apex of lobes rounded, 7–9-veined, glabrous above, pubescent below, stipules linear, up to 1 cm long; inflorescence a lateral raceme, short, few-flowered; flower buds fusiform, 2 cm long, puberulous, hypanthium turbinate, calyx splitting spathaceous, petals broadly ovate, subequal, 4–5 cm long, short-clawed, yellow, or yellow with dark purple blotch on the median petal, stamens 10, all fertile, unequal; fruit linear, flat, 7–15 cm × 1–1.5 cm, velutinous, c. 5-seeded, dehiscent; seeds suborbicular, up to 1 cm in diameter.

Selected sources 121, 178, 206, 247, 334, 731, 760, 965.

Bauhinia variegata L.

Sp. pl. 1: 375 (1753).

Synonyms *Bauhinia candida* Aiton (1789), *Phanera variegata* (L.) Benth. (1852).

Vernacular names Mountain ebony tree, St. Thomas' tree (En). Indonesia: tali kancu beureum (Sundanese). Malaysia: tapak kerbau (Peninsular). Laos: doc ban. Thailand: piang phako, sieo dok khaao (northern), pho-phe (south-western). Vietnam: hoa ban.

Distribution Originating from southern China, Burma (Myanmar), northern Thailand, Laos and northern Vietnam, *B. variegata* is now cultivated throughout the tropics including South-East Asia.

Uses On Leyte (the Philippines) the leaves are applied as a poultice to treat headache. In Burma (Myanmar) the root is employed as a remedy for dyspepsia and the bark as a tonic. In India the bark is credited with astringent, alterative and tonic properties and considered useful in the treatment of scrofula, skin diseases and ulcers. The flowers are consumed and credited with medicinal properties. In South-East Asia *B. variegata* is primarily known as an ornamental.

Observations A tree up to 15 m tall, young branches greyish pubescent; leaves broadly ovate to circular, 6–16 cm × 6–16 cm, bifid up to 1/4–1/3, base cordate, apex lobes broadly rounded, 11–13-veined, glabrous above, glabrescent and glaucous below, stipules minute, 1–2 mm long, early caducous; inflorescence a raceme on older twigs, very short, few-flowered; flower buds fusiform, 3–4 cm long, finely hairy, hypanthium infundibuliform, calyx splitting spathaceous, petals obovate, subequal, 4–5.5 cm long, short-clawed, white or violet, fertile stamens 5, unequal, staminodes 5; fruit strap-shaped, 20–30 cm × 2–2.5 cm, obliquely striate, 10–25-seeded, dehiscent; seeds orbicular, flat, 1–1.5 cm in diameter. In a wild state *B. variegata* is found in deciduous forest at 500–1500 m altitude.

Selected sources 88, 121, 178, 181, 206, 247, 731, 965.

J.W.A. Ridder-Numan

Beilschmiedia Nees

Wallich, Pl. asiat. rar. 2: 61, 69 (1831).

LAURACEAE

$x = 12$

Origin and geographic distribution *Beilschmiedia* consists of about 200 species and occurs throughout the tropics, and also in the Himalayas, subtropical China and Taiwan. Tropical Africa is richest in species; tropical America has some 15 species. The genus is represented in the Malesian area by about 50 species, most of which have a small area of distribution.

Uses *Beilschmiedia* is little used in traditional medicine in South-East Asia, where 4 species are recorded to have a medicinal use. A decoction of the bark is taken to treat digestive disorders, and leaves and roots are externally applied in poultices. The wood is sometimes used to treat malaria. In Vietnam bark of the endemic *B. sphaerocarpa* Lecomte is applied to abscesses.
Beilschmiedia is better known for its timber, which is used for light construction, flooring, mouldings, interior finish, furniture, interior fitting, veneer, plywood and carving.

Properties The bisbenzylisoquinoline alkaloid dehatrine was obtained from *B. madang* wood as an important antimalarial principle. It was isolated as a racemic mixture of two optical isomers. It significantly inhibited the growth of a cultured

Plasmodium falciparum K1-strain resistant to chloroquine, with an activity similar to quinine.

Botany Evergreen shrubs or small to medium-sized or fairly large trees up to 35(–40) m tall. Leaves arranged spirally or alternate to opposite, simple and entire, leathery, with glandular dots and aromatic when crushed, pinnately veined, often prominently reticulate below; stipules absent. Inflorescence an axillary, lateral or subterminal raceme or panicle, usually short and few-flowered. Flowers bisexual, regular, 3-merous, small; perianth segments 6, united in a short tube; stamens 6 or 9, in 3 rows inserted on the perianth tube, usually short-stalked staminodes in an innermost row; ovary superior, 1-celled, style short, conical, obtuse, with an inconspicuous stigma. Fruit a 1-seeded berry, oblong to ovoid. Seed without albumen, with a thin testa; cotyledons large, flat, convex. Seedling with hypogeal germination.
Although evergreen, most of the species flower and develop new reddish leaves periodically. Pollination is by insects; seed dispersal takes place by animals which eat the fleshy fruits.
Beilschmiedia is one of the *Lauraceae* genera in South-East Asia whose species are still comparatively unknown and ill-defined. It requires a thorough taxonomic revision. The genus is probably most closely related to *Cryptocarya* and *Dehaasia* and is characterized by the absence of a persistent involucre, a deciduous perianth, 2-celled anthers, often reticulately veined leaves and the naked fruiting pedicel which may be slightly thickened.

Ecology *Beilschmiedia* usually occurs in primary lowland rain forest, sometimes ascending into the montane zone up to 1400(–1750) m altitude. It is usually an element of the subcanopy or canopy layer.

Management *Beilschmiedia* can be propagated by seed. About 45% of the seed of *B. madang* germinates in 1–3.5 months.

Genetic resources In the Malesian region a large number of *Beilschmiedia* species are found and most have a small area of distribution in primary lowland rain forest. Therefore, the genetic diversity may be reduced through conversion of natural forest into other vegetation types.

Prospects The in-vitro antimalarial activity of *B. madang* deserves further research in view of the ongoing battle against drug-resistant malaria parasites.

Literature 121, 485, 541.

Selection of species

Beilschmiedia madang Blume

Mus. Bot. Lugd.-Bat. 1(21): 332 (1851).

Synonyms *Beilschmiedia malaccensis* (Meissn.) Hook.f. (1886), *Beilschmiedia curtisii* Gamble (1910), *Beilschmiedia scortechinii* Gamble (1910).

Vernacular names Indonesia: huru (Sundanese), mauseu tahang (Simeuluë, Sumatra), medang kohat (Bengkulu, Sumatra), medang mekolopon (Bangka).

Distribution Peninsular Malaysia, Singapore, Sumatra, Bangka and western Java; possibly also Kalimantan.

Uses In Bengkulu (Sumatra), the wood is used as an antimalarial. The wood is also used for house building.

Observations A medium-sized tree up to 24 m tall, bole up to 50 cm in diameter; leaves alternate, elliptical to oblong, 6.5–30 cm × 2–13 cm, base cuneate, apex acute to obtuse, glabrous to reddish-brown pubescent below, midrib raised above, tertiary venation faint above and distinct below, petiole 1–3 cm long; flowers hairy; fruit oblong, c. 2.5 cm × 1–1.5 cm. *B. madang* occurs scattered in lowland and lower montane forest up to 1250 m altitude.

Selected sources 121, 485, 541, 990.

Beilschmiedia pahangensis Gamble

Kew Bull.: 150 (1910).

Vernacular names Malaysia: medang salah, medang tandok, medang punggok (Peninsular).

Distribution Peninsular Malaysia.

Uses In Peninsular Malaysia a decoction of the bark is drunk to treat stomach-ache, as a post-partum tonic, and to treat digestive disorders and dysentery. Sometimes other plants are added to the decoction. The leaves and roots are sometimes pounded and externally applied to the stomach to treat digestive disorders.

Observations A small tree up to 15 m tall, bole up to 30 cm in diameter; leaves alternate to opposite, elliptical to lanceolate, 7–15 cm × 2–5.5 cm, base cuneate, often asymmetric, apex obtuse, glabrous, midrib raised to flattened above, tertiary venation distinct on both sides, petiole 0.5–1 cm long; flowers sparsely hairy, perianth distinctly swollen at base; fruit ellipsoid to oblong, c. 3.5 cm × 1.3 cm. *B. pahangensis* is locally common on river banks in lowland forests.

Selected sources 121, 731, 990.

Beilschmiedia tonkinensis (Lecomte) Ridley

Journ. Roy. As. Soc. Straits Br. 82: 190 (1920).

Vernacular names Malaysia: perapoh, medang salah (Peninsular). Vietnam: ch[aws]p b[aws]c b[ooj].

Distribution Indo-China and Peninsular Malaysia.

Uses In Penang (Malaysia) a leaf poultice is applied to broken bones.

Observations A small tree up to 15 m tall, bole up to 40 cm in diameter; leaves alternate to opposite, elliptical to oblong, 7–18 cm × 3–6 cm, base cuneate, apex obtuse, glabrous, midrib raised above, tertiary venation distinct on both sides, petiole 1–2.5 cm long; flowers hairy; fruit oblong, c. 2.5 cm × 1.5 cm. *B. tonkinensis* is a coastal species occasionally found inland.

Selected sources 121, 731, 990.

Nguyen Kim Dao

Blastus borneensis Cogn.

A.DC. & C.DC., Monogr. phan. 7: 477 (1891).

MELASTOMATACEAE

$2n$ = unknown

Synonyms *Blastus cogniauxii* Stapf (1894).

Vernacular names Malaysia: sendudok rimba, kedudok hutan, kedudok cherang (Peninsular).

Origin and geographic distribution *B. borneensis* is distributed in Indo-China (Cambodia, Laos and Vietnam), China (Hainan), peninsular Thailand, Peninsular Malaysia, Sumatra, Borneo and Sulawesi.

Uses It has been reported that a decoction of the roots is drunk in Peninsular Malaysia during the first three days after childbirth as a restorative.

Botany A branched shrub up to 4.5(–7) m tall; branchlets densely covered with peltate glands. Leaves decussately opposite, those of a pair often unequal in size, simple and entire, ovate to elliptical, 3–19(–28) cm × 1–6(–10) cm, attenuate to rounded at base, long-acuminate at apex, with 3(–5) longitudinal veins, with peltate glands below; petiole 0.5–3 cm long; stipules absent. Inflorescence an axillary or terminal thyrse rarely more than 5 cm long. Flowers regular, bisexual, 4-merous; hypantium campanulate to urceolate, with yellowish peltate glands; sepals very shortly connate into a low rim, up to 0.5(–1) mm long, persistent; petals free, up to 2.5 mm long, white to yellowish or rarely pinkish; stamens inserted on the sepals, up to 6 mm long, filaments and anthers about equal in length; ovary inferior, 4-celled, apically densely covered with peltate glands and deeply depressed, style up to 7(–11) mm long. Fruit a loculicidal capsule included in the hypantium, urceolate or cup-shaped, up to 3 mm long, pale brown, many-seeded. Seeds cuneate, 0.3–0.4 mm long, with a short beak at chalaza, pale brown, testa bullate.

B. borneensis can be found flowering throughout the year. It is a variable species in which 4 varieties have been distinguished: one in Indo-China, one in Thailand, one (var. *pulverulentus* (Ridley) C. Hansen) in Peninsular Malaysia and Sumatra, and one (var. *borneensis*) throughout the area of distribution of the species.

Blastus comprises 12 species and is confined to tropical and subtropical Asia. Southern China is richest in species (9), followed by Indo-China (4). In Malesia, only a single species is found. *Blastus* is classified in the tribe *Oxysporeae*, and is related to e.g. *Allomorphia* and *Oxyspora*. It is easily recognized by having only 4 stamens and peltate glands.

Ecology *B. borneensis* occurs in primary and secondary rain forest, often dipterocarp forest, from sea-level up to 2100 m altitude.

Genetic resources *B. borneensis* is widely distributed in the undergrowth of primary as well as secondary forest and does not seem to be easily liable to genetic erosion. However, several other *Blastus* species seem to be narrow endemics, particularly in southern China and northern Vietnam, whereas some varieties of *B. borneensis* also have a restricted geographical distribution; these may easily become endangered.

Prospects The information available on *B. borneensis* is restricted to botanical information and a single record on a medicinal use. This is insufficient to allow the prediction of the prospects as a medicinal plant.

Literature 313.

Other selected sources 121.

R.H.M.J. Lemmens

Blechum pyramidatum (Lamk) Urb.

Feddes Repert. 15: 323 (1918).

ACANTHACEAE

$2n$ = 34

Synonyms *Blechum brownei* Juss. (1807).

Vernacular names Philippines: sapin-sapin, dayang (Tagalog), bamburia (Iloko).

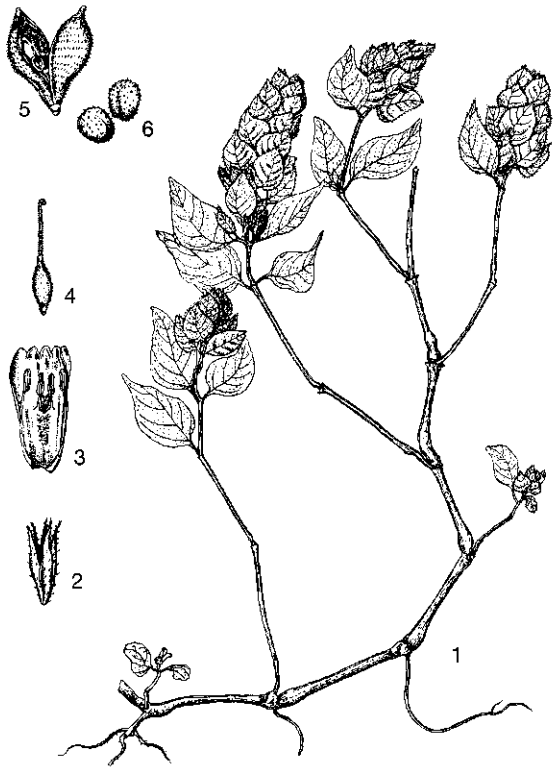
Origin and geographic distribution *B. pyra-*

midatum originates from tropical America, but has been introduced and is naturalized in southern Taiwan, the Philippines, and islands of the Pacific such as the Mariana Islands, the Caroline Islands and Western Samoa.

Uses A decoction of the entire plant is used to treat blennorrhoea in the Philippines; the pounded leaves are used to heal wounds. In Costa Rica, a decoction of the plant is a popular remedy for dysentery, and in Cuba it is valued as a powerful diuretic. In Jamaica, a decoction is used in a stimulant bath, and to treat colds, whereas in Mexico it is considered a remedy for snakebites, chills and fever. In Panama, a decoction of the entire plant is used to treat vomiting.

Botany An annual or short-lived, erect or ascending herb up to 50(–70) cm tall; stems often prostrate and rooting at lower nodes. Leaves decussately opposite, simple and entire, ovate, 3–10 cm × 2–5 cm, thin, obtuse or rounded at base, acute at apex, sparingly strigose above and nearly glabrous below; petiole up to 2.5 cm long; stipules absent. Inflorescence a dense terminal spike up to 6 cm long, with large foliaceous bracts c. 1.5 cm long, the margins conspicuously ciliate. Flowers solitary or in pairs in the axils of bracts, small, bisexual, each flower with 2 linear bracteoles; calyx 5-partite with linear segments; corolla gamopetalous, scarcely longer than bract, with slender tube and 5 subequal lobes contorted in bud, puberulent, white; stamens 4, didynamous, inserted above the middle of the corolla tube; ovary superior, 2-celled, style subulate. Fruit an ovoid capsule c. 5 mm long, puberulent, loculicidally 2-valved, after dehiscence the placentae rising elastically from the base of the fruit, many-seeded. Seeds orbicular, c. 1.5 mm in diameter.

Blechum consists of about 6 species and is native to tropical America. It should not be confused with *Blechnum*, which is a fern genus.



Blechum pyramidatum (Lamk) Urb. – 1, plant habit; 2, calyx; 3, corolla opened to show stamens; 4, pistil; 5, dehisced fruit; 6, seeds.

Ecology *B. pyramidatum* is common in and around many towns at low altitude in the Philippines: in waste places, open thickets and on old walls. In tropical America, it is a weed of fields, shady waste places and moist thickets, up to 1400 m altitude. It is sometimes a troublesome weed, e.g. in taro (*Colocasia esculenta* (L.) Schott) in Western Samoa.

Management Seeds of *B. pyramidatum* germinate at a temperature of 10–40°C, but the optimum is 20–35°C. There is no marked dormancy, and the seeds lose their germination capacity comparatively rapidly.

Genetic resources *B. pyramidatum* occurs commonly in anthropogenic habitats and is consequently not easily liable to genetic erosion.

Prospects It is not possible to give an indication of the medicinal prospects of *B. pyramidatum* because no information is available on pharmacological properties and phytochemistry. However, research seems worthwhile because of the medicinal uses in different parts of the world.

Literature 544, 760.

Other selected sources 117, 646.

R.H.M.J. Lemmens

Buchnera L.

Sp. pl. 2: 630 (1753); Gen. pl. ed. 5: 278 (1754).
SCROPHULARIACEAE
x = unknown

Origin and geographic distribution *Buchnera* comprises approximately 100 species and occurs in all tropical and subtropical regions. Southern and eastern Africa are richest in species (over 50). South-East Asia is comparatively poor, with 3

species in Indo-China and Thailand, and about 5 in the Malesian region (1 in Java, 1 in the Philippines, 4 in New Guinea).

Uses Some uses have been recorded for *Buchnera* species in traditional medicine in South-East Asia. In Papua New Guinea, whole plants of *B. ciliata* are used as a sedative during childbirth, whereas in Thailand, Vietnam and southern China whole plants of *B. cruciata* are applied to cure cough, asthma, epilepsy and ulcers, and to prevent anaemia.
In Tanzania, *B. hispida* Buch.-Ham. ex D. Don is powdered and mixed with castor-oil, and applied externally to scabies and eczema.

Properties As in many other *Scrophulariaceae*, mannitol is present in *Buchnera*.

Botany Annual or perennial hemiparasitic herbs; stems usually erect and simple or laxly branched, terete. Leaves opposite, occasionally alternate, lower ones often rosulate, simple, linear to ovate, entire to coarsely dentate, sessile or shortly petiolate; stipules absent. Inflorescence terminal, spicate, 4-angled, densely flowered; bracts large, subtending and largely covering the flowers. Flowers bisexual, sessile, with 2 small bracteoles, 5-merous; calyx tubular, equally lobed; corolla with slender cylindrical tube, with subequal, spreading lobes; stamens 4, adnate at the middle of the corolla tube, short, slightly didynamous; ovary superior, 2-celled, style filiform, stigma clavate. Fruit an ovoid to oblong capsule, loculicidally 2-valved, many-seeded. Seeds cylindrical or fusiform, longitudinally striate.

Ecology *Buchnera* is found in open forest and grassland, up to 1600 m altitude.
Some species, e.g. the African *B. hispida*, are facultative root parasites of grasses and cereals, and occasionally may be pests in crops (especially maize and sorghum). However, they are not of economic importance.

Genetic resources The South-East Asian *Buchnera* species do not seem to be liable to genetic erosion. They are not restricted to vulnerable habitats, and are usually widely distributed. However, some species, such as *B. ciliata*, are more or less narrow endemics, and overcollecting may easily result in too high pressure on populations.

Prospects The lack of data on chemistry and pharmacological activity makes it impossible to predict whether the uses of *Buchnera* in local medicine will have wider application.

Literature 120, 331.

Selection of species

Buchnera ciliata Pennell

Journ. Arn. Arb. 24: 263 (1943).

Vernacular names Papua New Guinea: bogle (Mount Hagen, Western Highlands).

Distribution New Guinea.

Uses On Mount Hagen, the whole plant is used for alleviating birth pains and to accelerate the expulsion of the placenta.

Observations A herb up to 50 cm tall, stem simple or distally slightly branched; lowest leaves ovate, short, middle leaves oblong, larger, c. 4 cm × 1 cm, upper leaves linear-lanceolate, 5–6 cm long, scabrous-pubescent; inflorescence slender and dense, bracts 3–4 mm long, strongly ciliate; calyx c. 5 mm long, corolla with 6–7 mm long tube and 3–4 mm long lobes, pinkish; fruit triangular-conical, c. 5 mm long. *B. ciliata* occurs in mountainous regions at about 1600 m altitude, in grassland and on deforested slopes.

Selected sources 347, 728, 897.

Buchnera cruciata Buch.-Ham. ex D. Don

Prodr. fl. nepal.: 91 (1825).

Synonyms *Buchnera ramosa* Bonati (1911).

Vernacular names Laos: hnha:z do:k lê (Xieng Khouang), khauz kamx no:yz (Louang Prabang). Thailand: ya khao kam khao (north-eastern), ya khao kam (south-eastern). Vietnam: m[aa]y m[aa]y (Phu Khanh), b[uj]c.

Distribution Nepal, eastern India, Burma (Myanmar), Indo-China, southern China and Thailand.

Uses In Thailand, the whole plant is used to treat asthma and ulcers. Mixed with the whole plant of *Pierranthus capitatus* (Bonati) Bonati it is used to treat anaemia. In Vietnam, an infusion of the plant is used to treat cough. In China, the whole plant is used to treat epilepsy.

Observations A herb up to 80 cm tall, stem simple; lowest leaves obovate, elliptical or oblong, 1–5 cm long, middle and upper leaves linear-lanceolate, 1–4 cm long, scabrous-pubescent; inflorescence densely flowered, bracts 2–3 mm long, pubescent; calyx c. 4 mm long, corolla with c. 8 mm long tube and c. 2 mm long lobes, purplish; fruit oblong-ovoid or oblong, 4–5 mm long. *B. cruciata* occurs in open deciduous forest and in grassland, up to 1600 m altitude.

Selected sources 169, 249, 250.

Wongsatit Chuakul, Noppamas Soonthornchareonnon & Orawan Ruangsomboon

Buddleja asiatica Lour.

Fl. cochinch.: 72 (1790).
BUDDLEJACEAE
$2n = 38$

Vernacular names White butterfly bush (En). Indonesia: jugul (Sundanese), daun putihan (Javanese), kayu saludang (Sumatra). Philippines: malasambung (Tagalog), lagundisalasa (Bisaya), tugnang (Iloko). Laos: dok fon^2, dok khap. Thailand: khrai bok (northern), kiang phaa lai (Chiang Mai), mae maai (Kanchanaburi). Vietnam: b[oj] ch[os], t[us]y ng[uw] th[ar]o, b[us]p l[eej].

Origin and geographic distribution *B. asiatica* occurs from Pakistan, eastern India, Burma (Myanmar), Laos, Vietnam and southern China, through Thailand and the whole of Malesia, to the Mariana Islands. It is sometimes cultivated and naturalized in other tropical and subtropical regions. *B. asiatica* is the only native species of the genus in the Malesian region, but a few other species are cultivated and sometimes naturalized.

Uses In the Philippines, *B. asiatica* plants are used as an abortifacient, to treat skin diseases and as a cure to stop weight loss. In Vietnam, the leaves are applied in an inhalation to treat headache, to treat skin diseases, and, in combination with other drugs, after childbirth. Dried roots are used to treat malaria in China, and as a tonic in Burma (Myanmar). The leaves are often used for stupefying fish, e.g. by the Dayak Kenyah people in East Kalimantan (Indonesia). *B. asiatica* is used as forage in Nepal.

A decoction of flower buds of *B. officinalis* Maxim., found wild in northern Vietnam and southern China, is used to treat eye diseases such as eye inflammation, nyctalopia, asthenopia and cataract, often in combination with other medicinal plants.

B. americana L. is used in traditional medicine in Central America, e.g. to treat respiratory diseases, gastro-intestinal disorders, headache and diarrhoea. *B. madagascariensis* Lamk is also used to treat respiratory diseases in Madagascar, and is sometimes planted and rarely naturalized in South-East Asia (Peninsular Malaysia).

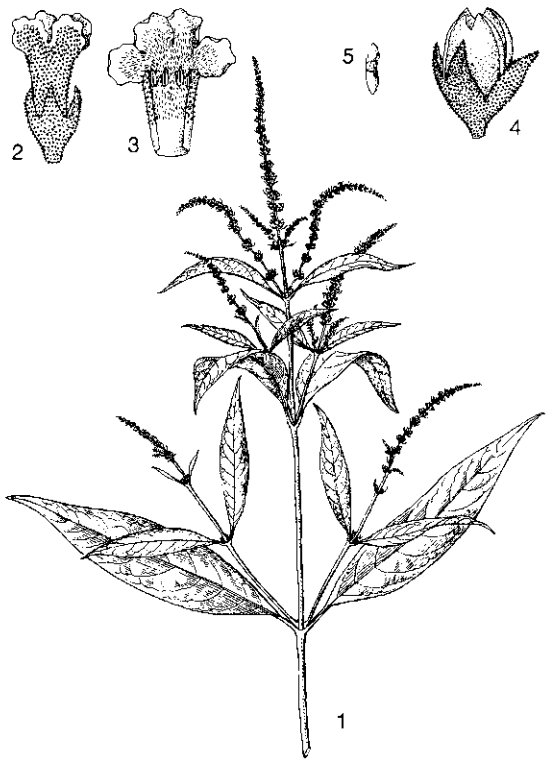
Several *Buddleja* species are widely planted as ornamentals, e.g. *B. davidii* Franch., which is also commonly cultivated in the Malesian region and is locally naturalized (Cameroon Highlands, Peninsular Malaysia).

Properties The alcoholic extract from *B. asiatica* leaves produced a persistent hypotensive effect on pentobarbitone-anaesthetized dogs and cats. The extract had an α-receptor antagonist activity. The essential oil isolated from *B. asiatica* leaves inhibited the growth of the pathogenic fungi *Aspergillus flavus*, *A. fumigatus* (causing bronchial and pulmonary infections), *Trichoderma viride* (causing dermatitis), *Trichophyton rubrum* (causing infection of keratinized tissues and skin) and *Curvularia prasadii* (causing leaf spot). The oil is rich in β-caryophyllene epoxide (22%), citronellol (17%) and β-caryophyllene (16%). A crude petroleum-ether-acetone extract of *B. asiatica* showed distinct larvicidal activity on the filarial mosquito *Culex quinquefasciatus*.

Four phenylethanoid glucosides have been isolated from *B. officinalis* flowers; one of these, verbascoside (= acetoside), showed antibacterial and anticancer activities, and is also known to exhibit antihypertensive and analgesic activities. Several flavonoid compounds (e.g. apigenin, luteolin and luteolin-7-O-glucoside) have been isolated from *B. officinalis*. A 70% methanolic extract of *B. officinalis* flowers showed an inhibitory effect on unpurified rat lens aldose reductase, an enzyme involved in the complications of diabetes. Luteolin, luteolin-7-O-β-D-glucopyranoside, apigenin and acacetin-7-O-α-L-rhamnopyranosyl-(6-1)-β-D-glucopyranoside have been isolated as active compounds.

Aqueous extracts of several *Buddleja* species (amongst which *B. officinalis*) showed an inhibitory effect against induced cytotoxicity of cultured hepatocytes. Testing of the isolated compounds indicated that the activity is most likely due to flavonoid constituents and phenylpropide glycosides.

Botany A shrub or small tree up to 7 m tall; branches terete, densely appressed or woolly stellate-hairy when young. Leaves opposite, simple, narrowly lanceolate to oblong- or ovate-lanceolate, 3–30 cm × 0.5–7 cm, cuneate at base, long-acuminate at apex, margin remotely serrate-dentate to entire, densely hairy beneath, pinnately veined; petiole 2–15 mm long; stipules absent, but 2 opposite petioles connected by a stipular line. Inflorescence a terminal and/or axillary spike-like thyrse up to 25 cm long, composed of 1–3-flowered cymes in the axils of linear bracts, densely tomentose. Flowers bisexual, 4-merous, occasionally a few 5-merous, sessile or subsessile; calyx campanulate, 1.5–4.5 mm long, with triangular-oblong lobes; corolla 3–6 mm long, lobes distinctly shorter than tube, outside stellate-hairy, white, sometimes pale violet or greenish; stamens inserted on the corolla tube, filaments extremely short; ovary superior, 2-



Buddleja asiatica Lour. – 1, flowering branch; 2, flower; 3, opened corolla showing stamens; 4, fruit; 5, seed.

celled, style short, stigma club-shaped. Fruit an ovoid or oblong, flattened capsule 3–5 mm long, 2-valved, glabrous, brown, many-seeded. Seeds ellipsoid, small, with a short wing at both sides, endosperm fleshy.

B. asiatica may flower throughout the year. The flowers are pollinated by insects, whereas the tiny seeds are wind-dispersed.

Buddleja comprises approximately 100 species, and is distributed in all tropics and subtropics. It is sometimes included in the family *Loganiaceae*.

Ecology *B. asiatica* prefers open, often disturbed or secondary vegetation, and behaves more or less as a pioneer. It is found in logged-over forest, regularly burned grassland, in gravel-beds, and on former lava-streams and landslides, and occurs there often gregariously. It may be found up to 3000 m altitude.

Management Seeds of *B. asiatica* start germinating 1–2 weeks after sowing. In glasshouse tests in India, the average germination rate was 21%. After 4 months, the average height and stem diameter of seedlings were 27 cm and 0.4 cm, respectively. *B. asiatica* can also be propagated using semi-hardwood cuttings.

Genetic resources *B. asiatica* is widespread, locally common and prefers disturbed habitats. This means that there is no risk of genetic erosion.

Prospects Like other *Buddleja* species, *B. asiatica* shows interesting pharmacological activities (e.g. antifungal activity), which deserve more attention in research. Especially the treatment of skin and eye diseases should be further investigated. In India, *B. asiatica* has been suggested as a promising shrub for regreening degraded habitats.

Literature 247, 270, 671, 760, 866, 958.

Other selected sources 250, 269, 370, 371, 603.

Siti Susiarti

Butea Roxb. ex Willd.

Sp. pl. 3(2): 917 (1802).

LEGUMINOSAE

$x = 9$; *B. monosperma*: $2n = 18$, 22, 32, *B. superba*: $2n = 18$

Origin and geographic distribution *Butea* comprises 2 species and its natural distribution is confined to the drier parts of India and mainland South-East Asia, with the exception of the presence of *B. monosperma* in Java. The latter species is planted throughout South-East Asia and certain parts of Africa.

Uses *B. monosperma* is widely used in Indian and continental South-East Asian folk medicine. The astringent bark exudate is used internally to treat diarrhoea, and is applied externally to boils, sores, ulcers and adenitis. The root bark and seeds are credited with anthelmintic activity, and the seeds, leaves and flowers with antimicrobial activity. Several of the traditional uses are supported by modern research. *B. monosperma* is well known as a dye and tannin-producing plant. The bark of *B. superba* is used as a remedy for snakebites and insect stings, and a decoction of stem and leaves is applied to haemorrhoids and is considered sedative. *B. superba* has recently attracted attention as a possible herbal substitute for Viagra, which is at present the best known oral agent for the treatment of erectile dysfunction. In Thailand over-the-counter preparations have been illegally developed from *B. superba* both as gel as well as pills.

Properties Aqueous extracts of *B. monosperma* roots and leaves showed ocular anti-inflammatory

activity in rabbits. The petroleum ether extract of flowers of *B. monosperma* exhibited anticonvulsant activity in mice and rats, and additionally antagonized the behavioural effects of amphetamine and potentiated the pentobarbital-induced sleep. It was also found to be anxiogenic and a depressant of the central nervous system. A methanol extract of the seeds showed significant in-vitro anthelmintic activity.

An ethanol concentrate of *B. monosperma* petals exhibited anti-oestrogenic activity in rats, and a flower decoction showed anti-implantation activity. The anti-implantation activity is, at least partly, due to the presence of the flavanone butin. The petroleum and ethyl acetate extracts of *B. monosperma* stem bark displayed antifungal activity against *Cladosporium cladosporioides*. The active constituent was identified as (–)-medicarpin (an isoflavonoid/pterocarpan). Seed extracts of *B. monosperma* showed anthelmintic and antispermatogenic activities.

A flavonol glycoside isolated from the stems of *B. superba* showed antimicrobial activity against numerous plant pathogenic fungi and gram-positive as well as gram-negative bacteria. An orally administered seed extract of *B. superba* showed moderate to strong antispermatogenic effect in mice and rats.

Drugs developed for erectile dysfunction are able to substitute, partially or completely, the malfunctioning endogenous mechanisms that control penile erection. Sildenafil citrate (Viagra) acts as an inhibitor of phosphodiesterase type 5 (PDE-5). This enzyme interferes with the production of cyclic guanosine monophosphate (c-GMP) that is aimed at relaxing the smooth muscles in the corpus cavernosum, thereby increasing the blood flow to the penis. The activity of *B. superba* is claimed to work according to the same mechanism.

Botany Lianas, scandent shrubs or trees, with tomentose young branches. Leaves alternate, 3-foliolate; stipules small, linear or subulate, pubescent, caducous; lateral leaflets obliquely ovate, with obtuse to rounded apex, terminal leaflet symmetric, rhomboid-obovate, with obtuse to emarginate apex; stipels present. Inflorescence an axillary or terminal densely fasciculate pseudo-raceme or panicle, bracteolate. Flowers bisexual, pedicellate; calyx broadly campanulate, with 4 short lobes, velvety, olive-green, persistent; petals papilionaceous, densely pubescent outside, brightly coloured, orange-red, more rarely yellow or white, standard ovate, auricled at base, acute at apex, strongly reflexed at anthesis, wings equal to or slightly longer than standard, falcate, keel slightly longer than standard and wings, falcate; stamens enclosed within the keel, 9 connate and 1 free; ovary superior, stipitate, woolly, 1-celled, with curved style. Fruit an oblong or broadly linear pod, distinctly stipitate, pendulous, in the lower part flat, with a single seed near the apex. Seed ellipsoid, flattened, c. 3 cm long.

At the beginning of the rainy season *B. monosperma* is leafless and flowers abundantly. Birds are the chief pollinators. At the end of the flowering period, new leaves develop; these are initially pale bronze-tinged green.

Butea is usually classified in the tribe *Phaseoleae* and seems to be related to *Meizotropis* and *Spatholobus*.

Confusion exists with respect to the Thai drug 'kwaao khruea', reputed for its rejuvenating properties. Contradictory reports on chemical constituents (especially phytoestrogens) of plant material collected under this name can be attributed to a mix-up between *B. superba* and *Pueraria mirifica* Airy Shaw & Suvat. The resemblance of the leaves of these species is striking, but they are very different with respect to constituents and activity. Whereas pharmacological interest in *P. mirifica* focuses on its isoflavones and miroestrol content, *B. superba* receives special attention for its high levels of flavonoids and flavonoid glycosides. Information with respect to the efficacy of a special selection of *B. superba* refers to its tuberous root as source of the active principle. However, botanical literature claims that *B. superba* does not have a tuberous root, whereas *Pueraria mirifica* does.

Ecology *Butea* grows gregariously in open grasslands and scattered in mixed forest, in relatively dry areas up to 1500 m altitude.

Management *B. monosperma* is propagated by seed. Before the beginning of the rainy season, complete pods are sown in rows 3–6 m apart. The pod opens at the tip and allows the young shoot and root to emerge. The cotyledons remain attached to the seedling for a considerable time. Seedlings thrive best on a rich loamy soil with a neutral pH. Root suckers are freely produced and enable vegetative propagation and easy tree recovery after damage.

Genetic resources *B. monosperma* is widely planted and does not seem to be at risk of genetic erosion. Populations of *B. superba* are locally threatened by over-collecting, especially in Thailand. Plantations of the latter have been established, with a high-yielding selection, that is mar-

keted as a cultivar (Wichai 101), serving as a guarantee of quality.

Prospects *Butea* shows several interesting pharmacological properties, including antimicrobial, anthelmintic, anti-inflammatory, anticonvulsant and antifertility activities. These deserve more research, possibly leading to a more adequate usage as a medicinal plant. The basis for the claimed activities of *B. superba* for the treatment of erectile dysfunction is still unclear. This warrants scientific publications in which the botanical identity of the plant material tested should be indisputably clarified.

Literature 181, 490, 523, 731, 815.

Selection of species

Butea monosperma (Lamk) Taub.

Engl. & Prantl, Nat. Pflanzenfam. 3(3): 366 (1894).

Synonyms *Butea frondosa* Roxb. ex Willd. (1802).

Vernacular names Flame of the forest (En). Indonesia: palasa (general), plasa (Javanese, Sundanese). Burma (Myanmar): pouk-pen. Cambodia: char. Laos: (kô'k) chan. Thailand: kwaao (northern), thong kwaao, thong thammachaat (central). Vietnam: l[aa]m v[oos], gi[ef]ng gi[ef]ng.

Distribution Nepal, throughout India, Sri Lanka, Burma (Myanmar), Indo-China, Thailand and Java; cultivated in tropical Asia and Africa, and in some subtropical regions.

Uses A red exudate (gum) from the bark is known as 'Butea gum' or 'Bengal kino'. It can be used as a powerful astringent and is applied in cases of diarrhoea. In Indo-China it is an ingredient of dressings applied to boils, sores, ulcers and adenitis. The bark is credited with anti-ulcer and antitumour properties, and the root bark is used as an aphrodisiac, analgesic, oestrogenic and anthelmintic. The leaves show some antimicrobial activity. The seeds are reputed to work as an anthelmintic, and also have bactericidal and fungicidal effects. The flowers are used in the treatment of liver disorders and credited with astringent, diuretic and anti-inflammatory activities. In India *B. monosperma* is an important host for the lac insect (*Laccifer lacca*), which produces shellac. The tree is much planted as an ornamental because it flowers with a profusion of bright orange, rarely sulphurous flowers. A bright yellow to deep orange-red dye can be prepared from the flowers, especially used for dyeing silk. The coarse, fibrous material obtained from the inner bark is used for rough cordage, for caulking boats and for making paper. The wood is sometimes used for utensils and construction, more commonly for fuel. *B. monosperma* is a valuable species for reclaiming saline soils.

Butea monosperma (Lamk) Taub. – 1, flowering twig; 2, fruits.

Observations A small to medium-sized, deciduous tree 5–12(–20) m tall; leaves with petiole up to 20 cm long and leaflets up to 27 cm × 26 cm; inflorescence with early caducous bracts; flowers 4–8 cm long, bright orange-red, more rarely yellow, pedicel c. 2 times longer than calyx; fruit up to 24 cm × 6 cm, covered with short brown hairs, pale yellowish-brown or grey when ripe. *B. monosperma* usually grows in open grassland, but also in mixed forest, in Java in relatively dry regions in the east, up to 1500 m altitude.

Selected sources 9, 70, 90, 121, 181, 250, 455, 542, 617, 731, 753, 815, 965.

Butea superba Willd.

Sp. pl. 3(2): 917 (1802).

Vernacular names Cambodia: char. Laos: (khùa) chan. Thailand: kwaao khruea (northern),

thong kruea (central). Vietnam: chan ki[eej]u, gi[ef]ng gi[ef]ng d[ej]p.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China and Thailand.

Uses In Burma (Myanmar) the bark is used as a remedy for snakebites and insect stings, and in Thailand to treat toothache. In Cambodia a decoction of stem and leaves is externally applied to haemorrhoids; it is also considered sedative and used to treat convulsions.

Observations A large liana with stem up to 40 cm in diameter; leaves with petiole up to 10 cm long and leaflets up to 30(–45) cm × 25(–40) cm; inflorescence with bracts persistent until anthesis; flowers 8–10 cm long, bright orange-red, pedicel c. 3 times longer than calyx; fruit up to 24 cm × 6 cm, covered with short brown hairs, pale yellowish-brown or grey when ripe. *B. superba* occurs in open forest.

Selected sources 92, 121, 181, 250, 731, 815, 825, 1024.

Raharni

Buxus rolfei S. Vidal

Revis. pl. vasc. filip.: 233 (1886).
BUXACEAE
$2n$ = unknown

Vernacular names Philippines: malagaap, piukbanau (Tagalog), sarapuyau (Negrito).

Origin and geographic distribution *B. rolfei* is endemic to the Philippines (Luzon, Sibuyan, Palawan, Mindanao), but may possibly have been recorded from Sulawesi (Indonesia).

Uses The fruits are dried and finely cut, and then scattered on water as a fish poison.
Leaves of *B. harlandii* Hance are used in Vietnam to treat dog bites.

Properties Steroidal alkaloids of the 9β,19 cyclopregnane and 9(10→19) abeo pregnane type have been found in all *Buxus* species investigated. Several of these isolated from the leaves of *B. longifolia* Boiss. and *B. sempervirens* L. showed significant antibacterial activity, also against human pathogenic bacteria. Furthermore, the steroidal alkaloid cyclobuxine isolated from *B. microphylla* Sieb. & Zucc. in Korea is reported to protect the isolated rat heart from the myocardial injuries produced by ischaemia and subsequent reperfusion by significantly suppressing ultrastructural damage. Buxaminol E isolated from the European *B. sempervirens* showed a hypotensive effect in tests with cats.

Botany A glabrous shrub with compressed-tetragonal branches. Leaves opposite, simple and entire, elliptical to oblong, 5–17 cm × 1.5–8 cm, acute at base, shortly acuminate at apex, thinly leathery, with numerous distinct secondary veins connecting into an intramarginal vein; petiole 2–7 mm long; stipules absent. Inflorescence an axillary raceme with c. 5 pairs of bracts. Flowers unisexual; male flowers pedicelled, with 4 perianth segments and 4 stamens; female flowers terminal in inflorescence, without perianth but with c. 6 spirally arranged bracteoles, ovary superior, 3-celled, styles 3, short, persistent. Fruit an ovoid capsule 1–1.5 cm long, 3-celled with 2 seeds per cell. Seeds trigonous-ellipsoid, c. 7 mm long, shiny black.
Buxus consists of approximately 100 species. It has a centre of diversity (section *Tricera*) in the Caribbean-Latin America region with about 50 species, more than 30 of which are confined to Cuba. A second centre of diversity is in eastern Asia, where about 40 species occur from China, Korea and Japan to Malaysia, Indonesia and the Philippines; most of these species have been classified in section *Buxus*, but 6 in section *Eugeniobuxus* (including *B. rolfei*). In Africa, about 7 species have been found (section *Probuxus*), whereas the 4 species of the closely related genus *Notobuxus* also occur here. Two species occur in Europe.

Ecology *B. rolfei* occurs in primary forest at low and medium altitudes.

Genetic resources *B. rolfei* appears to be endemic to the Philippines where it is restricted to primary forest, which is under high pressure. Consequently, it seems liable to genetic erosion and may become easily endangered.

Prospects The steroidal alkaloids present in *Buxus* are pharmacologically interesting compounds, which are probably also present in *B. rolfei*. This might offer possibilities for research.

Literature 117, 323, 495.

Other selected sources 55, 57, 121, 521, 535.

R.H.M.J. Lemmens

Calophyllum L.

Sp. pl. 1: 513 (1753); Gen. pl. ed. 5: 229 (1754).
GUTTIFERAE
x = unknown; *C. inophyllum*: $2n = 32$

Origin and geographic distribution *Calophyllum* is a very large genus comprising about 190 species. The Indo-Malesian region, Micronesia, Melanesia and northern Australia are rich in

species, tropical America, Madagascar and surrounding islands less rich. Peninsular Malaysia, Sumatra, Borneo and New Guinea show an abundance of species, about 40, 35, 65 and 35, respectively.

Uses Many *Calophyllum* species supply a good multipurpose timber, known as bintangor. Timber is definitely the primary use for these species. However, the recent discovery of compounds that are very promising as drugs for the treatment of acquired immunodeficiency syndrome (AIDS) throws new light on *Calophyllum* as a medicinal plant.

A decoction of the bark and the latex of some *Calophyllum* species is used in traditional medicine, internally against diarrhoea and after childbirth, externally against skin and eye diseases and rheumatism; leaves, flowers and seeds are also used. A balsam made from the fruits of *C. inophyllum* is used as a healing and analgesic agent in the treatment of burns. The poisonous latex from the bark of several species is used to stupify fish and, mixed with rice, to kill rats. Several other species not treated here are used in traditional medicine or as poisonous plant, e.g. *C. calaba* L. (latex used as fish poison and shampoo), *C. canum* Hook.f. (latex used as fish poison in Sarawak), *C. dioscurii* P.F. Stevens (decoction of roots used after childbirth in Peninsular Malaysia), *C. pisiferum* Planchon & Triana (decoction of bark used to treat diarrhoea in Cambodia), and *C. rubiginosum* M.R. Henderson & Wyatt-Smith (latex used to poison rats and as fish poison in Indonesia).

The fruits of some species are edible but often sour; caution is necessary as they contain toxic substances. The oil from the seeds is sometimes used as an illuminant and in soap making. The seed-oil and the latex from the bark have occasionally been used for dyeing batik cloth in Java. A decoction of the bark is sometimes used to toughen and dye fishing-nets. *C. inophyllum* is commonly planted as an ornamental.

Properties In the past decades, many natural products have been screened to identify compounds from which drugs against cancer and AIDS might be developed. Several coumarins have been isolated from *Calophyllum* that are able to inhibit HIV reverse transcriptase. Inophyllums have been isolated from the leaves and seeds of *C. inophyllum* and calanolides from fruits and twigs of *C. lanigerum* and *C. teysmannii*, and these compounds proved to be non-nucleoside inhibitors of HIV type 1. The compounds are essentially inactive against strains of the less common HIV type 2. The most promising compounds seem to be the dipyranocoumarin (+)-calanolide A isolated from *C. lanigerum* var. *austrocoriaceum* and the closely related compound (−)-calanolide B from *C. teysmannii* var. *inophylloide*. These compounds are under development as an AIDS chemotherapeutic. A study demonstrated the safety and favourable pharmacokinetic profile of single doses of (+)-calanolide A in healthy, HIV-negative individuals. Inophyllum B and P are the most active compounds isolated from *C. inophyllum*. Soulattrolide, another coumarin isolated from the latex of *C. teysmannii*, was also found to be a potent inhibitor of HIV-1 reverse transcriptase. The seeds of *C. cerasiferum* Vesque from the Fiji Islands contain (−)-calanolide B as its major coumarin constituent. Cordatolide A and B, which also inhibit HIV-1 reverse transcriptase, have been isolated from *C. cordato-oblongum* Thwaites, an endemic of Sri Lanka.

An analysis of the essential oil from *C. inophyllum* flowers showed the presence of 25 compounds, with a naphthalene derivative as the most abundant component. Antibacterial, anti-inflammatory and phagocytosis stimulant activities have been reported for this species. Seed extracts of *C. inophyllum* showed significant molluscicidal activity; the hydroxy acid calophyllic acid was isolated as the active compound. The ether extract of the leaves showed piscicidal activity.

Xanthones and coumarins with cytotoxic activity against cancer cells have been isolated from various *Calophyllum* species. For example, some of the 4-phenylcoumarins isolated from *C. inophyllum* might be valuable as potential cancer chemopreventive agents.

Botany Evergreen trees up to 40(–60) m tall, rarely shrubs, with sticky latex; twigs more or less flattened and angled. Leaves decussately opposite, simple and entire, leathery, glabrous, with closely parallel secondary venation, petiolate; stipules absent. Inflorescence terminal or axillary, racemose. Flowers usually bisexual, but sometimes functionally unisexual, regular, sweetly scented; perianth with 4–16 tepals in several whorls, usually whitish; stamens numerous, with filaments usually only slightly connate at base; ovary superior, unilocular, style often with a peltate stigma. Fruit a drupe, outer layer of pericarp often with large air spaces, 1-seeded. Seed with large cotyledons and radicle pointing to the base of the fruit; endosperm absent. Seedling with cryptocotylar germination and short epicotyl.

Growth of the young trees appears to be discontin-

uous and branching is rhythmic. Growth may be rather slow, and trees may take about 70 years to attain a diameter of 50 cm. However, there is reason to believe that growth may be considerably faster under favourable conditions.

The flowers are insect-pollinated, e.g. by bees. Hybridization may occur, often with *C. inophyllum* as one of the parents. Trees often bear fruits throughout the year. The fruits are eaten and dispersed by mammals (bats, squirrels, monkeys) and birds. However, the fruits of some species are dispersed by water, e.g. those of *C. inophyllum* which are dispersed by sea currents, but also by fruit bats.

Calophyllum is classified in the subfamily *Calophylloideae* together with its immediate relatives *Mammea* and *Mesua*, and some small genera of Madagascar and India. It is easily distinguishable by its single basal ovule and particularly by its nearly always strictly parallel and close venation of the leaves.

Ecology *Calophyllum* belongs to the lowland tropical rain forest, but a few species occur in montane rain forest. *Calophyllum* trees often reach to the top of the main canopy at maturity, but are not emergent. Only a few species grow in drier or more open habitats; *C. inophyllum* occurs mainly on sandy beaches.

Management Natural regeneration usually occurs near the mother tree. Seedlings grown in nurseries require shade. In plantation trials in Indonesia the spacing of seedlings is usually 2 m × 3 m.

Genetic resources Although *Calophyllum* is abundant in several areas (e.g. in Peninsular Malaysia, Borneo and New Guinea), in many other areas it is much less common and occurs scattered in the forest. The rarer species may become easily liable to genetic erosion when indiscriminate logging and large-scale destruction of lowland rain forest is practised. An example is *C. blancoi*, the stands of which are depleted in the Philippines due to logging and shifting cultivation.

Prospects The studies on the activity of several coumarins isolated from *Calophyllum* indicate that these compounds have a novel mechanism of interaction with human immunodeficiency virus type 1 reverse transcriptase. These non-nucleoside inhibitors differ mechanistically from the chain terminators AZT and DDI, which are at present the chemotherapeutic agents used to treat HIV infections, and as such could conceivably play a role in combination therapy against AIDS. Moreover, *Calophyllum* is a source of potential cancer chemopreventive agents.

Literature 183, 452, 607, 616, 722, 878, 891.

Selection of species

Calophyllum blancoi Planchon & Triana

Ann. Sci. Nat. Bot. 4, 15: 262 (1862).

Synonyms *Calophyllum racemosum* Merr. (1910), *Calophyllum glabrum* Merr. (1912), *Calophyllum mindanaense* Elmer (1915).

Vernacular names Philippines: bitangol, bitaog (general), palo maria del monte (Sp).

Distribution The Philippines and Borneo (Sabah, East Kalimantan); also in Taiwan (Lanyu Islands).

Uses In the Philippines, the latex from the bark is used externally to treat wounds, boils, swellings, and to alleviate asthma. The wood is used for many purposes.

Observations A medium-sized to large tree up to 40 m tall; leaves elliptical to suboblong, (3–)5–25(–30) cm long, with 5–18(–22) veins per 5 mm; inflorescence branched once or twice; flowers with 8–16 tepals; fruit ovoid to subspherical, 12–22 mm long. *C. blancoi* is a variable species, and usually occurs in well-drained primary forest up to 1900 m altitude.

Selected sources 760, 878, 891.

Calophyllum inophyllum L.

Sp. pl. 1: 513 (1753).

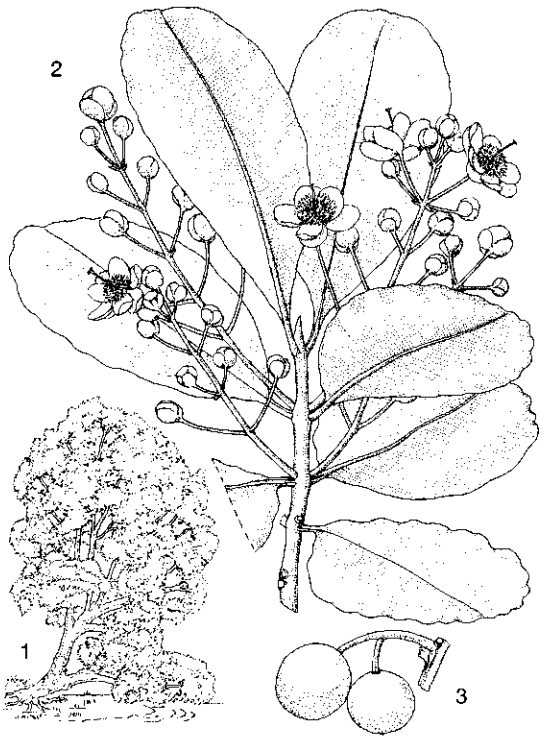
Vernacular names Alexandrian laurel, Borneo mahogany (En). Indonesia: nyamplung (Java), dingkaran (Sulawesi). Malaysia: bintangor laut, penaga laut (Peninsular), penaga (Sabah). Papua New Guinea: beach calophyllum. Philippines: palo maria (Sp), bitaog, butalau (general). Burma (Myanmar): ponnyet, ph'ông. Cambodia: khtung, kchyong. Thailand: kra thing (general), saraphee naen (northern), naowakan (Nan). Vietnam: c[aa]y m[uf]u, m[uf]u.

Distribution Eastern Africa, Madagascar, islands of the Indian Ocean, India, Sri Lanka, Burma (Myanmar), Indo-China, Thailand, Taiwan, the Ryukyu Islands, throughout Malesia, northern Australia and the islands of the Pacific Ocean; often planted within its range, in western Africa and in tropical America.

Uses The latex and pounded bark are used in traditional medicine in many regions; they are applied externally on wounds, ulcers and to treat

phthisis, orchitis and lung affections, and internally as a purgative, after childbirth and to treat gonorrhoea. In Indonesia, a cold infusion of the leaves in water is used to treat sore eyes, in the Philippines to treat haemorrhoids, and in Papua New Guinea against dysentery. Heated leaves are applied to cuts, sores, ulcers, boils and skin rash in Papua New Guinea, and the leaves are used in Cambodia in inhalations to treat migraine and vertigo. In Papua New Guinea, Thailand, Indo-China and India, the seed-oil is applied externally against rheumatism, swellings, ulcers, scabies, ringworm, boils and itch. The flowers are used as heart tonic in Thailand. *C. inophyllum* is used medicinally in Fiji to treat skin inflammations, in New Caledonia to treat ulcers, wounds and sores, and in Samoa to treat skin infections and scabies. It is also used to poison fish. The wood is used for many purposes. The oil from the seeds is used for illumination and soap making. The tree is planted as an ornamental and shade tree, and for reforestation and afforestation.

Observations A medium-sized tree up to 25(–35) m tall, usually with twisted or leaning bole; leaves elliptical, ovate, obovate or oblong, (5.5–)8–20(–23) cm long, with 4–10 veins per 5 mm; inflorescence usually unbranched but occasionally with 3-flowered branches; flowers with 8(–13) tepals; fruit spherical to obovoid, 25–50 mm long. *C. inophyllum* is often common on the seashore (sandy beaches), but is sometimes found inland on sandy soils up to 200 m altitude.



Calophyllum inophyllum L. – 1, typical habit of tree along beach; 2, flowering twig; 3, fruits.

Selected sources 121, 173, 334, 347, 401, 671, 722, 760, 772, 813, 878, 885, 891, 915.

Calophyllum lanigerum Miq.

Fl. Ind. Bat., Suppl. 1(3): 498 (1861).

Vernacular names Indonesia: betur belulang, bintangor belulang (Bangka, Belitung).

Distribution Southern Peninsular Malaysia, Singapore, the Riau Archipelago, Bangka, Belitung and Borneo.

Uses *C. lanigerum* is a source of HIV reverse transcriptase inhibitors. The wood is used especially for house and ship building.

Observations A small to medium-sized tree up to 25 m tall; leaves ovate to oblong, 4–20 cm long, with 6–13(–15) veins per 5 mm; inflorescence generally unbranched; flowers with (6–)8 tepals; fruit usually spherical, 12–29 mm long. Two varieties are distinguished: var. *lanigerum* from Bangka, Belitung and south-eastern Borneo, and var. *austrocoriaceum* (Whitm.) P.F. Stevens from Peninsular Malaysia to the Riau Archipelago and north-western Borneo. *C. lanigerum* grows in mixed dipterocarp rain forest, in hill forest, heath forest, and in peat swamps up to 950 m altitude. It is locally abundant.

Selected sources 187, 452, 607, 616, 878, 891.

Calophyllum soulattri Burm.f.

Fl. Indica: 121 (1768).

Synonyms *Calophyllum lancifolium* Elmer (1915), *Calophyllum solomonense* A.C. Smith (1941), *Calophyllum spectabile* auct. non Willd.

Vernacular names Indonesia: sulatri (Sundanese), malang-malang (Bangka). Malaysia: bintangor labu, bintangor lanchar, mintak (Peninsular). Philippines: bitangol-sibat (general), pamintaogon (Samar-Leyte Bisaya), gigabi (Panay Bisaya). Thailand: tanghon baiyai (Surat Thani). Vietnam: c[oof]ng tr[aws]ng.

Distribution Vietnam, Cambodia, the Andaman Islands, Thailand, throughout Malesia towards the Solomon Islands and northern Australia.

Uses In Indonesia, an infusion of the root is applied externally to alleviate rheumatic pains. The seed oil is applied externally to treat rheumatism,

wounds and skin problems, and for illumination and soap making. The latex may be used to poison dogs. The wood is used for many purposes, e.g. for house construction. The fruits are edible but sour and they should not be consumed in large quantities. The tree is sometimes planted as a shade tree or ornamental.

Observations A small to medium-sized tree up to 30 m tall; leaves ovate to elliptical or suboblong, (3.5–)6.5–29(–36) cm long, with (6–)12–18(–21) veins per 5 mm; inflorescence generally flabellate and branched; flowers with 4 tepals; fruit spherical, 9–16(–22) mm long. *C. soulattri* is a widespread but in many locations rather uncommon tree, growing in lowland or lower montane rain forest or sometimes in swamp forest, up to 1700 m altitude.

Selected sources 334, 878, 891.

Calophyllum teysmannii Miq.

Fl. Ind. Bat., Suppl. 1(3): 499 (1861).

Vernacular names Malaysia: bintangor batu (Peninsular). Thailand: yakang (Nara).

Distribution Peninsular Thailand, Peninsular Malaysia, Sumatra, the Riau Archipelago and Borneo.

Uses *C. teysmannii* is a source of HIV reverse transcriptase inhibitors. The wood has a number of uses including construction.

Observations A medium-sized to large tree up to 40 m tall; leaves usually obovate, (2–)3–14 cm long, with (4–)6–12(–21) veins per 5 mm; inflorescence usually unbranched; flowers with 4–8 tepals; fruit spherical to ellipsoid, 17–37 mm long. Two varieties occur throughout the range of the species: var. *teysmannii* growing in peat swamps, mixed dipterocarp forest, kerangas forest and on ridges in lower montane forest up to 1200 m altitude, and var. *inophylloide* (King) P.F. Stevens usually growing in well-drained lowland to lower montane mixed dipterocarp forest up to 1400 m altitude.

Selected sources 616, 727, 878, 891.

R.H.M.J. Lemmens

Calycopteris floribunda (Roxb.) Lamk

Encycl., Suppl. 2: 41 (1811).

COMBRETACEAE

$2n = 48$

Synonyms *Getonia floribunda* Roxb. (1798), *Calycopteris nutans* (Roxb.) Kurz (1877).

Vernacular names Malaysia: pelawas (Peninsular). Cambodia: ksouohs, ta suos, qgnu. Laos: dok ka deng, ngouang 'soum. Thailand: kruut (Surat Thani), khaao tok taek (central), nuai sut (peninsular). Vietnam: d[aa]y ch[uw]ng cheo, d[aa]y d[aaf]u m[aaf]u, c[aa]y b[uf] nh[ow]n.

Origin and geographic distribution *C. floribunda* is distributed from India and Burma (Myanmar), through Indo-China and Thailand, to Peninsular Malaysia (Langkawi Island, Pinang, Pahang).

Uses A poultice of the leaves has been used in Peninsular Malaysia to treat headache. In Cambodia, the leaves are considered tonic and depurative; a decoction is administered to women after childbirth. In India, the leaves are used as an anthelmintic and to treat colic and dyspepsia. Juice from young twigs is used against diarrhoea and dysentery, and the fruits to treat jaundice. The bark is crushed with water and the solution is given to cattle suffering from worms.

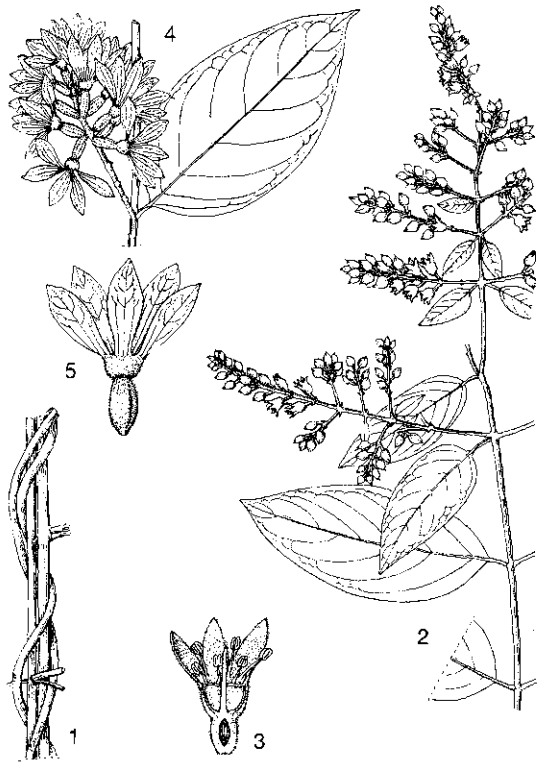
The leaves have also been used as cigarette-paper. In India, the stem is cut to get drinking water in the forest.

Properties The biflavonoids calycopterone, isocalycopterone and 4-demethylcalycopterone and the flavone 4',5-dihydroxy-3,3',6,7-tetramethoxyflavone were isolated from the flowers; the first three of these compounds showed a wide range of activity against a panel of solid human tumour cell lines. Quercetin and calycopterin have also been identified in the flowers. Calycopterin is the major flavonol in the leaves. Other flavonoids found in the leaves include neocalycopterone, neocalycopterone-4-methyl ether, calyflorenone A, calyflorenone B and quercetin.

Botany A large scandent shrub or liana, up to 10 m long; young branchlets densely fulvous-tomentellous. Leaves opposite, ovate to narrowly elliptical, 6–17 cm × 2–7 cm, entire, densely fulvous-tomentellous particularly below; petiole 0.5–1 cm long; stipules absent. Inflorescence an axillary and terminal panicle. Flowers bisexual, yellowish-green, about 1 cm long; receptacle divided into a lower and upper part; calyx with 5 accrescent lobes; petals absent; stamens 10, in 2 whorls, inserted within the upper receptacle; disk cupular; ovary inferior, 1-locular, style subulate. Fruit an ellipsoid, 5-gonous and 5-furrowed pseudocarp, c. 8 mm long, densely villous, crowned by enlarged, up to 1.5 cm long calyx-lobes, 1-seeded. Seed 5–6 mm long.

The plants often have galls, caused by thrips.

C. floribunda is the only species in the genus *Calycopteris*.



Calycopteris floribunda (Roxb.) Lamk – 1, intertwining branches; 2, flowering branch; 3, flower in longitudinal section; 4, fruiting branch; 5, fruit.

Ecology In Peninsular Malaysia, *C. floribunda* occurs in mixed forest, often along river banks. In Cambodia, it is locally common in forest edges and in regrowth after deforestation. It may have a shrubby habit, for instance inside the forest, but it may become a liana when more light is available, climbing into the trees.

Genetic resources Although *C. floribunda* occurs only very locally in the Malesian region (Peninsular Malaysia), it is widespread and locally common elsewhere in mainland South-East Asia. It does not seem to be liable to genetic erosion, the more so because it often occurs in secondary habitats.

Prospects *C. floribunda* deserves more attention in research, being a source of compounds with antitumour activity.

Literature 247, 250, 610, 976.

Other selected sources 121, 302.

R.H.M.J. Lemmens

Canscora diffusa (Vahl) R.Br. ex Roemer & Schultes

Syst. veg. 3: 301 (1818).

GENTIANACEAE

$2n = 36, 38, 60, 72, 84$

Vernacular names Philippines: chang-bato, kobamba, malingal (Tagalog).

Origin and geographic distribution *C. diffusa* has a very large area of distribution: it is widespread in tropical Africa, tropical Asia, tropical Australia and New Caledonia. In tropical Asia, it has been reported for Nepal, India, Sri Lanka, Vietnam, Laos, Thailand, Java (western part, scarce) and the Philippines (widespread), but probably it also occurs elsewhere.

Uses In the Philippines, a decoction of the whole plant is used as a tonic and antigastralgic; it is used as a substitute for tea.

C. decussata (Roxb.) Roemer & Schultes from tropical Africa, Madagascar and mainland tropical Asia (not in Malesia) is used in India as a laxative, alterative and nerve tonic; *C. diffusa* is sometimes used there as a substitute. *C. lucidissima* (H. Lév. & Vaniot) Hand.-Mazz. is used as a medicinal plant in China and Vietnam.

Properties There is only one report on the phytochemistry and pharmacological activity of *C. diffusa*. The adaptogenic glucosyloxyflavan diffutin was isolated from whole plants. However, there is more information available on *C. decussata*. Tests showed that an aqueous extract of *C. decussata* promotes the adhesion of peripheral neutrophils to human umbilical vein endothelial cells. *C. decussata* contains xanthone C-glycosides. One of these, mangiferin, showed central nervous system depressant and anti-inflammatory activities. This compound also has antifungal activity, and proved useful for the control of *Fusarium* wilt in safflower (*Carthamus tinctorius* L.). It showed some activity against *Mycobacterium tuberculosis*, but in general its antitubercular activity was low. Crude powder of *C. decussata* showed spermicidal activity in rats without any toxic side effects. A polyherbal preparation containing *C. decussata* enhanced performance in fattening pigs.

Furthermore, xanthones isolated from *C. lucidissima* showed activity against arrhythmia induced by myocardial ischaemia-reperfusion in tests with rats.

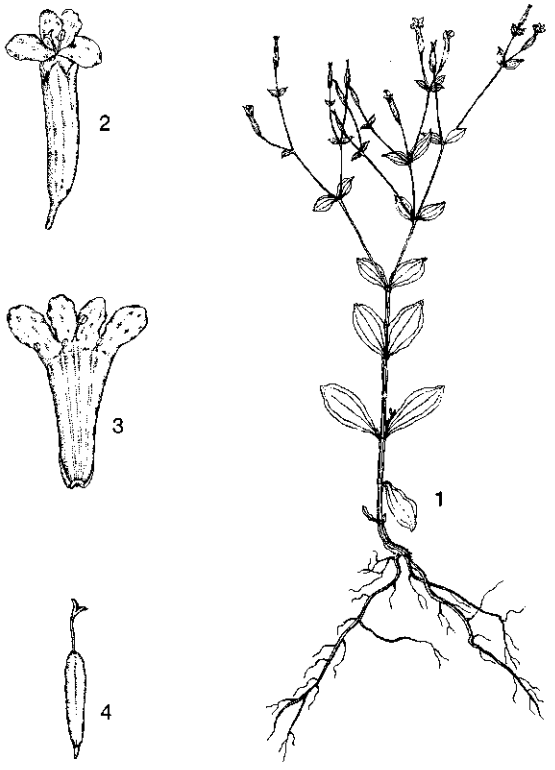
Botany An annual, erect, glabrous herb up to 80 cm tall, much branched, with quadrangular branches. Leaves opposite, simple and entire, lower ones elliptical to elliptical-oblong, c. 4 cm × 1

cm, attenuate towards the base, 3(–5)-veined, upper ones shorter and cordate. Inflorescence a terminal cyme, usually combined into thyrses, lax, many-flowered; bracts ovate. Flowers bisexual, 4-merous, up to 1.5 cm long; pedicels up to 1.5 cm long; calyx tubular, 4-ribbed, with dentate lobes; corolla with cylindrical tube, lobes shorter than tube, unequal, pinkish; stamens inserted in the tube near the throat at different levels; ovary superior, 1-celled, style filiform with bifid stigma. Fruit an oblong capsule 4–7 mm long, many-seeded. Seeds small, c. 0.2 mm in diameter, testa minutely faveolate.

C. diffusa can be found flowering throughout the year.

Canscora comprises approximately 15 species and occurs in tropical Africa, Asia and Australia. South-East Asia is richest in species, with 7 species in Thailand.

Ecology *C. diffusa* occurs on damp rocks, rocky crevices in stream beds in the forest, steep earth walls and old brick walls, up to 800 m altitude, but in the Philippines up to 1500 m.



Canscora diffusa (Vahl) R.Br. ex Roemer & Schultes – 1, habit of flowering plant; 2, flower; 3, corolla opened, showing stamens; 4, pistil.

Genetic resources *C. diffusa* is very widely distributed and does not seem to be easily endangered by genetic erosion. However, nothing is known about its genetic variability.

Prospects It might be promising to investigate whether the xanthones found in other *Canscora* species are also present in *C. diffusa* because of similar applications.

Literature 249, 278, 329, 585, 760, 842.

Other selected sources 62, 117, 274, 275, 276, 939.

R.H.M.J. Lemmens

Canthium Lamk

Encycl. Meth., Bot. 1: 602 (1785).

RUBIACEAE

x = unknown

Origin and geographic distribution *Canthium* in the broad sense is a large genus of over 200 species, which occurs in the African and Asian tropics. In Asia, *Canthium* sensu stricto is restricted to India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand and western Malesia (east to Java, Borneo and the Philippines). Several dozen species are found in Malesia.

Uses There are several records on the uses of *C. horridum* in traditional medicine in South-East Asia. Decoctions of several parts of the plant are used to treat wounds and fever, and after childbirth; the leaves are used to treat eye diseases; a decoction of the leaves and bark is used as an emmenagogue, and a decoction of bark and young twigs to treat dysentery. The fruit is edible and sometimes used to make confections. In Java the leaves are pounded in water to prepare a sweet jelly. *C. horridum* is sometimes planted in hedges. Two doubtful records on medicinal uses of *C. aciculatum* have been noted for Peninsular Malaysia. In tropical Africa many species of *Canthium* and related genera are used in traditional medicine to treat a wide array of ailments, the most important being cough, diabetes and hypertension.

The wood of some *Canthium* species that grow to timber size is used locally in house and boat building, and for flooring and implements.

Properties Biological screening of an ethanol-water (1:1) extract of *C. coromandelicum* in India showed analgesic, spasmolytic and hypotensive activities.

Botany Spiny or unarmed climbers or shrubs to small or medium-sized trees up to 25 m tall. Leaves opposite, simple and entire, short-stalked;

stipules triangular. Inflorescence axillary, cymose or umbellate, stalked, or flowers solitary. Flowers usually bisexual, sometimes unisexual, 4–5(–6)-merous; calyx with triangular lobes; corolla with a short tube and valvate lobes; stamens inserted in the throat of the corolla tube; ovary inferior, 2(–3)-celled, style with globose to cylindrical stigma. Fruit a drupe, ovoid, obovoid to globose, often strongly 2-lobed and laterally compressed; pyrenes 2(–3), plano-convex. Seedling with epigeal germination; cotyledons leafy, green.

Canthium belongs to the tribe *Vanguerieae* which is renowned for its very closely related genera with poorly defined limits. Many genera have been split off from *Canthium* in the broad sense, such as the South-East Asian genera *Meyna*, *Perakanthus* and *Psydrax* (the latter is also present in Africa, the Pacific and Australia). Many *Psydrax* specimens collected in Malesia have been named *Canthium didymum* Gaertner or *Canthium diococcum* (Gaertner) Merr. However, the true *Psydrax diococca* Gaertner (synonym: *Canthium didymum* Gaertner) occurs only in Sri Lanka and southern India. Research is needed to delimit sound genera for South-East Asia, a task that has already been accomplished for Africa. Only then will it be possible to decide whether the species treated here belong to *Canthium* sensu stricto or to one of the other genera.

C. horridum seems closely related to *C. coromandelicum* (Burm.f.) Alston (synonym: *C. parviflorum* Lamk) from India and Sri Lanka. However, the taxonomic relationships of the spiny small-leaved *Canthium* plants need further study.

Ecology In general, *Canthium* occurs scattered in lowland forest or lower montane forest. *C. horridum* is mainly found in forest edges and brushwood, *C. aciculatum* on limestone rocks.

Genetic resources As long as botanical knowledge of *Canthium* in South-East Asia is poor, it will remain difficult to establish the extent of genetic erosion for the different species. Although the exact areas of distribution are unclear, *C. horridum* seems widely spread and common, whereas *C. aciculatum* is a rare narrow endemic.

Prospects Knowledge of *Canthium* and related genera is scarce. A taxonomic revision of the genera and species for South-East Asia, therefore, is required to interpret the literature and to serve as a basis for further research. The reported medicinal uses of *C. horridum* in different parts of South-East Asia warrant studies on the phytochemistry and pharmacological properties.

Literature 2, 114, 115, 121, 671, 760.

Selection of species

Canthium aciculatum Ridley

Journ. Roy. As. Soc. Straits Br. 57: 57 (1910).

Vernacular names Malaysia: melor hutan, akar serumat, bulang pelandok.

Distribution Peninsular Malaysia (Lenggong, Perak).

Uses A decoction of the leaves is said to be used to allay hiccough in children, and a decoction of the roots to treat stomach-ache. However, it is doubtful whether these records refer to *C. aciculatum*.

Observations A slender, branched, spiny shrub; leaves ovate to lanceolate, usually longer than 3 cm, with a narrowly tapering tip, 5–6 pairs of secondary veins and rather conspicuous tertiary venation; flowers in 2–3-flowered cymes; fruit c. 0.5 cm long. *C. aciculatum* is rare and has been found on limestone rocks.

Selected sources 121, 789, 990.

Canthium horridum Blume

Catalogus: 45 (1823).

Synonyms *Plectronia horrida* (Blume) Benth. & Hook.f. ex Kurz (1877), *Canthium parviflorum* auct. non Lamk.

Vernacular names Indonesia: kaliyage (Sundanese), bestru (Javanese), selungkit (Jakarta). Malaysia: bulangan, bulang, kait-kait (Peninsular). Philippines: kuliak-daga (Tagalog), mimisan (Iloko), dayap-dayap (Bikol). Thailand: khlet nuu (Yala, Pattani), naam leprok (peninsular). Vietnam: g[aw]ng v[af]ng gai, g[aw]ng gai, g[aw]ng c[ow]m.

Distribution Indo-China, Thailand, Peninsular Malaysia, Singapore, Java, Borneo and the Philippines.

Uses In Peninsular Malaysia, decoctions of several parts of the plant are used to treat wounds and fever, and after childbirth. The leaves are pounded in water and applied to treat eye diseases in Indonesia. In the Philippines, a decoction of the leaves and bark is used as an emmenagogue. In Indo-China, a decoction of bark and young twigs is administered to treat dysentery. The fruits are edible and sometimes used to make confections. In Java the leaves are pounded in water to prepare a sweet jelly. *C. horridum* is sometimes planted in hedges.

Observations A scrambling or erect, spiny shrub or shrub-like tree up to 6 m tall; leaves ovate to elliptical, usually less than 3 cm long, without a prolonged tip, with 3–4 pairs of secondary veins and obscure tertiary venation; flow-

ers clustered, 2–4(–8) together; fruit 1–1.5 cm long, yellow when ripe. *C. horridum* is common in lowland forest, particularly in forest edges, and brushwood, in Java up to 1200 m altitude.

Selected sources 62, 121, 334, 671, 760, 789, 990.

Fitmawati

Carallia suffruticosa Ridley

Journ. Roy. As. Soc. Straits Br. 61: 6 (1912).
RHIZOPHORACEAE
$2n$ = unknown

Synonyms *Carallia fascicularis* Guill. (1914).

Vernacular names Malaysia: sisek puyu, meransi, redip pepuyoh (Peninsular). Vietnam: s[aw]ng m[ar], r[aw]ng c[uw]a.

Origin and geographic distribution *C. suffruticosa* occurs in southern Vietnam and Peninsular Malaysia (Perak, Terengganu, Selangor).

Uses In Peninsular Malaysia, an infusion of *C. suffruticosa* leaves is used internally against worms and cough, and after childbirth, whereas a decoction of the leaves is employed in a bath to treat fever. Pulped leaves are applied externally to boils. In Vietnam, the wood is used as fuel.
C. brachiata (Lour.) Merr. is also used in local medicine, e.g. the bark to treat itch, but it is mainly valued for its timber and fuelwood.

Properties There is no information on phytochemistry and properties of *C. suffruticosa*, but alkaloids, mainly (+)-hygrolin, have been identified in *C. brachiata* leaves.

Botany A shrub up to 3 m tall. Leaves decussately opposite, simple, elliptical-oblong, 10–18 cm × 3–6.5 cm, cuneate or sometimes rounded at base, acuminate at apex, distinctly fimbriate-dentate at margins, with 8–13 pairs of secondary veins, black-dotted beneath; petiole 1–1.5 cm long; stipules lanceolate, up to 1 cm long. Inflorescence an axillary cyme up to 1.5 cm long, with peduncle up to 0.5 cm long. Flowers bisexual, regular, whitish or reddish, with persistent bracteoles at base; calyx 5–7-lobed, with lanceolate lobes 3–4 mm long; petals 5–8, free, sagittate, unguiculate, c. 4 mm long; stamens twice the number of petals, free, 3–4 mm long, the ones opposite the petals longer; ovary inferior, 1-celled, style filiform, c. 4.5 mm long, stigma discoid. Fruit an ellipsoid berry c. 1.5 cm long, dark red, crowned by the remains of the floral parts, 1-seeded. Seed oblong, slightly curved, c. 1 cm long, brown.
Carallia comprises about 15 species, and occurs in Madagascar, India, Sri Lanka and throughout South-East Asia to the Solomon Islands and northern Australia.

Ecology *C. suffruticosa* occurs in lowland forest.

Genetic resources *C. suffruticosa* has a limited area of distribution and is rare in Peninsular Malaysia. It may well be liable to genetic erosion, or even extinction.

Prospects The uses of *C. suffruticosa* are limited and it is an uncommon species. Therefore, it seems very unlikely that its utilization will increase.

Literature 121, 247.

Other selected sources 250, 331, 883, 990.

Marfu'ah Wardani

Catunaregam Wolf

Gen. pl.: 75 (1776).
RUBIACEAE
$x = 11$; *C. spinosa*: $2n = 22, 44$

Origin and geographic distribution *Catunaregam* comprises approximately 8 species and occurs in tropical Africa and Asia. About 4 species are found in South-East Asia, which have a very limited distribution in Malesia (Peninsular Malaysia, Java).

Uses In India and Indo-China, *Catunaregam* fruits are used externally to treat ulcers and sores, and the bark is used internally against diarrhoea and dysentery and to regulate menses. The plants are also used in traditional medicine to treat bronchitis, asthma, leucoderma and diseases of the brain. In Indo-China, the leaves of *C. tomentosa* are considered to be cooling and diuretic and are prescribed against oliguria and dysuria. In Africa, *C. spinosa* is much used as a medicinal plant to treat melanomas, fever, nausea, coughs, toothache, dizziness, menorrhagia, depressed fontanelle, snake bites, gonorrhoea and as a sedative. The fruits are used as a substitute for soap. Bark and fruits are used as a fish poison. The plants are often planted in fences. The wood is used as fuelwood, and sometimes also to make small implements, e.g. combs.

Properties The fruits of *C. spinosa* are emetic. Fruit and root extracts have insecticidal and insect-repelling properties. Several triterpenes (e.g. α-amyrin, β-amyrin, oleanolic acid and 1-keto-3α-hydroxy-oleanane from the root bark), sterols (e.g. β-sitosterol from the root bark) and triterpene saponins (from the fruits and leaves) have been

reported for *C. spinosa*. Other isolated compounds include coumarins (e.g. scopoletin, scopolin and xeroboside from African plants), iridoids (e.g. the glucoside 10-methylixoside from the leaves and bark) and an aliphatic diol, randiol, from the bark. Extracts of *C. spinosa* fruit pulp prevented pregnancy in 67% of treated rats and significantly reduced implantation sites when compared with a control group. The triterpene diglucoside saponin randianin isolated from the methanolic extract of *C. spinosa* fruits haemolyzed human red blood cells. Several other saponins have been isolated from methanolic extracts of the fruits, and several of these significantly enhanced the proliferation of human lymphocytes in vitro, whereas the crude saponin fraction showed haemolytic and immunostimulating activities. Sun-dried and powdered unripe fruits of *C. spinosa* killed fish in 45–180 minutes at a concentration of 15 ppm; residual toxicity in treated water persisted for about 72 hours. Triterpenoidal glycosides isolated from the leaves and fruits showed molluscicidal activity against *Biomphalaria glabrata*, which is a schistosomiasis vector.

An extract of the African *C. nilotica* (Stapf) Tirveng. showed strong larvicidal activity against mosquitoes. Molluscicidal saponins are also present in this species and these also have haemolytic activity.

Botany Spiny shrubs or small trees up to 10 m tall; spines opposite or alternate. Leaves mostly clustered on short axillary branchlets, opposite, simple and entire; stipules interpetiolar, ovate or triangular. Inflorescence a terminal simple or branched cyme, sometimes flowers solitary or fascicled. Flowers bisexual, 5–10-merous, pedicellate; calyx with distinct tube and short lobes; corolla gamopetalous, subrotate, tube shorter than lobes, densely pubescent outside and with a band of hairs inside; stamens inserted in throat of corolla tube, anthers sessile, usually exserted; ovary inferior, 2(–3)-locular, style as long as corolla tube or exserted, stigma ellipsoid or cylindrical. Fruit berry-like, ellipsoid to globose, many-seeded. Seeds discoid or compressed-ellipsoid, embedded in pulp, with reticulation on testa.

In older literature, species now included in *Catunaregam* were considered to belong in the large genus *Randia*. However, *Randia* has been split up into numerous smaller genera.

Ecology *Catunaregam* occurs in dry, open lowland locations, also in recently burned savanna and in dry, open forest, sometimes also on the beach.

Genetic resources In Malesia, *Catunaregam* is uncommon or even rare, but this seems the result of its preference for drier climatic conditions. In mainland South-East Asia, species are common and widely distributed, and are not in need of protection.

Prospects Interesting pharmacological properties have been demonstrated in *Catunaregam*, such as haemolytic and immunostimulating activities. The insecticidal, molluscicidal and piscicidal properties also deserve more attention, in the search for effective plant-based pesticides which are easily biodegradable. *Catunaregam* species may be promising for planting as multi-purpose plants in regions in South-East Asia with dry climatic conditions.

Literature 224, 671, 852.

Selection of species

Catunaregam spinosa (Thunberg) Tirveng.

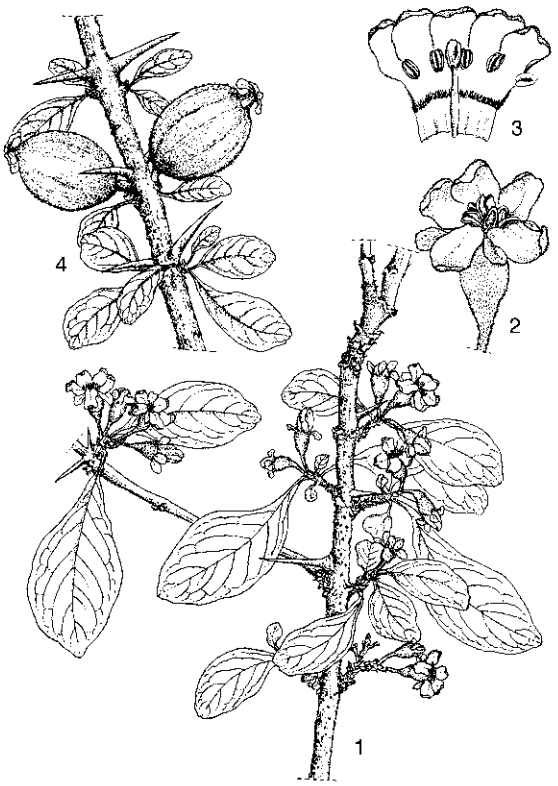
Bull. Mus. Nation. Hist. Nat., 3e sér., no. 521, Bot. 35: 13 (1978).

Synonyms *Randia dumetorum* (Retz.) Poir. (1811), *Randia spinosa* (Thunberg) Blume (1826), *Xeromphis spinosa* (Thunberg) Keay (1958).

Vernacular names Laos: may ngieng pa. Thailand: khet khaang (Chanthaburi), khlet (Ratchaburi), ma khwet (northern). Vietnam: g[aw]ng tu h[us], g[aw]ng tr[aa]u.

Distribution Eastern and southern Africa, Nepal, India, Sri Lanka, Indo-China, Thailand and Java (rare).

Uses In Indo-China, powdered and roasted fruits (without seeds) are used externally to treat ulcers, and the bark is used internally against diarrhoea and dysentery and to regulate menses. In India, the bark is used to treat diarrhoea and dysentery; the plant is also used there in traditional medicine to treat bronchitis, asthma, leucoderma and diseases of the brain, and the fruit pulp for poulticing sores. In Africa, *C. spinosa* is a much used medicinal plant. A decoction of the powdered root is applied directly on melanomas, and the infusion is administered orally as an emetic and to relieve fever, nausea, general coughs, toothache, pains during pregnancy, dizziness, menorrhagia, depressed fontanelle, snakebites and gonorrhoea. The fruits are used as a substitute for soap. Bark and fruits are used in India, Nepal and Africa as a fish poison. In Indo-China, it is often planted in fences, whereas the



Catunaregam spinosa (Thunberg) Tirveng. – 1, flowering branch; 2, flower; 3, opened corolla with stamens, style and stigma; 4, fruiting branch.

wood is commonly used in India as fuelwood.

Observations A spiny, much-branched large shrub or small tree up to 7.5 m tall; leaves glabrous or pubescent on veins only; flowers 5(–8)-merous, white becoming yellowish; fruit ellipsoid to globose, 2–3.5 cm long, yellowish. *C. spinosa* occurs on dry, bare soils, also on the beach.

Selected sources 62, 121, 224, 650, 665, 671, 810, 822, 823, 852, 884.

Catunaregam tomentosa (Blume ex DC.) Tirveng.

Taxon 27(5/6): 515 (1979).

Synonyms *Randia tomentosa* (Blume ex DC.) Hook.f. (1880) non Wight & Arnott, *Randia dasycarpa* (Kurz) Bakh.f. (1965), *Xeromphis tomentosa* (Blume ex DC.) Yamazaki (1970).

Vernacular names Cambodia: lovieng. Thailand: ka thaeng (general), khet (Chiang Mai), khlet (central, Kanchanaburi). Vietnam: g[aw]ng, g[aw]ng b[oj]t, g[aw]ng tr[aws]ng.

Distribution Burma (Myanmar), Indo-China, Thailand, northern Peninsular Malaysia and Java (rare).

Uses In Indo-China, the leaves are considered cooling and diuretic and are prescribed against oliguria and dysuria. The fruits are used in Cambodia for washing the hair and clothes, undoubtedly because of the presence of saponins. The wood is used to make combs, and the plant is often planted in fences.

Observations A spiny large shrub or small tree up to 10 m tall; leaves densely ferruginous-tomentose beneath; flowers 8–10-merous, white; fruit globose, 2.5–4 cm in diameter, velvety brown. *C. tomentosa* occurs on dry, bare soils, also in burned savannas.

Selected sources 62, 121, 671.

R.H.M.J. Lemmens

Cecropia peltata L.

Syst. nat. ed. 10, 2: 1286 (1759).

CECROPIACEAE

$2n = 28$

Synonyms *Cecropia surinamensis* Miq. (1853).

Vernacular names Trumpet tree (En). Indonesia: pohon daun payung (general).

Origin and geographic distribution *C. peltata* is native to Central and South America, where it occurs from southern Mexico to Colombia, Guyana, Suriname, northern Brazil and Venezuela. It has been introduced in West and Central Africa, where it has naturalized and spread in some areas, e.g. in Cameroon and Côte d'Ivoire. It was also introduced into the botanical gardens of Singapore (1902) and Bogor (Indonesia), and has since become naturalized and is expanding in western Java and Peninsular Malaysia.

Uses The sap and leaves of *C. peltata* are used extensively in traditional medicine in tropical America. Sometimes bark, roots and fruits are also applied. The acrid, bitter and astringent sap is applied externally to treat snakebites, scorpion stings, ulcers, warts and other skin affections. Fresh or dried leaves are traded on the market, and used in decoctions, infusions or as a tincture to treat asthma, bronchitis, coughs, diabetes, diarrhoea, dysentery, fever, influenza, gonorrhoea, oedema, liver complaints, hypertension, Parkinson's disease, nervous disorders, toothache, sore throat, as a cardiac tonic and diuretic, and to expel the placenta after childbirth. The use of leaves in an infusion to treat asthma and rheumatism has been much advocated.

The wood is sometimes used, e.g. for the manufacture of local musical instruments, insulation board, boxes, crates, matchsticks and paper pulp. The infructescence is edible. Young buds are eaten as a cooked vegetable. The ripe fruit is edible.
Other *Cecropia* species are also used in traditional medicine in tropical America for similar purposes, e.g. C. *obtusifolia* Bertol., the leaves of which serve to treat diabetes and as an anti-inflammatory agent.

Properties Proanthocyanidins and leucocyanidins have been found in *C. peltata*, but flavonols, flavones, ellagic acid, saponins and sapogenins seem to be absent. Extracts of *C. peltata* showed cytotoxic, antibacterial and antifungal activities. Tests with rats showed that an aqueous leaf extract of *C. obtusifolia* from Central America has a slight diuretic effect and distinct antihypertensive activity, and that this species has an evident hypoglycaemic action. A 95% ethanol extract exhibited spasmogenic activity on guinea-pig ileum at a concentration of 0.33 ml/l. A leaf extract of *C. obtusifolia* showed substantial central nervous system depressant, analgesic and muscle relaxant activities in different experimental models.
The wood is very light (specific gravity 0.29–0.35), and is not durable; it is susceptible to termite attack, and is very perishable when in contact with the soil. A satisfactory quality of unbleached pulp can be obtained from the wood.

Botany A small to medium-sized dioecious tree up to 15(–20) m tall, often with prop or stilt roots; stem internodes hollow; watery sap turning blackish after exposure to the air present in terminal branchlets. Leaves arranged spirally, clustered at apices of branches, peltate, umbrella-shaped, 30–50(–90) cm in diameter, radially incised to at least halfway along the blade, with 7–10(–11) ovate, acuminate lobes; petiole long, with 1–2 patches of dense hairs at the base; stipules large, amplexicaul, connate. Inflorescence a pedunculate spike clustered digitately, initially enveloped by a closed spathe. Flowers with tubular perianth; male flowers with 2 stamens; female flowers with a superior, 1-celled ovary. Fruit achene-like, small, 1-seeded. Seed c. 2 mm long, brownish, with endosperm, cotyledons flat. Seedling with epigeal germination, first leaves lanceolate, unlobed and finely toothed.
Seedlings show rapid growth; they may grow to over 2 m in height in one year, occasionally up to 4 m on fertile soils in western Java. Growth in height remains rapid for 4–5 years (up to 2 m/year), but diameter growth is little during this period. Trees reach maximum height after about 10 years, and may survive for another 20 years. Trees in plantations reached an average height of 14 m and 25 cm in diameter after 21 years. They may produce flowers and fruits 3–6 years after germination, but this strongly depends on light conditions. They can be found flowering throughout the year, but peak flowering often occurs during the dry season. The flowers are probably wind-pollinated. Fruits take about 4 months to ripen after emergence of the inflorescence. The seeds are dispersed by animals, usually bats and birds, but they are also water-dispersed. In tropical America, many *Cecropia* species, including *C. peltata*, are associated with ants of the genus *Azteca*. These aggressive ants inhabit the hollow stems, and glycogen-containing food bodies are present in the pads of hairs at the bases of petioles.
Cecropia comprises about 65 species and occurs from Mexico through Central America, the West Indies and South America to Paraguay and Argentina. The major concentration of species is in the northern Andes. Few species have been introduced in other regions, of which *C. peltata* is the most important one. *Cecropia* has been classified in *Moraceae* or *Urticaceae*, but is now usually placed in the separate family *Cecropiaceae*, together with 2 other Neotropical genera, the African *Musanga* and *Myrianthus* and the Asian-Australian *Poikilospermum*.

Ecology Many *Cecropia* species are characteristic of early secondary regrowth in the forest, and are valuable in the regeneration of forest following disturbance. They are typically pioneer species growing in forest gaps, roadsides, landslides and plantations. *C. peltata* grows naturally under these conditions up to 1300 m altitude. In western Java, it grows at altitudes up to 1600 m, e.g. in graveyards and gullies. It prefers clayey or loamy soils. In Cameroon and Côte d'Ivoire (Africa) *C. peltata* has spread extensively as a pioneer species, replacing the indigenous *Musanga cecropioides* R.Br. ex Tedlie.

Management There are about 2500 air-dried seeds per gram. Seeds require full sunlight for successful germination. In the nursery, seeds are usually germinated under light shade on a seedbed prepared from equal amounts of clay, sand and filter presscake. Under full light conditions the germination rate of seeds may be 90%. Seeds remain viable for 2–3 months on the forest floor, but for over 6 months when stored under optimal laboratory conditions.
Under natural conditions, seedling mortality may

be extremely high (99% within the first year). In nursery experiments, seedlings showed 45% mortality during the first 9 months; seedlings planted out in the field when 25–60 cm tall showed a survival rate of up to 80%.

Genetic resources In its natural area of distribution, *C. peltata* shows some variation in morphology and in the presence or absence of a symbiotic relation with ants. As a pioneer species with a fairly large area of distribution, it is not under pressure. It seems even capable of expanding rapidly after introduction, particularly in Africa.

Prospects *C. peltata* is interesting for its medicinal properties, and also for other uses (e.g. for pulp production). However, the prospects for South-East Asia are unclear because it has only recently obtained a foothold there. It is certainly capable of growing in this region, but the experiences in tropical Africa where it seems to supersede indigenous species, at least locally, should be a warning against introducing it unconditionally.

Literature 122, 431, 646.

Other selected sources 121, 459, 730.

J.W. Hildebrand

Ceriscoides curranii (Merr.) Tirveng.

Nordic Journ. Bot. 3(4): 456 (1983).

RUBIACEAE

$2n$ = unknown

Synonyms *Randia aculeata* Blanco (1837) non L., *Gardenia curranii* Merr. (1918).

Vernacular names Philippines: malarayap, malasampaga, sinasampaga (Tagalog).

Origin and geographic distribution *C. curranii* is endemic to Luzon in the Philippines.

Uses The fruit may serve as an effective fish poison in the Philippines.

Properties The ichthyotoxic activity of the fruits is probably due to the presence of saponins, comparable to the more or less related *Catunaregam spinosa* (Thunberg) Tirveng.

Botany A small dioecious tree of c. 4 m tall, with straight stem, young branches with numerous paired thorns. Leaves opposite or fasciculate at tips of short shoots, simple and entire, lanceolate, glabrous, obtuse at apex, sessile; stipules triangular, deciduous. Flowers terminal on short shoots, unisexual, 5(–6)-merous, fragrant, female ones solitary or in pairs; calyx toothed; corolla gamopetalous, tube inflated in the middle, lobes large, twisted; stamens inserted on the corolla tube; ovary inferior, 1-celled, style with bifid stigma. Fruit indehiscent, many-seeded. Seeds small. *Ceriscoides* is a small genus of 6 species: 4 in mainland South-East Asia, 1 in Java and 1 in the Philippines. It seems most closely related to *Gardenia*, which also has a 1-celled ovary but differs particularly in its unarmed habit and larger, bisexual flowers. *Catunaregam* is similarly thorned but differs in its 2-celled ovary.

Ecology *C. curranii* is an uncommon component of thickets and forest at low altitude.

Genetic resources *C. curranii* has a very limited distribution in the Philippines and is apparently uncommon there. It would therefore seem liable to genetic erosion or even extinction.

Prospects Extremely little is known about *C. curranii*, not only its chemistry and properties, but also its botany, exact distribution and affinity.

Literature 121, 621.

Other selected sources 930, 931.

R.H.M.J. Lemmens

Cestrum nocturnum L.

Sp. pl. 1: 191 (1753).

SOLANACEAE

$2n$ = 16

Vernacular names Night blooming cestrum, night blooming jessamine (En). Philippines: dama de noche (Sp, Tagalog). Thailand: raatree. Vietnam: d[aj] l[ys] h[uw][ow]ng.

Origin and geographic distribution *C. nocturnum* probably originates from Central America, and is widely cultivated and locally naturalized throughout the tropics. It is cultivated throughout South-East Asia.

Uses *C. nocturnum* has been introduced in South-East Asia as an ornamental for its sweet-scented flowers, which bloom at night. In Central America and the Caribbean a leaf decoction is used as a lotion on skin eruptions. In former times a fruit extract was taken orally as a sedative in cases of epilepsy, chorea and hysteria, the treatment being gradually reduced and terminated within a short time. In Thailand the leaves are considered toxic to humans, but they may be used in small doses to treat epilepsy. The leaves are used in Chinese folk medicine as an external application for burns and swellings.

Properties All parts of *C. nocturnum* are rich in saponins, yielding some 4–5%. The leaves yield flavonol glycosides and numerous steroidal saponins (e.g. nocturnoside A, tigogenin, smilagenin and yuccagenin). Some of these saponins show

considerable cytotoxic activity against human squamous cell carcinoma (HSC-2) cells with LD_{50} values ranging from 2.0 µg/ml to 13 µg/ml, sometimes being 5–10 times more active than against normal human gingival fibroblasts. The saponin fraction showed cardiovascular effects and may act as a respiratory stimulant. Older reports mention cardiotonic and cardiotoxic properties for a saponin isolated from *C. nocturnum*.

Fresh powdered leaves of *C. nocturnum* show promising control against the beetles *Sitophilus oryzae* (rice weevil) and *Trogoderma granarium*, two common pests in stored grain. Phenylacetylaldehyde, one of three principal volatile compounds emitted from the flowers, strongly attracts the females of the cabbage looper moth (*Trichoplusia ni*).

Toxicity reports of *C. nocturnum* in livestock in southern Africa mention dullness, tachycardia, rising temperature, suppression of urine and decrease in respiratory rate as symptoms. Death occurs with coma and slight convulsions. Toxicity of *Cestrum* for livestock involves several systems. One system mimics vitamin D attributes and influences calcium uptake, leading to a condition called calcinosis. An example of this system is found in *C. diurnum* L., originating from the Caribbean and occasionally cultivated in South-East Asia. Another system involves liver poisoning and explains the frequent records of hepatotoxic compounds in *C. laevigatum* Schlechtendal and *C. parqui* L'Hérit.

A methanol-water (1:1) extract of *C. parqui* aerial parts showed inhibition of carrageenin-induced oedema in rats. The aggregation of human blood platelets induced by adenosine diphosphate and platelet activating factor was also inhibited with an IC_{50} of 3 mg/ml and 2 mg/ml, respectively. The extract did not however inhibit arachidonic acid-mediated platelet aggregation.

Botany An evergreen shrub up to 4 m tall; branches erect or drooping, angular, olive or bluish-green, lenticellate, glabrescent. Leaves alternate, simple and entire, narrowly ovate to ovate, (4–)8–13 cm × (1.5)2–4.5(–6) cm, base obtuse or narrowly cuneate, apex acute, membranous to coriaceous; petiole 1–2 cm long; stipules absent. Inflorescence an axillary or terminal cyme 3–8 cm long, often combined in a large leafy panicle. Flowers bisexual, regular, fragrant, yellow or greenish-white, pedicellate; bracteoles 2, one leafy, the other linear; calyx cupular, 2–4.5 mm long, 5–6-toothed; corolla tube 20–30 mm long, gradually expanding upward, 5-lobed, lobes 2–5 mm long; stamens included, filaments adnate to the corolla tube, upper part free, with 2 teeth at base of free part; ovary superior, 2-celled, style exserted. Fruit a globose berry 0.5–1 cm in diameter, whitish, 1–3-seeded. Seeds ovoid, 2.5–6 mm long, black.

C. nocturnum can be found flowering and fruiting throughout the year, intermittently profusely flowering.

Cestrum consists of some 150 species, and is indigenous from the southern United States to Chile. Numerous species are cultivated throughout the world for their ornamental value, in South-East Asia e.g. *C. laevigatum*, *C. nocturnum* and *C. parqui*.

Ecology In South-East Asia *C. nocturnum* is cultivated and locally naturalized from sea-level up to 1600 m altitude.

Management *C. nocturnum* can be easily propagated by semi-hardwood cuttings.

Genetic resources *C. nocturnum* is cultivated throughout the tropics and does not appear to be threatened by genetic erosion.

Prospects Recently, steroidal saponins as found in *C. nocturnum* have received scientific attention because of their structural diversity and significant biological activity. The application of powdered leaves to control insect pests in stored grain deserves more attention.

Literature 80, 138, 306, 626, 646, 844.

Other selected sources 15, 62, 330, 760.

Slamet Sutanti Budi Rahayu

Chionachne macrophylla (Benth.) W.D. Clayton

Kew Bull. 35(4): 814 (1981).

GRAMINEAE

$2n = 40$

Synonyms *Polytoca macrophylla* Benth. (1881).

Vernacular names Indonesia: kumkum (Ternate). Papua New Guinea: chaska (New Britain).

Origin and geographic distribution *C. macrophylla* occurs in the Moluccas, New Guinea, the Bismarck Archipelago and the Louisiade Archipelago. It has been experimentally planted as a forage elsewhere, e.g. in Java.

Uses In New Britain (Papua New Guinea) the juice from *C. macrophylla* is drunk to treat cough. It is a useful forage with fair nutritional value.

Botany A large perennial herb up to 250 cm tall; culms erect or slanting, compressed, often branched. Leaves alternate, lanceolate to linear-

lanceolate, 20–80 cm × 2.5–6 cm, narrowed at base and acuminate at apex, scabrous at margins, glabrous, with broad, pale midrib; sheath with long, sharp, white, easily caducous hairs along the margin and in central part, ligule short, truncate. Inflorescence an axillary many-jointed spike-like raceme up to 20 cm long, usually gathered into a compound panicle. Spikelets in alternate pairs, in each pair 1 pedicelled and 1 sessile, sessile spikelets male or female, pedicelled spikelets male, sterile or rudimentary, all spikelets 1–1.5 cm long; male spikelets 2-flowered, female spikelets 1-flowered, in lower part of raceme; glumes many-veined, lemma slightly shorter, 3-veined, awnless, palea about equally long as lemma, 2-veined; male flowers with 2 lodicules and 3 stamens with linear anthers; female flowers with long styles shortly connate at base, stigmas long. Fruit an ovoid, dorsally compressed caryopsis c. 3.5 mm long, with a broad rounded-emarginate base.

Female spikelets have a white elaiosome at the base. Dispersal of the spikelet is by ants, which are attracted by the elaiosome.

Chionachne comprises about 7 species and occurs from India, throughout South-East Asia to Australia and Polynesia. It belongs to the tribe *Andropogoneae*, subtribe *Chionachninae*. It is traditionally included in the tribe *Maydeae*, together with e.g. *Zea mays* L. (maize), but this is a heterogenous group.

Ecology *C. macrophylla* occurs at forest margins and on stream sides.

Genetic resources There is no reason to consider *C. macrophylla* threatened.

Prospects It is unlikely that the medicinal uses of *C. macrophylla*, which are of little importance to date, will increase. Perhaps it has prospects as a forage.

Literature 334, 347.

Other selected sources 62.

R.H.M.J. Lemmens

Chroesthes longifolia (Wight) B. Hansen

Nord. Journ. Bot. 3(2): 210 (1983).

ACANTHACEAE

$2n$ = unknown

Synonyms *Lepidagathis longifolia* Wight (1850).

Vernacular names Malaysia: penluroh, serga (Peninsular).

Origin and geographic distribution *C. longifolia* is endemic to Peninsular Malaysia, but may also occur in Burma (Myanmar).

Uses In Peninsular Malaysia, a decoction of the roots is drunk to induce abortion during the first three months of pregnancy.

Properties Oral administration of an aqueous root extract (500–550 mg/kg body weight) for 10 days postcoitum to female rats significantly reduced the litter size. This antifertility effect seems consistent with the alleged use as an abortifacient.

Botany A shrub up to 2.5 m tall; branches terete and glabrous. Leaves opposite, simple and entire, lanceolate, 16–23 cm × 3.5–5 cm, attenuate at base, acuminate at apex, glabrous; petiole 0.5–2 cm long; stipules absent. Inflorescence a terminal panicle, up to 25 cm long, bracteate, with secund flowers, one bract at each node sterile, the other subtending 1 flower. Flowers bisexual, 5-merous; calyx up to 1.7 cm long, with unequal lobes connate at base, the posterior one largest, glandular-pubescent; corolla c. 2 cm long, tube inflated, 2-lipped, upper lip shortly emarginate, lower lip deeply trifid, glandular-pubescent outside, dark purple; stamens 4, didynamous, inserted at the base of the inflated part of the corolla, anthers basally spurred; ovary superior, 2-celled, glabrous, style pubescent below. Fruit unknown.

Although *C. longifolia* has been recorded as common and numerous collections exist in herbaria, fruits have never been encountered.

Chroesthes comprises 3 species, and occurs in Burma (Myanmar), Indo-China, southern China, Thailand and Peninsular Malaysia. It belongs to the tribe *Lepidagathideae*, and is related to *Lepidagathis*, which differs in muticous anthers (bicalcarate in *Chroesthes*), smaller capsules and longer-pubescent seeds. The inclusion of *C. longifolia* in *Chroesthes* is somewhat doubtful, as the fruits are unknown.

Ecology *C. longifolia* has been recorded as common in forest in Peninsular Malaysia.

Genetic resources There is no reason to consider *C. longifolia* as threatened: it is common in Peninsular Malaysia. However, the limited area of distribution may be reason for some caution, and the apparent absence of fruits could be a research topic.

Prospects It has been claimed that the traditional use of *C. longifolia* as an abortifacient may be derived from the fact that this plant is never found with fruits and that it is probably in fact quite ineffective. However, the test on the fertility

of rats showed the efficacy of this traditional medicine. More research is desirable.

Literature 121, 912.

Other selected sources 310, 789.

R.H.M.J. Lemmens

Chydenanthus excelsus (Blume) Miers

Trans. Linn. Soc. London 2(1): 112 (1875).

LECYTHIDACEAE

$2n$ = unknown

Synonyms *Stravadium excelsus* (Blume) DC. (1828), *Barringtonia vriesei* Teijsm. & Binnend. (1851), *Doxoma vriesei* (Teijsm. & Binnend.) Miers (1875).

Vernacular names Indonesia: besole (Javanese, Sundanese), emprak (Javanese), puyung-puyung (Balinese).

Origin and geographic distribution *C. excelsus* occurs in the Andaman and Nicobar Islands, Burma (Myanmar), Sumatra, Java, southern Borneo, the Lesser Sunda Islands, Sulawesi, the Moluccas and western New Guinea.

Uses In Java the seeds of *C. excelsus* are used as a fish poison, and occasionally as an antidiarrhoeal and emetic in cases of difficult breathing. The wood is strong but not very durable and of little economic value.

Properties *C. excelsus* seeds contain a saponin-like substance called chydenantine, and the wood contains ellagic acid and derivatives. The pounded bark is very poisonous and ingestion may result in stupor and death.

Botany An evergreen, medium-sized tree up to 30 m tall; bole fluted, up to 50 cm in diameter, bark surface smooth, greyish-brown. Leaves alternate, simple, elliptical to elliptical-oblong, rarely obovate, (4–)7–26(–30) cm × (1.2–)3–8(–12) cm, base cuneate, apex acuminate, entire or faintly serrulate, glabrous, with numerous lateral veins; petiole 1–2 cm long; stipules minute, subulate or reduced to dots, caducous. Inflorescence a terminal or axillary, stout panicle up to 18(–30) cm long, velutinous, many-flowered. Flowers bisexual, 4-merous, greenish-white; pedicel articulate, thick, 0.5–1 cm long, with 2 bracteoles; calyx cup-shaped, obtusely lobed, up to 2 cm long; petals free but connate to the staminal tube, obovate, c. 3 cm × 1.5 cm; stamens numerous, connate at base, up to 4.5 cm long, yellow; disk intrastaminal, circular; ovary inferior, 2-celled, style slender. Fruit a 1-seeded berry, ellipsoid or obovoid, bluntly quadrangular, c. 12 cm × 6 cm, lenticellate or warty, puberulous, crowned by the persistent calyx. Seedling with hypogeal germination; cotyledons absent (seed containing a swollen hypocotyl); stem with scales at the first few nodes.

C. excelsus can be found flowering and fruiting throughout the year. Flowers open at night and drop early in the morning. *Chydenanthus* comprises only a single species.

Ecology *C. excelsus* occurs in primary and secondary forest as well as teak plantations on various soils including limestone and peat swamp, from sea-level up to 600 m altitude. In dry areas it grows on moist soils in valleys or along rivers.

Genetic resources *C. excelsus* is widespread, occurring in both primary and secondary forest on a wide range of soils and is not threatened by genetic erosion.

Prospects Pharmacological research is needed to evaluate the potential of the traditional medicinal uses of *C. excelsus*.

Literature 334, 450, 953.

Other selected sources 62, 331.

J.L.C.H. van Valkenburg

Cleidion spiciflorum (Burm.f.) Merr.

Interpr. Herb. amboin.: 322 (1917).

EUPHORBIACEAE

2n = unknown

Synonyms *Cleidion javanicum* Blume (1826).

Vernacular names Philippines: saligao (Tagalog, Iloko), hantatampsi (Cebu Bisaya), malatuba (Bikol). Thailand: madeemee (northern), kamlai (Surat Thani), kaadaao krachaai (Prachuap Khiri Khan). Vietnam: m[or] chim, c[ow]m g[af]o.

Origin and geographic distribution *C. spiciflorum* is very widely distributed, from India, Sri Lanka and the Andaman Islands, through Burma (Myanmar), Indo-China, southern China, Thailand and the whole Malesian region (but not yet reported for the Moluccas), to the Solomon Islands, the Bismarck Archipelago and northern Australia (Queensland).

Uses In the Philippines, a decoction of *C. spiciflorum* bark is taken internally as a stomachic, and a decoction of the leaves has been used to induce abortion. The seeds are effective in treating constipation. In traditional medicine in the Solomon Islands, a decoction of the bark is used to bathe babies suffering from scabies, and the seeds are chewed with betel nut (*Areca catechu* L.) to relieve colds. However, some caution is needed as the plant is said to be poisonous. The tree has

several mystical uses in the Solomon Islands. It is sometimes cultivated as a shade tree in New Guinea and the Solomon Islands. The wood is occasionally used, e.g. for stakes to cultivate yams (*Dioscorea*) in the Solomon Islands, or as firewood.

Properties There is no information on the phytochemistry or pharmacological properties of *C. spiciflorum*. The wood is greyish-white and soft.

Botany A dioecious, small to medium-sized tree up to 28 m tall, bole up to 40 cm in diameter, lacking buttresses; branches glabrous. Leaves arranged spirally, simple, elliptical to lanceolate-elliptical, (5.5–)10–21 cm × (2.5–)4–8.5 cm, acute or obtuse at base, acuminate or obtuse at apex, crenate to serrate-dentate or sometimes subentire at margins, glabrous but with scattered glands below, pinnately veined; petiole 0.5–6 cm long, slender, kneed at both ends; stipules fugacious. Inflorescence axillary, unisexual, male one spiciform-racemose, up to 20 cm long, female flowers usually solitary. Flowers unisexual, with 3–5 perianth lobes (petals absent), disk absent; male flowers with numerous free or connate stamens on a conical receptacle; female flowers with very long pedicel and a superior, 2(–3)-celled ovary, styles 2(–3), very long, connate at base, deeply bifid. Fruit a 2(–3)-celled, double-globose, woody capsule 1.5–2.5 cm in diameter, with persistent, lateral or subterminal styles, usually splitting into 2 one-seeded parts. Seeds subglobose, c. 1.2 mm in diameter, dark brown, mottled, smooth.

Cleidion is a pantropical genus of about 25 species.

Ecology *C. spiciflorum* occurs in rain forest, or on stream- or riversides in drier regions, also at the foot of limestone hills, in ridge forest and swamp forest, up to 800 m altitude. It is common in many regions, e.g. in Thailand and New Guinea, but rare in some other regions, e.g. Peninsular Malaysia and Borneo.

Genetic resources *C. spiciflorum* is widespread, locally common, and does not seem to be liable to genetic erosion. However, in several regions it is rare, and nothing is known about the genetic variability.

Prospects It is striking that *C. spiciflorum* is used in traditional medicine in regions as far apart as the Philippines and the Solomon Islands. It may be a tree of future importance, for medicinal uses as well as a shade tree. However, research on its phytochemical and pharmacological properties is desirable.

Literature 332, 760.

Other selected sources 19, 20, 21, 22, 23, 24, 62, 121, 731, 782, 990.

Janahar Murad

Clematis L.

Sp. pl. 1: 543 (1753); Gen. pl. ed. 5: 242 (1754).
RANUNCULACEAE
$x = 8$; *C. phanerophlebia*: $2n = 16$

Origin and geographic distribution *Clematis* comprises about 320 species, and has a worldwide distribution except for the polar regions; in Malesia 19 species occur.

Uses The medicinal uses of South-East Asian *Clematis* are diverse although not on a large scale: pounded leaves are used to treat colds, coughs, wounds and as an anodyne and febrifuge, roots to treat lumbago and as an anodyne, and sap as a tonic. In New Guinea crushed leaves of a *Clematis* species of uncertain identity (incorrectly referred to as *C. glycinoides*) are inhaled for colds; the juice of the green leaves is used to induce abortion, and the plant is reputedly poisonous to livestock. In the Admiralty Islands and the Northern Province, Papua New Guinea, crushed leaves of plants identified as the very rare *C. clemensiae* H. Eichler are sniffed to clear the nose. There is a single record of the use of *C. leschenaultiana* DC. as a remedy for abdominal pain in Java.

Clematis species of more temperate regions in Asia, e.g. in northern Vietnam and China, are more widely used and better known. They are used as an antimalarial, antirheumatic, analgesic, antidote, diuretic, laxative, and to relieve headaches. *C. chinensis* Osbeck is well known in traditional Chinese medicine. In Vietnam roasted roots, mixed with other drugs, are used as a diuretic, remedy for indigestion and emmenagogue. They are also reputedly used as a galactagogue. In Taiwan a root decoction is used to treat headache, fever and chills. In China it is applied as an analgesic, diuretic, antitumour, anti-inflammatory and insecticidal agent. In Vietnam a post-partum drink is prepared from the leaves of *C. meyeniana* Walpers. In Indo-China a root decoction of *C. gouriana* Roxb. ex DC. is used as a diaphoretic and diuretic. The fresh, crushed leaves are used as a rubefacient or vesicant, the compound responsible for the activity being volatile. In Taiwan the pounded leaves are applied to wounds and snakebites, and the leaves are employed as a febrifuge. In Chinese medicine, the root is used as a remedy for goitre, and the fruit as a tonic and

stomachic. The aboveground parts are considered a drastic purgative, easily resulting in a toxic overdose. The stem is used as an anthelmintic in Nepal. In Africa coughing and migraine are cured by inhaling *C. villosa* DC. Crushed and dried leaves softened in warm water are used to treat rheumatism.

The stems of numerous species belonging to section *Clematis* (e.g. *C. vitalba* L. of temperate regions) are used as ropes. In Lombok stems of *C. multistriata* H. Eichler are used for binding. *Clematis* is planted worldwide as an ornamental.

Properties Some *Clematis* species are rich in saponins (e.g. *C. chinensis*), whereas others are void of these (e.g. *C. smilacifolia*). Protoanemonin was isolated from several *Clematis* species. In a general screening using the disk diffusion method, methanol extracts of dried leaves and stem bark of *C. papuasica* showed a broad antimicrobial activity against gram-negative and gram-positive bacteria. An aqueous extract of *C. chinensis*, tested in various rat models showed hypotensive activity. It produced a hypotensive response mediated through histaminergic activity. Isolated preconstricted helical tail artery strips were relaxed, and the extract produced both negative chronotropic and inotropic effects on isolated atria. A crude extract of *C. chinensis* showed moderate hepatoprotective activity in CCl_4-induced hepatotoxicity in rats.

Botany Lianas or climbers, or (outside Malesia) upright shrubs or herbs. Leaves opposite, occasionally alternate, mostly pinnately compound or ternate, sometimes simple; petiole, rachis and petiolules often twining; stipules absent. Inflorescence a 1–many-flowered cyme at the top of young stems or axillary, sometimes on older stems, arranged in raceme- or panicle-like synflorescences. Flowers bisexual or unisexual, regular; tepals 4–6, valvate; stamens many; carpels (3–)5–many, style persistent, usually hairy. Fruit consisting of sessile, often laterally compressed nutlets.

Confusion with respect to the proper identity of Malesian *Clematis* is considerable. The name *C. glycinoides* is often used for plants in New Guinea, but in most cases it refers to *C. pickeringii*, but often probably also to several other species of section *Aspidanthera* subsection *Papuasicae*. True *C. glycinoides* DC. is confined to northern Australia.

Ecology In Malesia *Clematis* is found from sea-level up to 3000 m altitude, most commonly encountered as lianas along rivers, at forest edges, and in relatively open primary and secondary forest, covering small trees, shrubs, rocks and walls.

Management In general *Clematis* can be easily propagated by seed, layering or cuttings.

Genetic resources *Clematis* species are commonly found in areas of regeneration, and are usually common and cannot be considered threatened. However, some species are restricted in their distribution; the Philippines, Sulawesi and New Guinea, for example, all have several endemics which may be threatened by continued habitat degradation.

Prospects Little is known about the pharmacological properties of Malesian *Clematis*. Further research is needed to support its traditional uses, for instance the widespread use as a sniff to clear the nose.

Literature 164, 344, 361, 438, 464, 731.

Selection of species

Clematis javana DC.

Syst. Nat. 1: 152 (1817).

Synonyms *Clematis vitalba* L. subsp. *javana* (DC.) O. Kuntze (1885), *Clematis gouriana* auct. non Roxb. ex DC.

Vernacular names Indonesia: slerem, merangan (Javanese). Philippines: salingbuabong (Igorot), kalupat (Bisaya), kamugna (Bagobo). Papua New Guinea: zanzanfulolo (Sasaningko, Morobe Province).

Distribution Java, the Lesser Sunda Islands, the Philippines, the Moluccas and New Guinea.

Uses In the Philippines pounded leaves or leaf juice are applied to wounds. In the Huon Peninsula, Papua New Guinea, the sap from the stems is taken as a general tonic.

Observations A liana up to 6 m long, stems sharply 6-ribbed; leaves usually biternate, leaflets ovate to narrowly ovate, (4–)5–8.5(–11) cm × 2–7 cm, base cordate or rounded, apex long-cuspidate, usually coarsely dentate; inflorescence a terminal or axillary dichasial panicle or raceme; tepals narrowly elliptical to oblong-obovate, 7–12 mm long, greenish-white or white, stamens 40–70, carpels 10–25; nutlets narrowly ovoid-ellipsoid to ovoid-fusiform, c. 4 mm long, densely pubescent, plumose tail 3–4 cm long. *C. javana* occurs in primary and secondary forest, thickets, as well as grassland and hedges, from sea-level up to 1600 m altitude.

Selected sources 62, 226, 356, 438.

Clematis papuasica Merr. & Perry

Journ. Arn. Arb. 24: 34 (1943).

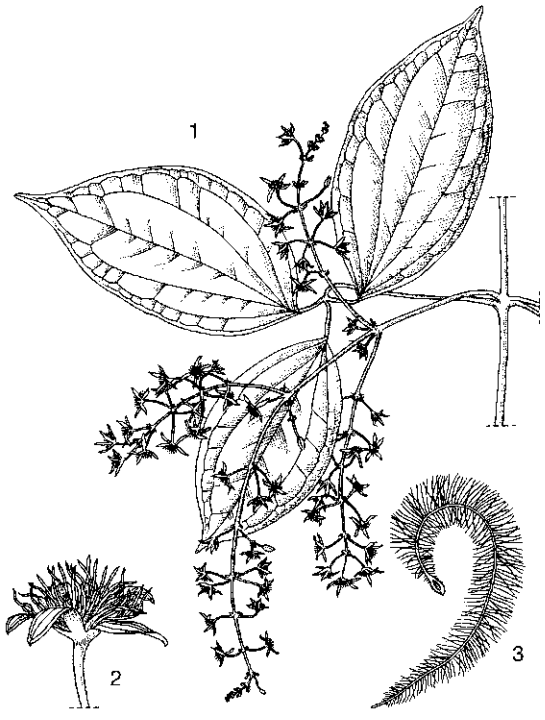
Synonyms *Clematis pickeringii* auct. non A. Gray.

Vernacular names Indonesia: larate, naowi (Talaud Islands). Papua New Guinea: rugu-robu (Bougainville), feriyanuya (Bredabu, Central Province), mungla (Kombo, Western Highlands).

Distribution The Talaud Islands, the Moluccas, New Guinea and the Solomon Islands.

Uses Throughout Papua New Guinea crushed leaves are sniffed, to unblock nasal passages and to treat a cold or cough. In the Western Highlands sap from the stem is blown into a red swollen eye. In the Solomon Islands pounded leaves are applied to the forehead as a febrifuge.

Observations A liana up to 10 m long, stems cylindrical, with 12 distinct and 12 indistinct ribs; leaves ternate or rarely simple, leaflets elliptical, ovate-lanceolate, oblong or rounded, (5–)10–17(–19) cm × (2.5–)5–9(–15) cm, base cuneate to somewhat cordate, apex long-cuspidate to rounded, entire to somewhat wavy; inflorescence an axillary panicle-like raceme; male flowers with tepals oblong, (3–)7–9(–10) mm × (1–)1.5–2.5(–3) mm, white or tinged yellow, somewhat fragrant, and 20–30(–45) stamens, female flowers with tepals oblong or oblong-elliptical, 11–13 mm × 2.5–4 mm, spreading, 6–8 staminodes and 20–30 carpels; nutlets oblique-ovate, c. 6 mm long, densely pubescent, plumose tail (4–)6–8 cm long. *C. papuasica* occurs in secondary forest, forest fringes and thickets, from sea-level up to 2000 m altitude.



Clematis papuasica Merr. & Perry – 1, flowering twig; 2, flower; 3, nutlet.

Selected sources 226, 347, 353, 355, 361, 438.

Clematis phanerophlebia Merr. & Perry

Journ. Arn. Arb. 24: 35 (1943).

Synonyms *Clematis perspicuinervia* Merr. & Perry (1948).

Vernacular names Papua New Guinea: itituwa (Kaneba, Gulf Province).

Distribution New Guinea.

Uses Pounded stems are used as a fish poison in small streams. A drink prepared by crushing stalks in water and mixing this with traditional salt is taken to treat chest pains.

Observations A liana, stems cylindrical with many somewhat differently rounded ribs; leaves simple or ternate, leaflets ovate to elliptical-lanceolate or oblong-ovate, 5–14 cm × 2–6 cm, base rounded, apex cuspidate, entire or dentate; inflorescence an axillary, dichasially ramified, raceme-like panicle; male flowers with tepals narrowly oblong to obovate, 6–7 mm × 2 mm, and 18–20 stamens, female flowers with tepals linear-lanceolate, 14–15 mm × 1.5–2.5 mm, 4–6 staminodes and 16–20 carpels; nutlets elliptical or ovate, c. 3 mm long, densely pubescent, plumose tail 3–4 cm long. *C. phanerophlebia* occurs in forest and thickets at 600–2500 m altitude.

Selected sources 68, 226, 438.

Clematis pickeringii A. Gray

U.S. Expl. Exped., Bot. 1: 1 (1854).

Synonyms *Clematis aristata* auct. non R.Br. ex Edw., *Clematis glycinoides* auct. non DC.

Vernacular names Indonesia: hubuk, lelukawinga (Sumba).

Distribution Eastern Java, the Lesser Sunda Islands, Sulawesi, the Moluccas (Buru, Seram), south-eastern New Guinea, northern Australia, New Caledonia and the Fiji Islands.

Uses In Sumba leaves and roots are chewed by small children as an anodyne when teething.

Observations A liana up to 5 m long, stems uniformly many-ribbed; leaves usually ternate, leaflets ovate or ovate-elliptical, 5–8.5(–15) cm × (3–)3.5–6.5(–8.5) cm, base rounded or somewhat

cordate, apex usually cuspidate, usually entire, typically somewhat fleshy coriaceous; inflorescence a terminal or axillary panicle with opposite branches and flowers; male flowers with tepals oblong-lanceolate, (6.5–)7.5–9(–11) mm × 1.5–2.5 mm, and 35–55 stamens of very different length, female flowers with tepals oblong to lanceolate, erect or spreading, 7–14 mm × 1.5–3 mm, 8–16 staminodes and 18–35 carpels; nutlets oblong to ovoid-fusiform, 5.5–7 mm long, densely hairy, with 2 longitudinal furrows on each side, plumose tail 4–6 cm long. *C. pickeringii* occurs in secondary forest and forest fringes, as well as savanna and mountain forest, from sea-level up to 1300 m altitude.

Selected sources 62, 226, 438.

Clematis smilacifolia Wallich

Asiat. Res. 13: 402 (1820).

Synonyms *Clematis subpeltata* Wallich (1832), *Clematis loureiriana* auct. non DC.

Vernacular names Indonesia: sanghur (Javanese), kajang helang (Sundanese), werewere (Seram). Philippines: amnok, anatel (Igorot). Laos: khoua kau san. Thailand: phuang kaeo kudan (Bangkok). Vietnam: d[a]y [oo]ng l[ax]o, v[awf]ng kim cong.

Distribution Nepal, eastern India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand and throughout the Malesian region.

Uses In Vietnam a root decoction is used to treat lumbago, and a decoction of the aboveground parts to treat itch.

Observations A liana up to 10 m long, stems many-ribbed; leaves simple, leaflets broadly ovate, 7–18(–37) cm × (2.5–)5–12(–16) cm, base cordate or rounded, apex cuspidate to obtuse, entire or sometimes minutely dentate; inflorescence a terminal or axillary, dichasial raceme, 3–7-flowered, fragrant; tepals 4(–6), oblong to linear, (12–)18–25(–30) mm × (3–)4–5(–7) mm, brown, stamens 50–60, carpels c. 40; nutlets elliptical to oblique-rhombic, (4.5–)6.5–8 mm × (2.5–)3–4 mm, appressed hairy, plumose tail 5–7 cm long. *C. smilacifolia* occurs in thickets, evergreen forest, bamboo forest and on river banks, from sea-level up to 1600(–2400) m altitude.

Selected sources 62, 438, 671, 732.

J.L.C.H. van Valkenburg

Clusia L.

Sp. pl. 1: 509 (1753); Gen. pl. ed. 5: 226 (1754).

GUTTIFERAE

x = unknown

Origin and geographic distribution *Clusia* comprises approximately 250 species and is confined to the tropics of the New World. Some species are planted in gardens elsewhere in the tropics, including Malaysia and Thailand, and have sometimes become naturalized, e.g. *C. rosea* in Sri Lanka.

Uses *Clusia* is used in traditional medicine in tropical America. The bitter gum is well known because of its drastic, sometimes dangerous, purgative properties. It is used in ointments to treat sores and wounds, and also to allay toothache and calluses on the feet. The dried and powdered gum is widely traded and used as a resolutive plaster to treat fractures, dislocations and burns. Decoctions of bark and fruit rind are applied to soothe rheumatic pains. A leaf or flower decoction is used internally as a pectoral to relieve chest complaints.

The gum is burned in houses as a disinfectant and is also used for caulking boats. The reddish wood is used in house construction, e.g. for poles, but timber is not usually available in merchantable sizes. There are no records on medicinal use of *Clusia* in South-East Asia; it is occasionally planted as an ornamental in gardens. Elsewhere, *Clusia* is also planted for ornamental purposes.

Properties The polyisoprenylated benzophenone derivatives guttiferone E and xanthochymol have been isolated from *C. rosea* leaves. These compounds inhibit the cytopathic effects of in-vitro human immunodeficiency virus (HIV) infection in human cells. They also exhibited cytotoxic activity against CA-human colon CO-115 cell lines. Other polyisoprenylated benzophenones have been found in the resin of the flowers and in fruits of *Clusia* species.

Three biphenyl derivatives, clusiparalicolines A, B and C, have been isolated from *C. paralicola* G. Mariz roots. The first 2 of these compounds were found to be active in the DNA strand-scission assay, whereas all 3 compounds exhibited modest cytotoxicity against KB human cancer cell lines. In tests with rats, an aqueous extract of the leaves of *C. coclensis* Standl. injected intravenously induced a rapid and transitory decrease in blood pressure and heart frequency.

Propolis is a resinous hive product collected by honey bees that has been used in folk medicine in

tropical America since around 300 BC. Various biological activities have been attributed to it, such as anticancer, antioxidant, anti-inflammatory, antibiotic and antifungal effects. It is also extensively used in food and beverages to improve health and prevent diseases such as inflammation, heart complaints, diabetes and even cancer. The resins exuded by *Clusia* flowers are a major source of propolis. Several compounds isolated from propolis showed cytotoxic activity on human fibrosarcoma and murine colon carcinoma cell lines.

Botany Trees or shrubs, mostly dioecious, often epiphytic, with whitish or yellowish sap. Leaves opposite, simple and entire, usually stiffly leathery, veins often anastomosing at the margins to form marginal veins; petiole distinct or indistinct; stipules absent. Inflorescence an axillary or terminal cymose panicle, or flowers solitary. Flowers unisexual, regular, in bud mostly globose; sepals (2–)4–5(–8), mostly free, decussate or imbricate, rotund; petals 4–9(–12), free, ovate or rotund; male flowers with numerous stamens basally connate and rudimentary ovary; female flowers with superior ovary consisting of 4–10 basally or entirely connate carpels with sessile stigmas and rudimentary stamens. Fruit a fleshy or leathery tardily dehiscent capsule, with a stigmatic area on top, many-seeded. Seeds enveloped in an arillode.

Both *C. rosea* and *C. minor* are usually shrubs or poorly formed trees, but occasionally they occur as an epiphyte, sometimes strangling the host in the manner of figs (*Ficus* species). Free-living trees grow from terrestrial seedlings or from epiphytic seedlings eventually strangling and shading their host trees. Although the large flowers are often produced continuously, they last for only short periods and are usually not in great number. They are commonly visited by bees, which collect the viscous, hydrophobic resin, and use this as a nest-building material with antimicrobial properties.

It has been suggested that *C. rosea* is wholly apomictic and that *C. minor* is commonly apomictic in reproduction. In the latter some forms may be facultatively apomictic or may reproduce by normal sexual means. Apomictic specimens produce functional seed, probably by adventitious embryony. *C. rosea* shows crassulacean acid metabolism (CAM), with nocturnal CO_2 fixation.

Ecology In the natural area of distribution, *C. rosea* often occurs on coastal limestone and in savanna, and *C. minor* most commonly in forest in areas with a seasonally dry climate. For cultivated plants, drainage must be good, but otherwise little care is required where conditions are guaranteed hot and humid.

Management *C. rosea* can be propagated successfully by softwood cuttings. The best results have been obtained from shoot-tip cuttings 15 cm long with 2 leaves, treated with indole-3-butyric acid, and rooted in washed, coarse sand under mist. Alternative propagation is by seed or air-layering. Planting should preferably be done in a medium-fertile loam-based mix with additional sand. The plants respond well to pruning.

Genetic resources *C. rosea* and *C. minor* are widespread in their natural areas of distribution in tropical America, and have also spread elsewhere for cultivation as an ornamental (particularly *C. rosea*). They are therefore unlikely to be at risk from genetic erosion. The apomictic reproduction and the ease of vegetative propagation by cuttings are interesting for breeding activities.

Prospects Although not indigenous in South-East Asia, *Clusia* may have good prospects for this region, not only as an ornamental plant, but also as medicinal plant, for which it is valued in tropical America. More research on anti-cancer and anti-HIV activities seems desirable.

Literature 71, 286, 646, 836.

Selection of species

Clusia minor L.

Sp. pl. 1: 510 (1753).

Synonyms *Clusia odorata* Seem. (1853).

Distribution Widespread in tropical America; occasionally planted elsewhere in the tropics.

Uses In tropical America, the gum is used in ointments to treat sores. It acts as a drastic purgative. A decoction of dried flowers is used as a pectoral to treat chest complaints. The latex is also used for caulking boats. *C. minor* is occasionally planted as an ornamental, e.g. in Malaysia.

Observations A shrub to small tree up to 7 m tall, sometimes epiphytic, branchlets with exfoliating bark; leaves ovate, membranous or thinly coriaceous, apically obtuse to acute, with numerous lateral veins, petiole rather slender; flowers solitary or few together, petals c. 1.5 cm long, white or pink; fruit ovoid, 2.5–3.5 cm long. In its natural area of distribution, *C. minor* occurs most commonly in forests in areas with a seasonally dry climate.

Selected sources 71, 121, 188, 586, 646.

Clusia rosea Jacq.

Enum. syst. pl.: 34 (1760).

Synonyms *Clusia major* auct. non L.

Vernacular names Balsam apple (En). Pitch apple (Am). Copey (Sp).

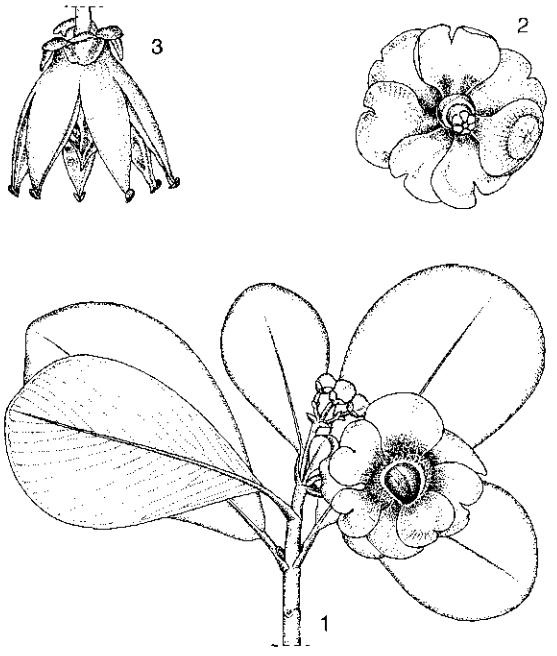
Distribution The Antilles, Panama, Colombia and Venezuela; planted elsewhere in the tropics and occasionally naturalized, e.g. in Sri Lanka.

Uses In tropical America, the bitter gum is well known because of its drastic, sometimes dangerous, purgative properties. It is used to allay toothache and calluses on the feet. The dried and powdered gum is widely traded and used as a resolutive plaster to treat fractures, dislocations and burns. Decoctions of bark and fruit rind are applied to soothe rheumatic pains. A leaf or flower decoction is used internally as a pectoral to relieve chest complaints. The gum is burned in houses as a disinfectant and is also used for caulking boats. The reddish wood is applied in house construction, e.g. for poles. *C. rosea* is planted for ornamental purposes in the southern United States (Florida), where it is a handsome, fast-growing tree with a broad spreading crown, and also in South-East Asia. It is commonly cultivated as an indoor pot plant for its decorative foliage.

Observations A shrub to medium-sized tree up to 20 m tall, sometimes epiphytic; leaves broadly obovate, stiffly coriaceous, apically rounded to emarginate, with numerous lateral veins, petiole stout; flowers often solitary, petals 3–4 cm long, white or pink; fruit turbinate, 4–8 cm long, whitish-green, often with brown outside, whitish inside; seeds ovoid, white with a scarlet arillode. In its natural area of distribution *C. rosea* occurs in evergreen and semideciduous lowland forest up to 500 m altitude, but also on coastal limestone and in savanna.

Selected sources 67, 71, 121, 143, 188, 305, 586, 646, 782.

R.E. Nasution



Clusia rosea Jacq. – 1, branch with male fower with copious resin production; 2, female flower; 3, dehisced fruit.

Cnesmone javanica Blume

Bijdr. fl. Ned. Ind.: 630 (1826; *'Cnesmosa javanica'*).

EUPHORBIACEAE

$2n$ = unknown

Vernacular names Indonesia: pulus areng, pulus jalantong (Sundanese). Malaysia: jelatang badak, jelatang gajah, jelatang rusa (Peninsular). Thailand: karangtang kwaang (peninsular), tamyae khruea (Saraburi), raachaa se-khue (Karen, Kanchanaburi). Vietnam: h[oof] ly, d[aa]y b[oj] n[ej]t.

Origin and geographic distribution *C. javanica* is distributed in eastern India (Assam), Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Bali and Borneo.

Uses There is one report from Peninsular Malaysia, stating that the juice of *C. javanica* is mixed with the latex of *Antiaris toxicaria* Lesch. to produce a dart poison. In Thailand, it is an ingredient of a compound drug used as an anti-inflammatory.

Botany A monoecious slender, herbaceous or slightly woody climber, with stinging hairs. Leaves alternate, distichous, simple, oblong or ovate-cordate, 6–22 cm × 3–13 cm, cordate at base, margin with acuminate teeth, on both sides with patent hairs and scattered bristles, 3-veined from the base; petiole 1.5–11 cm long; stipules oblong, up to 1 cm long, persistent. Inflorescence an axillary or leaf-opposed, bracteate raceme up to 11 cm long, on a peduncle up to 13 cm long, at base with 1 or 2 female flowers, upwards with many male flowers. Flowers unisexual, with 3-lobed perianth (petals absent) up to 1 cm long; male flowers with 3 stamens alternating with the perianth lobes, filaments thick, widened towards the apex, connec-

tive broad, with incurved appendage; female flowers with superior, depressed, 3-celled ovary, styles 3, shortly connate, fleshy, strongly papillose, persistent. Fruit a (2–)3-lobed capsule c. 1.5 cm in diameter, seated on the calyx, velutinous and hispid, each cell 1-seeded. Seeds globose, with a fleshy outer layer.

C. javanica can be found flowering and fruiting throughout the year.

Cnesmone comprises about 10 species, and occurs from eastern India and southern China to western Malesia. It belongs to the tribe *Plukenetieae* and is related to *Megistostigma*. Blume published the genus as *Cnesmosa* in 1826, but 2 years later he corrected the name into *Cnesmone*.

Ecology *C. javanica* occurs in evergreen forest, often in open locations, bamboo forest, brushwood and young forest, in Java up to 300 m altitude, in Thailand up to 500 m. It is common in the northern part of Peninsular Malaysia.

Genetic resources *C. javanica* is widely distributed, locally common, and often occurs in disturbed habitats. It is therefore unlikely to be at risk of genetic erosion, although it appears to be more rare in some regions, e.g. Sumatra and Borneo.

Prospects There is hardly any information on the uses and no information at all on the properties of *C. javanica*. It seems unlikely that it will become more important in the future.

Literature 62, 121.

Other selected sources 19, 20, 22, 23, 990.

Raharni

Cnestis palala (Lour.) Merr.

Journ. Roy. As. Soc. Straits Br. 85: 201 (1922).

CONNARACEAE

$2n$ = unknown

Synonyms *Cnestis diffusa* Blanco (1837), *Cnestis platantha* Griffith (1854).

Vernacular names Indonesia: andor balimbing, baih patuh senggulin, jukut abang (Sumatra). Malaysia: garing-garing, sembelit merah, sembelit kecil (Peninsular). Philippines: kalakalamyasan (Tagalog), salsaladoi (Iloko), palo santo (Sp). Laos: 'hon kai[1], 'sā māt, bén bit. Thailand: kra phaak laak (Trat), ngonkai (central), maa daeng (peninsular). Vietnam: tr[uw][owf]ng kh[ees], d[aa]y v[aws]p c[aaf]y.

Origin and geographic distribution *C. palala* occurs in the Andaman Islands, southern Burma (Myanmar), southern Laos, Vietnam, Thailand, Peninsular Malaysia, Sumatra, Borneo, the northern part of the Philippines, and Sulawesi.

Uses In Malaysia, a decoction of the roots is drunk to treat stomach-ache, chronic colonic obstruction, urinary troubles and, together with *Phyllanthus pulcher* Wallich ex Muell. Arg., malaria. It is also applied as a tonic after childbirth, and as an anticoagluant as a remedy for stroke and blood clotting. External uses include treating sprains with a foment, and gonorrhoea with a poultice. In Laos, an infusion of the roots is used internally to treat dysentery, and a decoction of the leaves externally to treat scabies and wounds. The seeds have been used in southern Vietnam to poison dogs.

Several *Cnestis* species are used in traditional medicine in Africa, e.g. *C. corniculata* Lamk, the leaves of which are applied against blennorrhoea, *C. urens* Gilg, the seeds of which are used to treat stomach-ache and toothache, and especially *C. ferruginea* Vahl ex DC., which is administered for a vast array of complaints; the fruit pulp is commonly used to clean the teeth. The fruits of *C. polyphylla* Lamk have been applied in Madagascar to poison dogs and rats. The stems of African *Cnestis* are sometimes used as a rope to climb palm trees, and to make baskets.

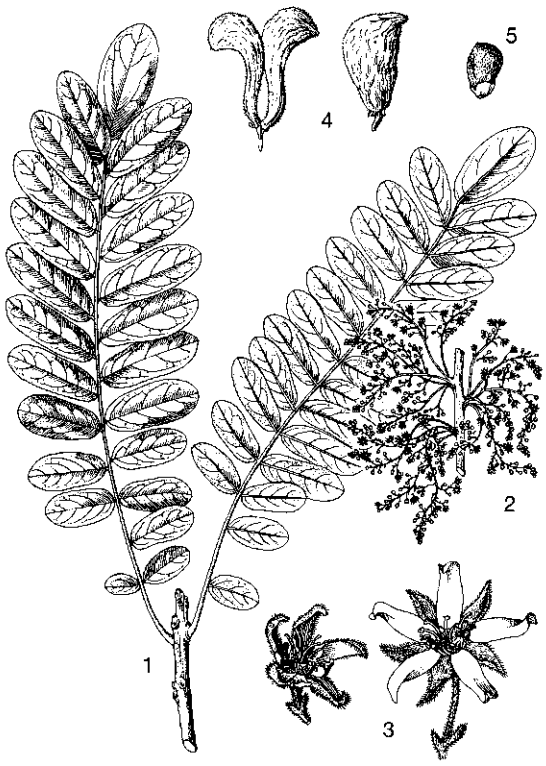
Properties Seeds and bark of several *Cnestis* species have been reported to be poisonous. In tests, the extracts were fatal to rabbits and mice after convulsive attacks. The seeds of *C. palala* showed acute toxicity in tests with dogs. An unusual amino acid, L-methionine sulfoximine, has been isolated from the fresh seeds of *C. palala*. A neurotoxin also identified as methionine sulfoximine has been isolated from *C. polyphylla* root bark at 0.4% yield. This compound seems common in *Connaraceae*. The seeds of *C. polyphylla* yielded a compound with a cytotoxic effect on a hepatoma tissue culture. The toxic compound inhibits protein synthesis in a hepatoma tissue culture as well as in the rabbit reticulocyte lysate assay.

Extracts of *C. ferruginea* showed antimicrobial activity; they were markedly active against *Aspergillus niger*, dermatophytes and several bacteria. General phytochemical screening of the leaves of this species showed the presence of glycosidic anthraquinones, sterols, tannins and flavonoids, but not of alkaloids or saponins.

Botany A small to large liana up to 25 m long, or a shrub, often with climbing branches, rarely a small tree up to 10 m tall; branchlets densely brown-pubescent, later more or less glabrescent.

Leaves imparipinnate, 6–21-jugate; petiole 1–7 cm long; stipules absent; lateral leaflets narrowly ovate or narrowly oblong to ovate or oblong, (1–)1.5–8 cm × 0.7–2.5 cm, terminal leaflet narrowly elliptical or narrowly obovate to elliptical or obovate, 3–8 cm × 1–3 cm, leaflets densely pilose below; petiolules 0.5–1.5 mm long. Inflorescence an axillary raceme or panicle, on older branches, densely yellowish-brown pubescent, up to 35-flowered. Flowers bisexual, regular, 5-merous, obscurely heterodistylous; pedicel articulated; sepals narrowly ovate to narrowly oblong, 2–5 mm long; petals ovate or elliptical to narrowly oblong, (0.5–)2–4(–5) mm long, white to creamy; stamens 10, slightly differing in length in the 2 whorls; carpels 5, free, superior. Fruit consisting of 1–3 ellipsoid to pyriform follicles 2.5–6 cm long, densely reddish-hairy outside and with long yellowish hairs inside, each follicle 1-seeded. Seed ovoid, 1.5–3 cm long, black, with an arilloid at base; cotyledons thin, veined; endosperm abundant.

Cnestis consists of 13 species, all restricted to Africa (including Madagascar and the Mascarene Islands) except the Asiatic *C. palala*. *C. palala* is a variable species, in leaf characteristics as well as in the shape and size of inflorescences, petals and follicles. Several distinct species have been distinguished for South-East Asia, but these are connected by intermediates. *C. palala* shares its extreme variability with many other *Connaraceae* species both in Asia and Africa.



Cnestis palala (Lour.) Merr. – 1, branch with leaves; 2, branch with inflorescences; 3, different types of flowers; 4, different types of fruits; 5, seed.

Ecology *C. palala* occurs in primary and secondary rain forest up to 500 m altitude, also in riverine and marsh forest, sometimes in dry forest and thickets.

Genetic resources *C. palala* is widespread in different habitats, and does not seem to be easily liable to genetic erosion. Its apparently wide genetic variability, which is connected with distribution (e.g. comparatively long petals in mainland South-East Asia and the Philippines, short ones in Sumatra and Borneo) warrants more research, also in connection with phytochemistry.

Prospects *C. palala* is fairly widely used in traditional medicine, as are other *Cnestis* species in Africa. It seems to have interesting properties, which however have been little studied. Its uses in treating malaria, blood clotting, urinary troubles and chronic colonic obstructions justify more research.

Literature 247, 657, 707.

Other selected sources 113, 120, 121, 249, 250, 423, 700, 731.

H.C. Ong

Cocculus DC.

Syst. nat. 1: 515 (1817).

MENISPERMACEAE

$x = 13$; *C. laurifolius*: $2n = 26$, *C. orbiculatus*: $2n = 50, 52$

Origin and geographic distribution *Cocculus* comprises 8 species, and occurs in Central and North America, Africa, south-eastern and eastern Asia, and Polynesia. In Malesia, 2 species occur, whereas a third one (*C. hirsutus* (L.) Theob.) found in tropical Africa, Arabia, India, Sri Lanka, Burma (Myanmar) and southern China, has been collected once in Thailand.

Uses There are no records of medicinal uses of *Cocculus* in the Malesian region, but it is imported as a medicine by Chinese people in Malaysia. In Chinese traditional medicine, *Cocculus* roots are often used to treat rheumatism and arthritis, sometimes in mixtures with *Stephania* and *Aristolochia*, and to treat oedema.

C. hirsutus has many medicinal uses in Pakistan: the leaves are used to treat prurigo, eczema, impetigo and acute gonorrhoea, and the roots to treat fever, rheumatism and syphilitic cachexia, and as a tonic, alterative and diuretic. Roots and leaves of *C. pendulus* (J.R. Forster & J.G. Forster) Diels are commonly used in traditional medicine in Africa to treat various complaints, but most commonly as a febrifuge.

Properties Morphinane alkaloids with antitumour activity have been isolated from methanolic extracts of stems and roots of *C. orbiculatus*, e.g. sinococuline and isosinococuline. These compounds showed significant activity against Sarcoma 180 ascites in mice.

Methanolic extracts of dried stem bark of *C. orbiculatus* significantly inhibited seed germination of *Echinochloa crus-galli* (L.) P. Beauv., *Brassica rugosa* Prain and cucumber; aristolochic and aristolic acids were isolated and identified as the active principles.

Many alkaloids have been isolated from the leaves of *C. laurifolius*, e.g. cocculine, isoboldine, norisoboldine, coclafine, erythlaurine, erythramide, laurifinine and cocculitine. Cocculine showed an action similar to that of curare. The quaternary alkaloid isocorydine-methochloride has also been isolated from this species; it showed neuromuscular blocking action.

An aqueous extract of aerial parts of *C. hirsutus* showed significant diuretic and laxative effects in rats. *C. pendulus* extracts showed distinct nematicidal activity against *Meloidogyne javanica* and insecticidal activity against larvae of *Spodoptera litura*. Ethanolic stem extracts of *C. pendulus* showed hypotensive and anticancer activity. Numerous alkaloids possessing anticancer activity have been isolated from this species, e.g. cocsulinin.

Botany Slender dioecious climbers, erect shrubs or small trees. Leaves arranged spirally, simple and entire, rarely lobed, shortly petiolate; stipules absent. Inflorescence an axillary cyme or thyrse. Flowers small, unisexual, regular; sepals 6–9 in 3 whorls, outer ones smallest; petals 6, bifid or emarginate at apex; male flowers with inflexed auricles at base of petals clasping the 6 free stamens; female flowers with 6 staminodes and 3 or 6 free, superior carpels, styles subulate and reflexed. Fruit consisting of 1–6 drupes, curved with style-scar near base; endocarp dorsally verruculose or ridged, each drupe 1-seeded. Seeds curved almost into a ring, dorsiventrally flattened; endosperm very thin; cotyledons liguliform.

Ecology *C. laurifolius* usually occurs in secondary habitats, such as open woodland, thickets, grassland, plantations and river banks. In Malesia, *C. orbiculatus* is usually found climbing over coastal vegetations, but sometimes also inland on limestone.

Management On the coast of the Black Sea, *C. laurifolius* is cultivated, where it proved resistant to frost, although plants were killed back to the roots at temperatures below –9°C. Normal N nutrition in spring and well-timed high K application improved frost resistance. The plants there are propagated by semi-hardwood cuttings under glass.

In India, in-vitro propagation has been successfully practised for *C. pendulus*. Multiple shoot formation was obtained from nodal explants and callus on Murashige and Skoog medium with low concentration of benzyladenine. High alkaloid-producing cell lines of *C. pendulus* have been established which produce antineoplastic agents.

Genetic resources *Cocculus* is widely distributed and usually occurs in secondary vegetation types, which makes it not easily liable to genetic erosion due to habitat destruction.

Prospects Like many other *Menispermaceae*, *Cocculus* species are promising medicinal plants. Several uses in traditional medicine and biological activities deserve more attention in research, e.g. the reputed febrifugal, diuretic and anticancer properties. The fact that they can be easily cultivated makes them even more promising.

Literature 247, 266, 272, 385, 731, 765.

Selection of species

Cocculus laurifolius DC.

Syst. nat. 1: 530 (1817).

Vernacular names Indonesia: ki pacar, tejan (Sundanese). Thailand: yang nan ton (north-eastern, central), sakae dong (north-eastern), suramarit (eastern). Vietnam: v[eej] ch[aa]u, [oo] d[uw][owj]c, d[aa]y k[oof] c[aaf]u.

Distribution Nepal, India, Burma (Myanmar), Indo-China, southern China, Taiwan, Japan, Thailand, Sumatra, Java and the Philippines.

Uses In traditional medicine in China, the roots and stems are used to treat hypertension, headache, abdominal pain and rheumatic pain. *C. laurifolius* is sometimes cultivated as an ornamental, e.g. in milder parts of North America and Europe.

Observations An erect shrub or small tree up to 6 m tall, with main stem up to 12 cm in dia-

meter; leaves elliptical or oblanceolate-elliptical, 7–11(–15) cm × 3–5.5 cm, strongly 3-veined with veins running parallel to margins and continuing beyond the middle of the leaf; flowers yellowish, female ones with 3 carpels; drupe rotund in outline, c. 4 mm in diameter. *C. laurifolius* occurs in open woodland, thickets, grassland, teak and banana plantations, and on river banks, up to 1500 m altitude.

Selected sources 247, 249, 649, 691.

Cocculus orbiculatus (L.) DC.

Syst. nat. 1: 523 (1817).

Synonyms *Cocculus trilobus* (Thunberg) DC. (1817), *Cocculus sarmentosus* (Lour.) Diels (1910).

Vernacular names Vietnam: d[aa]y xanh, d[aa]y m[ooj]t, m[ooj]c ph[of]ng ky.

Distribution Nepal, India, China, Taiwan, Japan, Hawaii, Indo-China, Thailand, Peninsular Malaysia, Singapore, north-eastern Sumatra, western and central Java, and the Philippines; also in Réunion and Mauritius, but there possibly introduced.

Cocculus orbiculatus (L.) DC. – 1, branch of male flowering plant; 2, male flower; 3, female flower; 4, infructescence; 5, endocarp.

Uses In Vietnam, the stem is used as a diuretic to treat oedema. The roots are considered febrifuge and used to treat epilepsy. In traditional medicine in China, the stems and leaves are applied against flatulence, stomach-ache and oedema. In Thailand, the leaves are used to produce a jelly.

Observations A slender herbaceous or slightly woody climber, with stem up to 1.5 mm in diameter; leaves broadly elliptical to narrowly elliptical or ovate, 3–10 cm × 1–5.5 cm, base 3(–5)-veined with veins usually not running parallel to margins and becoming indistinct at or below the middle of the leaf; flowers whitish, female ones with 6 carpels; drupe rotund in outline, 4–5 mm in diameter, dark blue. In South-East Asia, *C. orbiculatus* often occurs near the sea-shore, but sometimes also inland on limestone terraces.

Selected sources 247, 249, 402, 403, 671, 981.

Francisca Murti Setyowati

Codonopsis javanica (Blume) Hook.f.

Ill. Himal. pl.: 116, t. 16B (1855).

CAMPANULACEAE

$2n = 16$

Synonyms *Campanumoea javanica* Blume (1826), *Campanumoea cordata* Miq. (1862), *Campanumoea maximowiczii* Honda (1936).

Vernacular names Indonesia: ki cepot (Sundanese), guci, indil-indil (Javanese). Vietnam: d[ar]ng s[aa]m, m[awf]n c[as]y, r[aaf]y c[as]y.

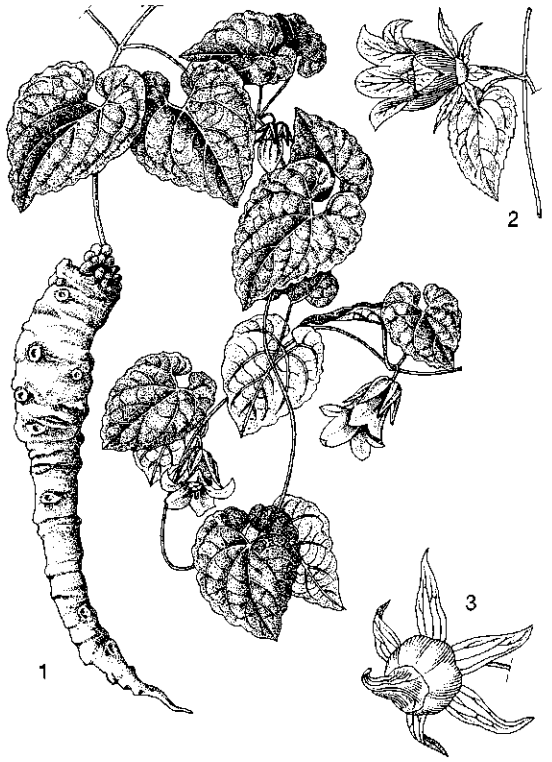
Origin and geographic distribution *C. javanica* occurs in eastern India, Burma (Myanmar), Indo-China, southern China, Taiwan, Japan, Thailand, Sumatra and Java. It is locally planted as a medicinal plant in Vietnam.

Uses *C. javanica* is not important as a medicinal plant in the Malesian region, with only one record on an obscure use of the root in Java. However, it is much more important in Indo-China. In Vietnam, the root is considered stomachic, expectorant and diuretic. Infusions, decoctions, pills, powders or elixirs from the roots are recommended as a general tonic, as a cough remedy and for the treatment of jaundice, dyspepsia, diarrhoea, oedema, haemorrhoids, and a wide range of urogenital and lymphatic afflictions. In China and Korea *Codonopsis* species are employed as a general tonic. In China the roots are also used to promote lactation. Several species (e.g. *C. pilosula* (Franch.) Nannf., *C. tangshen* Oliv.), indigenous or introduced in northern Vietnam, are imported and

mentioned in the Vietnamese Pharmacopoeia as Radix Codonopsis.

Properties The triterpene taraxerol was isolated from the roots of *C. javanica*, together with steroids, β-sitosterol and α-spinasterol. There is no information on pharmacological activities of *C. javanica*, but the related *C. pilosula* has been better investigated. In order to support its use in traditional medicine for the treatment of nephritis, *C. pilosula* was subjected to both in-vitro and in-vivo testing. Intraperitoneal injection in rats and in-vitro tests with endothelial cells and kidney homogenates revealed stimulatory effects on nitric oxide release. This may well contribute to the hypotensive effect and antinephretic action, possibly by increasing renal bloodflow. An extract of *C. pilosula* weakly stimulated lymphocyte proliferation in vitro. It enhanced cytotoxic T-lymphocyte activity, but failed to enhance natural killer-cell activity. The extract stimulated immunoglobin production by B-cells and interleukin-1 production by monocytes. Another experiment revealed that pollen of *C. pilosula* as a feed additive could efficiently counteract the liver toxicity in mice induced by CCl_4. An experiment using 5 animal models of gastric ulcer showed that an extract of *C. pilosula* had a significant effect on gastric ulcers induced by stress, acetic acid and sodium hydroxide, but little effect on ulcers induced by pyloroligature and indomethacin. The extract was also capable of reducing gastric acid pepsin secretion. It is possible that inhibition of gastro-intestinal movement and propulsion is one of the mechanisms involved in the anti-ulcer action of *C. pilosula* extract.

Botany A vigorous, perennial climber up to 3 m long, with tuberous roots; stems slender, twining, green, usually glabrous. Leaves opposite, but higher up often arranged spirally, simple, ovate to oblong-ovate, 2.5–8 cm × 2–5 cm, base cordate, apex obtuse, acute or acuminate, serrate, glabrous or slightly hairy; petiole 1.5–6.5 cm long; stipules absent. Flowers solitary, axillary, rarely terminal, bisexual, regular, 5-merous; pedicel 1–5.5 cm long; calyx implanted below the ovary, lobes lanceolate to oblong, 11–23 mm × 3–4 mm, entire or serrate, slighty to widely spreading, pale green; corolla broadly campanulate, 12–35 mm long, up to more than halfway lobed, greenish-white or yellowish-white outside, with purplish streaks inside; stamens (4–)6, free, inserted on the ovary; ovary inferior, (3–)4–5(–6)-celled, style cylindrical, 3–6-lobed. Fruit a subglobular berry 0.5–1.5 cm × 1–2.5 cm, red to dark purple, at the base sustained by the persistent red calyx lobes, and crowned by the withered corolla. Seeds ovoid, c. 1 mm long, pale brown.



Codonopsis javanica (Blume) Hook.f. – 1, plant habit; 2, flower; 3, fruit.

C. javanica can be found flowering and fruiting throughout the year. Generic delimitation of *Codonopsis* is problematic, with the genera *Campanumoea* and *Leptocodon* variously included or excluded. *Codonopsis* consists of some 40 species, and has a distinctive Asian distribution with species concentrated particularly in the temperate regions of the Himalaya and the mountains of western China. *C. javanica* belongs to the subgenus *Codonopsis*, characterized by carrot-like or branched tubers, and tubular or bell-shaped corolla emitting a foetid smell. The taxonomical status of the Vietnamese and Chinese *Codonopsis* species used in traditional medicine deserves more attention.

Ecology In Malesia *C. javanica* is found in open forest, forest edges, secondary growth and thickets or even meadows in mountainous areas at 1000–2500 m altitude. In northern Vietnam *C. javanica* and *C. pilosula* are planted in regions at higher elevations with a minimum rainfall of 2000 mm.

Management *C. javanica* and *C. pilosula* are propagated by seed. A yield of 600–700 kg roots/ha is obtained after 3 years.

Genetic resources Since *C. javanica* is widespread and variable, its genetic basis does not appear to be threatened. However, wild populations may seriously be affected by overcollecting in Indo-China and southern China.

Prospects The immunostimulating activity as observed in the related *C. pilosula*, supporting its use as a general tonic in local medicine, may likewise be present in *C. javanica*. Research is needed to determine its prospects as a medicinal plant of wider use in the Malesian region.

Literature 216, 247, 293, 477, 841, 1008.

Other selected sources 294, 334, 526, 531, 671, 980, 1017.

J.L.C.H. van Valkenburg

Coldenia procumbens L.

Sp. pl. 1: 125 (1753).
BORAGINACEAE
$2n$ = unknown

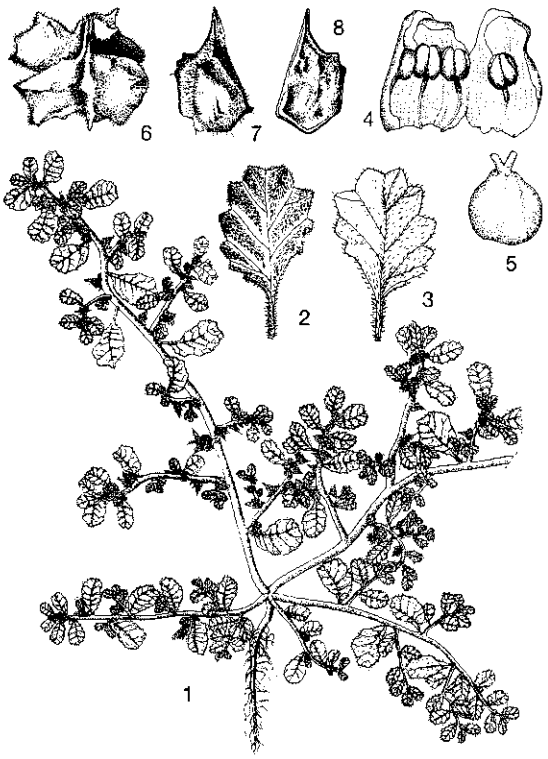
Vernacular names Philippines: tapiasin, oreganong-lalaki (Tagalog), tabatabokol (Iloko). Thailand: yaa teentukkae (Suphan Buri, Phitsanulok), yaa teentukto, yaa tupto (Chiang Mai). Vietnam: c[as]p di[eef]n.

Origin and geographic distribution *C. procumbens* is widespread in tropical and subtropical Africa, Asia and Australia. In Asia, it has been recorded from India, Sri Lanka, Burma (Myanmar), Indo-China, Taiwan, Hainan, Thailand, Peninsular Malaysia, Java, Borneo, the Philippines, the Lesser Sunda Islands, the Moluccas and New Guinea.

Uses In the Philippines *C. procumbens* leaves are used as a poultice to mature abscesses. In India, they are applied to rheumatic swellings.

Properties In a general pharmacological screening with mice and rats, an ethanolic extract of whole *C. procumbens* plants produced depression of the central nervous system and significant prolongation of the pentobarbital-induced sleeping time. It exhibited significant analgesic effects, but had no anticonvulsant effects, did not alter body temperature, and did not abolish conditioned avoidance responses. The acetone, ethanol and water extracts of dried aerial parts of *C. procumbens* showed weak angiotensin-converting enzyme inhibition.

Botany A small, annual, prostrate herb with



Coldenia procumbens L. – 1, plant habit; 2, leaf upper surface; 3, leaf lower surface; 4, corolla opened showing stamens; 5, pistil; 6, fruit; 7, nutlet dorsal surface; 8, nutlet ventral surface.

dorsiventrally compressed, ascendingly branched stems up to 50 cm long, greyish hairy. Leaves alternate, simple, asymmetric, oblong or obovate, 0.5–3 cm × 0.5–1.5 cm, crenate-dentate to lobulate, with 4–6 pairs of veins impressed above, prominent beneath; petiole up to 0.5 cm long; stipules absent. Flowers arranged between the leaves, bisexual, 4-merous, tiny, subsessile; calyx c. 1.5 mm long, slightly accrescent in fruit; corolla up to 2 mm long, with cylindrical tube and diminute lobes, white; stamens inserted about the middle of the corolla tube, included; ovary superior, glandular villous, style bifid nearly to the base. Fruit dividing initially into 2 halves, later each half into 2 one-seeded nutlets; nutlets sharply angulate ventrally, with a distinct beak.

The mesocarp (middle layer of the nutlet wall) is thick and corky at the dorsal side. This enables dispersal of the nutlets by water.

Coldenia is a monotypic genus. Several American species have been included, but these have now been referred to the genus *Tiquilia*, which com-

prises perennial herbs and subshrubs with symmetric leaves and 5-merous flowers.

Ecology *C. procumbens* is often found in seasonally flooded locations, e.g. on dry rice fields, where it is a common weed, but it can also withstand severe drought.

Genetic resources *C. procumbens* is sufficiently widely distributed and adapted to anthropogenic habitats to ensure its survival in the long run. It is sometimes even considered a potentially serious weed, e.g. in vegetable crops in the Andaman and Nicobar Islands.

Prospects The scanty information available on the pharmacological properties of *C. procumbens* seems to warrant more research because it indicates that the plant possesses analgesic properties.

Literature 247, 760, 768.

Other selected sources 117, 881.

N.O. Aguilar

Colocasia esculenta (L.) Schott

Schott & Endl., Melet. bot.: 18 (1832).

ARACEAE

$2n = 28$

Synonyms *Colocasia antiquorum* Schott (1832).

Vernacular names Taro, old cocoyam, dasheen, eddoe (En). Taro (Fr). Indonesia: bentul, talas, keladi. Malaysia: keladi, keladi china, birah keladi. Papua New Guinea: anega, ba, biloun. Philippines: gabi (Tagalog), abalong (Bisaya), natong (Bikol). Cambodia: tra:w. Laos: bo:n, phüak. Thailand: phuak (general), bon-nam (southern), tun (northern). Vietnam: khoai n[uw][ows]c, m[oo]n n[uw][ows]c, khoai s[oj].

Origin and geographic distribution Taro originated in South-East or southern Central Asia, where it was probably cultivated before rice. In Asia, it is planted in India, southern China, throughout Malaysia, locally in Java and Bali, throughout the Philippines, and in New Guinea. Taro is also grown in many islands of the Pacific, throughout the West Indies and in western and northern Africa.

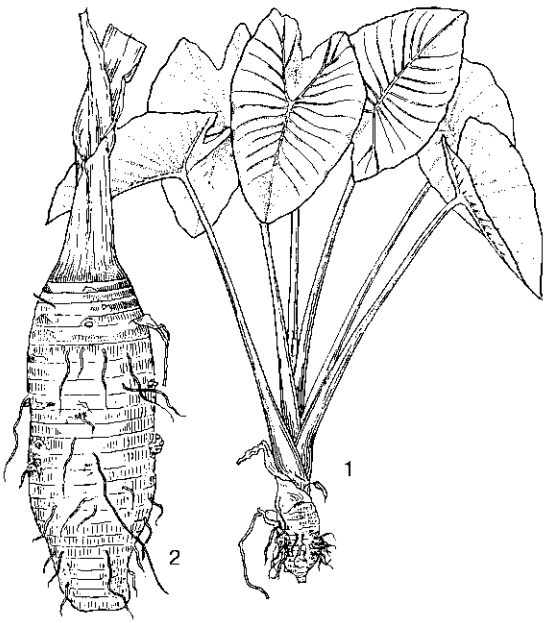
Uses Several uses of taro in traditional medicine are known for India, China and New Guinea. The corms are used to treat stomach-ache, diarrhoea, and as a poultice on sores and skin diseases. Chopped, tied in a cloth and heated the corms are used to treat rheumatism. The corm juice is used in cases of baldness, piles, as a laxative, and as an antidote to insect stings. Stems and leaves are applied to wounds including snakebites. Leaves are applied to burns, and are eaten to treat sore throat, dysentery and stomach-ache. The juice from the petioles is considered styptic and used to arrest arterial haemorrhage, and also to treat earache, inflamed glands, boils and as an external stimulant and rubefacient. The leaves are used for wrapping up a bolus of mustard-seed and garlic to be used as a prophylactic after childbirth.

The primary use of taro is as a food plant. When cooked, taro corms, cormels, stolons, leaf blades and petioles can be eaten. Most taro in South-East Asia is consumed by humans, but it also has uses in religious festivals and is fed to livestock, primarily pigs. Because it is easily digested and practically non-allergenic, taro can be used by persons with digestive problems. Taro corm puree makes an excellent baby food. A marked improvement in dental condition and a reduced incidence of pneumonia, diarrhoea, enteritis and beri-beri has been observed for babies fed with taro instead of bread and rice. The fine taro starch can be used as a soup thickener, for the production of alcohol and biodegradable plastics. The leaves are used as a wrapper for steamed food. Several cultivars are decorative ornamentals.

Properties Taro contains enzyme inhibitors, particularly with inhibitory activities against trypsin and chymotrypsin, but these are largely destroyed during cooking. Growth retardation was found in mice fed with lectin from taro corms. An α-D-galactosidase capable of converting group B red blood cells into group O, without apparent changes in the shape of the red blood cells, was isolated from the stem of taro. Taro leaves showed an aggravating effect on serum and tissue lipids in cholesterol-fed rats; there was a significant increase in total lipids, total cholesterol and triglyceride levels.

If eaten raw or undercooked, all parts of the plant are acrid and will irritate the mouth and throat, probably caused by bundles of needle-shaped crystals of calcium oxalate and one or more chemicals associated with them. Taro has very small starch particles, diameter 1–6.5 µm. Per 100 g edible portion corms contain approximately: water 70 g, protein 1.1 g, carbohydrates 26 g, fibre 1.5 g, vitamin C 15 mg. The energy value averages 475 kJ per 100 g. Leaves contain about 4.2% protein.

Botany A perennial (but mostly grown as an annual), erect herb up to 2 m tall; root system adventitious, fibrous and shallow; storage stem (corm) massive (up to 4 kg), cylindrical or spheri-



Colocasia esculenta (L.) Schott – 1, plant habit; 2, corm.

cal, up to 30 cm × 15 cm, usually brown, with lateral buds located above leaf scars giving rise to new cormels, suckers or stolons. Leaves arranged spirally, rosulate, simple, peltate, consisting of long petiole (sometimes over 1 m) with distinct sheath, and large, heart-shaped blade up to 85 cm × 60 cm, with rounded posterior lobes. Inflorescence a spadix tipped by a sterile appendage, surrounded by a spathe and supported by a peduncle that is much shorter than the petiole. Flowers unisexual, small, without perianth; male flowers in upper part of spadix, with stamens entirely connate; female flowers at base of spadix, with superior, 1-celled ovary having an almost sessile stigma; male and female flowers separated by a band of sterile flowers. Fruit a many-seeded berry, densely packed and forming a fruiting head. Seeds ovoid to ellipsoid, less than 2 mm long, with copious endosperm.

Corms reach maximum weight after 10–11.5 months when rainfed and 12–15 months when irrigated, but are usually harvested before this time.

Colocasia comprises 8 species from tropical Asia. It is classified in the tribe *Colocasieae*, together with e.g. *Alocasia*. There are 2 types of taro: the dasheen type and eddoe type, the latter with better developed cormels surrounding a smaller corm and frequently classified as var. *antiquorum* (Schott) Hubb. & Rehder. In South-East Asia, there are many taro cultivars.

Ecology Taro tolerates a wide range of environments and management systems. It grows well in wetlands. Temperatures of 25–30°C and high humidity favour growth. When grown as a rainfed crop, best yields are obtained when rainfall is at least 2000 mm/year and evenly distributed. Taro is grown from sea-level up to 1200 m altitude in Malaysia, 1800 m in the Philippines and even 2700 m in Papua New Guinea. It is shade tolerant and often grown as an intercrop with tree crops.

Management Farmers propagate taro vegetatively. Corm pieces, whole small corms, cormels and stolons can be planted, but suckers and headsets (corm apex plus 15–30 cm attached petiole bases) are usually preferred. Planting is done in hand-dug holes or machine-made furrows or ridges. Taro can be grown at densities of 4000–49 000 plants/ha. Weeding is most important during the first 3–5 months after planting. On soils that have been cropped several times, taro responds well to fertilizer, either inorganic or animal manures. Crop duration usually varies from 4–10 months for rainfed taro and 9–12 months for wetland taro. Harvesting is done by hand. Yields for rainfed taro probably average about 5 t/ha, but 12.5–25 t/ha is common on fertile soils. Yields in wetlands are higher and up to 75 t/ha have been reported.

Genetic resources Germplasm collections of taro are maintained at the National University of Malaysia, the Philippine Root Crop Research & Training Center and the Bubia Research Station in Papua New Guinea. Worldwide there are only a few taro breeding programmes focusing on agronomic improvements.

Prospects Although taro is fairly commonly used in traditional medicine, little or no research has been done on phytochemistry and pharmacological properties. The good digestibility and non-allergenic properties of taro make it an excellent substitute for bread and rice for persons sensitive for allergens from these products. However, some reports on adverse effects of taro warrant more research.

Literature 162, 245, 597, 754, 837.

Other selected sources 121, 347, 760.

Rosna Mat Taha

Connarus L.

Sp. pl. 2: 675 (1753); Gen. pl. ed. 5: 305 (1754).
CONNARACEAE
x = unknown

Origin and geographic distribution *Connarus* comprises approximately 80 species and occurs in all tropical areas: 7 species in Africa, about 20 in tropical Asia, 1 in Australia, 2 in Melanesia, and about 50 in tropical America. In the Malesian region, 19 species have been recorded.

Uses Many different parts of *Connarus* plants are used in South-East Asia. In traditional medicine, roots are used internally to treat fever, amenorrhoea and bubonic plague, and externally to treat itch. Bark is used to treat asthma, chest complaints and stomach-ache, and leaves to treat chest complaints, fever and as anthelmintic. In Peninsular Malaysia, the fruits of *C. ferrugineus* Jack have been used for killing dogs. The lianescent stems are used for binding. Young shoots of *C. semidecandrus* are occasionally eaten as a vegetable. The seed-oil of *C. monocarpus* is used in soap production in India.

In Africa, *C. africanus* Lamk (which is related to *C. monocarpus*) is used in traditional medicine. A hot decoction of the bark is used to wash ulcers, powdered bark is applied to wounds, and root bark serves as a taenicide. The sap from the leaves is administered in the form of nose drops in cases of syncope; aphrodisiac properties have also been attributed to it. Dried and ground seeds are taken as a purge and vermifuge. In tropical America, *Connarus* is also considered useful in traditional medicine, e.g. the leaves of *C. suberosus* Planchon are applied to treat malaria.

Properties The presence of myricetin, quercetin, kaempferol, delphinidin and cyanidin has been demonstrated in leaf extracts of *C. semidecandrus*. In India, 1% rapanon, 1.5% bergenin (an isocoumarin) and 1.3% leucopelargonidin (a flavone diol) have been isolated from *C. monocarpus* roots. The hepatoprotective effects of bergenin (isolated from *Mallotus japonicus* (Thunberg) Müll. Arg.) were evaluated against carbontetrachloride-induced liver damage in rats. The results clearly indicated that bergenin has a potent protective activity.

In tests on mice in Indonesia, an ethanolic extract of *C. grandis* leaves showed depressant activity on the central nervous system, and also dose-dependent sympholitic, parasympathomimetic and muscle-relaxant activities. Extracts of *C. suberosus* from South America also showed depressive action on the central nervous system of mice, rats and guinea-pigs, and additionally analgesic and anticonvulsive activities.

Botany Lianas or shrubs to small trees. Leaves alternate, imparipinnate or trifoliolate, rarely unifoliolate; stipules absent; leaflets opposite or not, usually acuminate at apex, often glandular punctate; stipels absent. Inflorescence an axillary panicle, often appearing terminal and compound by a reduced development of the leaves. Flowers bisexual, 5-merous, heterostylous; pedicel with a distinct joint; sepals connate at base, often thick and fleshy, usually glandular punctate; petals free or slightly coherent, more or less pilose outside and often glandular hairy inside, whitish to pinkish; stamens 10, epipetalous ones shorter and often rudimentary, filaments connate at base, longer ones often with stipitate glands, anthers often with glandular hairs at apex; ovary 1, superior, 1-celled, style often pilose and with stipitate glands. Fruit a follicle, opening lengthwise along the ventral suture, sometimes also along the dorsal suture, usually stipitate and with a short mucro apically, red when mature, 1-seeded. Seed attached to the ventral side of the follicle, ovoid or slightly kidney-shaped, testa shiny black with yellow and fleshy sarcotesta below the lateral hilum; cotyledons thick, planoconvex; endosperm absent. Seedling with hypogeal germination; cotyledons sessile, at most slightly spreading, testa persistent; first leaves opposite and unifoliolate or scale-like.

Connarus belongs to the tribe *Connareae* characterized by a single carpel per flower, together with *Ellipanthus*, which always has 1-foliolate leaves.

Ecology Most *Connarus* species are lianas of the forest at low and medium altitudes (up to 1100(–1400) m), but some can also be found in more open locations, even as a shrub in grassland.

Genetic resources The *Connarus* species treated here have a wide distribution and ecological amplitude, and are not at risk of genetic erosion. Several other species have a very limited distribution in South-East Asia and may easily become endangered, e.g. *C. agamae* Merr. and *C. lucens* Schellenb. in northern Borneo, *C. ferrugineus* Jack in Peninsular Malaysia, *C. lamii* Leenh. in Irian Jaya, and *C. schumannianus* Gilg in Papua New Guinea.

Prospects Very little research has been conducted on the chemistry and pharmacological properties of *Connarus*. However, the fact that *Connarus* is used in traditional medicine in all

tropical areas for similar complaints warrants more research.

Literature 120, 731.

Selection of species

Connarus grandis Jack

Mal. Misc. 2, 7: 40 (1822).

Synonyms *Connarus ellipticus* King (1897).

Vernacular names Indonesia: akar mambu (Sumatra), areuy ki caang, bangkongan (Sundanese). Malaysia: akar nyamok jantan, akar tulang daeng padang, akar chinchin (Peninsular).

Distribution Peninsular Malaysia, Sumatra, western Java, Borneo and the Philippines.

Uses A decoction of the bark (probably of this species) is used in southern Sumatra to treat asthma and other chest complaints.

Observations A large liana up to 30 m long, with stem up to 7.5 cm in diameter, rarely a shrub or small tree up to 7 m tall, with bole up to 18 cm in diameter; leaves with 3–5 leaflets, leaflets oblong-ovate to lanceolate-oblong, 5.5–27 cm × 3.5–12.5 cm, glabrous, more or less tripliveined; petals 6–7 mm long, often glabrous; fruit obovoid, 5–7 cm long, with thick and woody pericarp, mucro lateral. *C. grandis* occurs in primary, secondary and mossy forest, often in more open locations, up to 1400 m altitude.

Selected sources 51, 121, 247, 334.

Connarus monocarpus L.

Sp. pl. 2: 675 (1753).

Synonyms *Connarus oligophyllus* Wallich ex Planchon (1850).

Vernacular names Indonesia: ki carang areuy (Sundanese), feu feuw (Sumatra), akar kunjal (Bangka). Malaysia: akar tulang daeng, lelemak, merensa (Peninsular). Philippines: bago-bago (Panay Bisaya), ongali (Samar-Leyte Bisaya). Thailand: thopthaep (Pattani).

Distribution Sri Lanka, eastern India, southern Thailand and throughout Malesia except the Moluccas and New Guinea.

Uses In Peninsular Malaysia, a decoction of the bark is drunk to treat stomach-ache, and the pounded root is applied as a poultice to treat itch. In India, a decoction of the root is taken to cure syphilis, and the fruits to treat eye diseases. In India, a fatty oil is obtained from the seeds of *C. monocarpus* and used in soap production. The stems are used for binding purposes.

Observations A large liana up to 40 m long, with stem up to 15 cm in diameter, rarely a shrub or small tree; leaves with (3–)5–9 leaflets, leaflets ovate-elliptical to lanceolate, 4–14 cm × 2.5–7 cm, glabrous; petals 6–10 mm long, on both sides densely but minutely tomentose; fruit obliquely spindle-shaped to obliquely ellipsoid, 3–5 cm long, with thin and coriaceous pericarp, mucro apical. Two subspecies are distinguished: subsp. *monocarpus* from Sri Lanka and eastern India, and subsp. *malayanus* Leenh. from the Malesian region. *C. monocarpus* occurs in primary and secondary forest, also in more open locations and on limestone rock, up to 600 m altitude.

Connarus monocarpus L. – 1, flowering twig; 2, flower; 3, fruiting twig; 4, fruit; 5, seed.

Selected sources 121, 247, 249, 331.

Connarus semidecandrus Jack

Mal. Misc. 2, 7: 39 (1822).

Synonyms *Connarus mutabilis* Blume (1850), *Connarus neurocalyx* Planchon (1850), *Connarus gibbosus* Wallich ex Hook.f. (1876).

Vernacular names Indonesia: akar kalat (Sumatra), simbo krah (Kalimantan), kunit wawakas imbolay (Sulawesi). Malaysia: akar nyamok, akar tulang daeng, akar membur (Peninsular). Philip-

pines: sandalino (Tagalog), kamot (Pampangan). Cambodia: am pous, loum puos, loum pouh. Laos: houn hai[1], 'sop 'sêp (Vientiane). Thailand: thopthaep khruea (central), khaang daeng (northern), maak song (peninsular). Vietnam: d[aa]y l[oos]p b[oos]p.

Distribution The Andaman Islands, Burma (Myanmar), Indo-China (Cambodia, Laos and southern Vietnam), Thailand, throughout Malesia (except eastern Java and several of the Lesser Sunda Islands), Palau and the Solomon Islands.

Uses In Peninsular Malaysia and Thailand, a decoction of the leaves is used to treat chest-complaints, and the roots to treat fever. Leaves and stems possess laxative, anthelmintic and antipyretic properties, and they are used in the treatment of parasitic diseases in children. In the Philippines, a decoction of the root is taken internally to treat amenorrhoea and as a uterine tonic. In Cambodia, the roots are used in the treatment of bubonic plague. Young shoots are eaten as a vegetable in Indo-China and the Moluccas. The stems are used for binding purposes.

Observations A large liana, scandent or creeping shrub, or small tree, with stem up to 10 cm in diameter; leaves with 3–7(–11) leaflets, leaflets elliptical to lanceolate, 4–25 cm × 2–9 cm, glabrous or minutely pubescent below; petals 2.5–7 mm long, outside glabrous except margins and apex, inside glandular pubescent; fruit obliquely pyriform to semi-ellipsoid, 1.5–4 cm long, with thin and coriaceous pericarp, mucro apical or nearly apical. *C. semidecandrus* occurs in primary and secondary forest, often in more open locations, but also in thickets in grassland, on dry as well as swampy soils, on granite as well as limestone, up to 1100 m altitude.

Selected sources 121, 173, 247, 249, 250, 331, 760.

Wardah

Conyza sumatrensis (Retz.) E.H. Walker

Journ. Jap. Bot. 46: 72 (1971).
COMPOSITAE
$2n$ = unknown

Synonyms *Erigeron sumatrensis* Retz. (1789), *Erigeron linifolius* auct. non Willd.

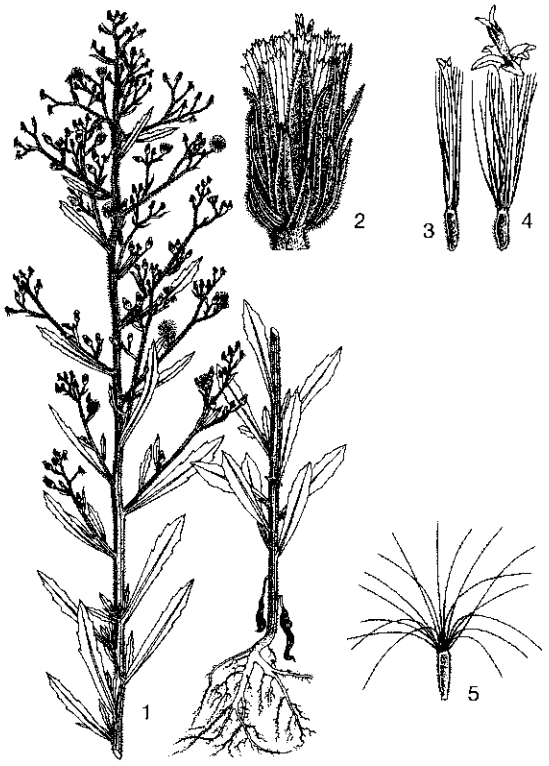
Vernacular names Fleabane (En). Indonesia: jalantir, monyenyen (Sundanese), sembung (Javanese). Malaysia: chapa, sawi bulan, tembak-tembak hutan. Vietnam: c[us]c voi.

Origin and geographic distribution *C. sumatrensis* originates from South America, but has at present a pantropical distribution. It has even spread as a weed to more temperate areas, e.g. in Europe.

Uses In Java pounded *C. sumatrensis* root enters into a compound prescription to treat lumbago. A paste of ground leaves is applied as a poultice on the forehead to soothe headache. In Peninsular Malaysia leaves are used to treat rheumatism or lumbago. A root decoction may be taken as a post-partum protective medicine. In Africa leaf juice is applied in a poultice as febrifuge for small children, or simply rubbed on the body in adults. Leaf sap is used as a remedy for ophthalmia in the form of nose or eye drops. Nasal drops are also given in cases of vertigo and epilepsy. The leaves are made into cigarettes to treat tuberculosis and asthma. They may be used as a vegetable.

Properties In a general screening experiment, the essential oil from *C. sumatrensis* leaves was markedly effective against *Aspergillus niger* even at low concentrations (1 µl/ml growth medium). Lachnophyllum lactone and osthol isolated from *C. sumatrensis* exhibited repellent activity against sea snails.

Botany A short-lived perennial, erect herb up to 350 cm tall, strongly branched in upper part. Leaves alternate, simple, oblanceolate to linear-oblanceolate, 3–12 cm × 0.3–3 cm, gradually tapering at base, larger ones sparsely coarsely dentate-serrate in the upper part, smaller ones often entire, grey-hairy on both sides, sessile; stipules absent. Inflorescence a small cylindrical head 5–6 mm long, many together arranged in a long leafy panicle, many-flowered, shortly peduncled; involucral bracts 3-seriate, linear, 2–5 mm long, erect, later patent, in fruit reflexed. Flowers all tubular, c. 4 mm long; marginal flowers female, corolla with 2-lobed apex, pale yellow to purplish, shortly exserted from the involucre; disk flowers bisexual or male, with narrowly funnel-shaped corolla widening into 5 lobes, pale yellow; stamens 5, forming a tube, exserted; ovary inferior, 1-celled, style with 2 short, thick arms. Fruit a small, compressed, ellipsoid achene 1.5–2 mm long, with narrowed base and thickened margins, sparsely hairy; pappus hairs numerous, 1–2-seriate, 3–4 mm long, thin, toothed. Seedling with epigeal germination; hypocotyl c. 1 mm long; cotyledons subsessile, elliptical to ovate; epicotyl absent.
C. sumatrensis can be found flowering and fruiting throughout the year. It has no seed dormancy, and the fruits are wind dispersed.



Conyza sumatrensis (Retz.) E.H. Walker – 1, plant habit; 2, flower head; 3, marginal flower; 4, disk flower; 5, fruit.

Conyza comprises about 60 species, and occurs primarily in tropical and subtropical regions. Several species are widespread weeds, e.g. *C. bonariensis* (L.) Cronq. and *C. canadensis* (L.) Cronq.

Ecology *C. sumatrensis* occurs gregariously in sunny or slightly shaded, dry or moist localities on a wide range of soils in regions with a weak or pronounced dry season. It can be found in grassland, roadsides, wasteland, fields, secondary forest, and rubber and tea plantations, from sea-level up to over 3000 m altitude.

Management In South-East Asia *C. sumatrensis* is considered a not too harmful weed. It is relatively easy to remove during the early stages of its development, but more difficult when the stem base has become woody.

Genetic resources *C. sumatrensis* is a pantropical weed, well adapted to disturbance and is not threatened by genetic erosion.

Prospects Little is known about the pharmacological properties of *C. sumatrensis*. Further research is needed to evaluate the potential of its traditional medicinal uses.

Literature 120, 121, 208, 334, 879.
Other selected sources 62, 112, 667.

J.L.C.H. van Valkenburg

Coptosapelta tomentosa (Blume) Valeton ex K. Heyne

Nutt. pl. Ned. Ind. ed. 2, 2: 1384 (1927).
RUBIACEAE
$2n$ = unknown

Synonyms *Coptosapelta flavescens* Korth. (1851).

Vernacular names Indonesia: kertupai (Lampung), akar metedong (Bangka). Malaysia: peruwal, prual (Peninsular). Laos: dok khat khao. Thailand: yaan khlong (peninsular). Vietnam: d[aa]y v[af]ng hoan.

Origin and geographic distribution *C. tomentosa* is found from Burma (Myanmar) to Indo-China, Thailand, Peninsular Malaysia, Sumatra, Bangka, Java and Borneo.

Uses For medicinal purposes, the roots of *C. tomentosa* are most important. In Peninsular Malaysia, a decoction of the roots is taken to treat intestinal worms; a lotion or poultice is applied to young children. A decoction of the roots is also taken to treat colic, fever and ulceration of the nose. An infusion, drunk cold, is used as a protective medicine after childbirth. The boiled, dried and powdered roots are rubbed on the whole body against fever and rheumatism. In Sumatra, a cold infusion of the roots is taken to treat intestinal worms, and a poultice is applied against flatulence or fever. In Vietnam, an ointment of the roots is used to treat dropsy. It also has diuretic and detoxicating effects, and is used to treat fever, beriberi and rheumatism. It also regulates menstruation. The leaves are applied on wounds. In Peninsular Malaysia, the bark seems to be used as dart poison for small game, but there is also mention that it is possibly sometimes mistaken for a *Strychnos* species.
A decoction of roots and leaves of *C. griffithii* Hook.f. from Peninsular Malaysia is taken to treat stomach-ache, colic and fever.

Properties Nothing is known about the chemistry of *C. tomentosa*. An extract of the bark, injected into frogs, caused local paralysis of the muscles, and large doses stopped the heart. In rabbits, however, no effects were observed. *C. diffusa* (Champ. ex Benth.) v. Steenis contains the triterpene thysanolactone.
Coptosapelta is an active aluminium accumulator,

a feature that occurs mainly in the primitive taxa of the *Rubiaceae* occurring in tropical forests with relatively high rainfall.

Botany A liana up to 8 m long; branches at apex densely yellowish-brown pubescent. Leaves opposite, simple, ovate-oblong or oblong, 5–16 cm × 2–7.5 cm, base rounded, apex acuminate, glabrous above, pubescent on veins beneath when young, glossy; petiole 0.7–1.5 cm long, pubescent; stipules interpetiolar, triangular, concave, 3–6 mm long, with appressed long white hairs along margins. Inflorescence a cyme, terminal and in upper leaf axils, united into a terminal, drooping, pubescent panicle 8–35 cm long. Flowers bisexual, 5-merous, white, gradually turning orange-yellow, fragrant; calyx tube campanulate, pubescent, lobes obtuse, 1.5–2 mm long, ciliate; corolla tube narrow, 5–8 mm long, appressed hairy outside, lobes contorted in bud, 8–11 mm × 2 mm; stamens 5, inserted in the throat of the corolla, filaments 1.5 mm long, anthers linear, c. 10 mm long, slender, sagittate, pilose, exserted; ovary inferior, 2-celled, style filiform, shorter than corolla lobes, upper part thickened, hairy, green, entire. Fruit a 2-celled capsule, compressed globose, 1–1.5 cm long, glabrous, yellow, loculicidally 2-valved, many-seeded. Seeds small, radiatingly ribbed, winged all around, wing divided into narrow lobes.

C. tomentosa flowers in Java from December–March, and in Indo-China flowering is in September, and fruiting in March. The flowers are protrandrous; already in bud, the pollen is found on the style and in opened flowers the anthers are empty.

The small Indo-Asiatic genus *Coptosapelta* comprises 4–6 species. The monotypic genus *Thysanospermum* Champ. ex Benth. from southern China, Taiwan and the Ryukyu Islands is reduced to *Coptosapelta*. The species *C. diffusa* (synonym: *Thysanospermum diffusum* Champ. ex Benth.) does not occur in Malesia.

Ecology *C. tomentosa* occurs in secondary forest, brushwood and along forest margins, climbing to tops of trees, in Java from sea-level up to 550 m altitude. It is rare but can be locally abundant.

Management In Vietnam, the roots and stems of *C. tomentosa* are harvested throughout the year. They are mainly used fresh.

Genetic resources and breeding There is possibly some danger of genetic erosion, because *C. tomentosa* is harvested from natural populations only, and, moreover, it is uncommon. There are no known breeding programmes.

Prospects The rather numerous medicinal applications of *C. tomentosa* in different parts of South-East Asia may be a startingpoint for research.

Literature 18, 121, 216, 307.

Other selected sources 62, 334, 414, 731, 789, 951.

S. Brotonegoro

Coriaria intermedia Matsum.

Bot. Mag. Tokyo, Bot. Soc. 12: 62 (1898).

CORIARIACEAE

$2n = 40$

Synonyms *Coriaria japonica* A. Gray subsp. *intermedia* (Matsum.) T.C. Huang (1992).

Vernacular names Philippines: baket, buakat, bikit (Igorot).

Origin and geographic distribution Taiwan and the Philippines (northern Luzon).

Uses *C. intermedia* is used in Taiwan to treat gastro-intestinal disorders, rheumatism and cancer of the uterus. In the Philippines, a decoction of the leaves and fruits is considered deadly poisonous. Other *Coriaria* species are also used medicinally, e.g. *C. papuana* Warb. as an emetic in Papua New Guinea, and *C. myrtifolia* L., which is sometimes used in southern Europe as an intestinal astringent and for the preparation of astringent compresses. However, caution is required when using *Coriaria* as a medicinal plant, because of the presence of toxic principles.

Coriaria species have been used in various regions of the world for tanning and dyeing blackish. Several of them possess root nodules with atmospheric nitrogen-fixing properties and may be useful in planting programmes for erosion control.

Properties *C. intermedia* and many other *Coriaria* species contain bitter, toxic lactones and produce large amounts of ellagitannins. The toxic principles are picrotaxan-type sesquiterpenes such as coriamyrtin, corianin, coriatin and tutin. These have convulsive, insecticidal and ichthyotoxic activities. Coriamyrtin, which is present in *C. intermedia* fruits (up to almost 0.2%), is a bulbar and medullar stimulant. Symptoms of intoxication include epileptiform convulsions, myosis and dyspnoea; a coma might follow, as well as death by respiratory or cardiac arrest. In China, a mixture of the crystalline sesquiterpenes, including coriamyrtin and tutin, has been used by muscle injection for the treatment of catatonia; it is applied as a shock therapy for schizophrenia. Glycosides of the flavonols kaempferol and quercetin

were present in all *Coriaria* species investigated. The seeds contain much fatty oil, coriolic acid being the main fatty acid. Honey produced from *Coriaria* may be toxic, as reported from New Zealand.
Leaves of *C. japonica* are known to show antitumour and antiviral properties.

Botany A shrub up to 3 m tall; roots forming nodules. Leaves decussately opposite, simple and entire, oblong to slightly ovate, (3–)5–7 cm × 1.5–2.5 cm, cuneate at base, acute at apex, glabrous, 3-veined; petiole c. 2 mm long; stipules absent, but near the leaf axils numerous minute emergentia often present. Inflorescence consisting of subaxillary fascicles of 1–3 racemes 4–10 cm long, with ovate bracts up to 5 mm long. Flowers bisexual or unisexual, regular, 5-merous, yellowish-green; pedicel 2–7 mm long; sepals free, broadly ovate, c. 3 mm long, persistent; petals free, shorter than sepals, accrescent and becoming fleshy; stamens 10; carpels 5, free, 1-celled, each with a papillose style. Fruit (pseudo-fruit) consisting of laterally compressed achenes, more or less enclosed by the fleshy-accrescent petals, up to 5 mm in diameter. Seeds one per achene, compressed.
When plants start flowering, the first inflorescences consist of male flowers, followed by racemes of female flowers, which again overlap slightly with a second phase of male ones. The flowers with exerted stamens and styles are adapted to wind pollination. The fleshy pseudofruits are probably dispersed by birds.
Coriaria comprises about 20 species with a much interrupted distribution: the West-Mediterranean region of Europe and northern Africa, the Himalayas, eastern Asia, New Zealand, and western South America and Central America. In Malesia, 2 species are found: *C. intermedia* in the Philippines, *and C. papuana* in Papua New Guinea. *C. intermedia* is closely allied to *C. japonica* A. Gray and is even considered by some authors to be conspecific.

Coriaria intermedia Matsum. – 1, fruiting branch; 2, male flower; 3, female flower; 4, fruit; 5, fruit in cross section.

Ecology *C. intermedia* occurs in thickets, open forest, on sunny and stony slopes, and often in dry riverbeds and watercourses, in the Philippines in the mountains at 1400–2400 m altitude. In general, *Coriaria* species are often pioneer plants, growing gregariously in exposed locations.

Management Experiments with *C. nepalensis* Wallich in India showed that propagation by cuttings is possible, but with a maximum rooting success of only 40% when using growth promotors.

Genetic resources Although *C. intermedia* has a limited distribution, its pioneer character would seem to protect it sufficiently against threats.

Prospects The possibilities for using *C. intermedia* as a medicinal plant seem to be limited due to its toxicity. However, some interesting properties found in *Coriaria* species warrant more research, such as the antitumour and antiviral properties of the leaves.

Literature 142, 247, 760, 929.
Other selected sources 380, 698.

R.H.M.J. Lemmens

Corymborkis veratrifolia (Reinw.) Blume

Coll. Orchid.: 125, pl. 42 fig. E, pl. 43 fig. 1 (1859).
ORCHIDACEAE
$2n = 40, 58$
Synonyms *Corymborkis longiflora* (Hook.f.) O. Kuntze (1891).
Vernacular names Malaysia: lelumbah paya,

kayu hok (Peninsular). Thailand: klon duu (Surat Thani), waan haang hanumaan (Yala), lek naang yong (Pattani). Vietnam: d[ij]a lan l[as] d[uwf]a, t[ar]n lan.

Origin and geographic distribution *C. veratrifolia* is widely distributed in tropical Asia, from India, Sri Lanka and the Andaman Islands, through Indo-China, Thailand and the whole of Malesia (except the eastern Lesser Sunda Islands), to some islands of southern Japan, some of the Caroline Islands, the Solomon Islands, the Santa Cruz Islands, Vanuatu, Fiji, Samoa and to Australia (Cape York Peninsula).

Uses In Peninsular Malaysia, the juice of fresh leaves is used to cause vomiting as a means of breaking fever, especially in children; the plant is even commonly cultivated for this purpose.

In Africa, *C. corymbis* Thouars is used in traditional medicine: an infusion of the leaves and a decoction of the roots are taken as a purge.

C. veratrifolia is occasionally cultivated, e.g. in Java, and it has been recorded there as being often found on old graves, perhaps indicating ritual uses.

Properties The freshly gathered roots have a strong odour of stale urine. *C. veratrifolia* has been found alkaloid positive, but in small concentration. It is one of the very few plants that survive in large numbers on the forest floor on Christmas Island, where plants are subject to heavy predation by red land crabs. This may be due to the presence of alkaloids.

Botany A small to large terrestrial herb 40–310 cm tall, with short, sympodially branching rhizome, creeping subterraneously; roots fasciculate and wiry; stems often several from one rhizome, erect, unbranched, leafy. Leaves distichous, but often apparently arranged spirally, the lowermost without blades, narrowly elliptical or narrowly ovate, 15–50(–110) cm × 3–14(–18) cm, plicate with 6–11 main veins, tapering at base into sheathing base, acute or acuminate at apex; petiole absent or very short. Inflorescence an erect to drooping axillary panicle up to 15 cm long, with 2–9 branches, up to 70-flowered, with distichously arranged flowers. Flowers bisexual, 3-merous, white to greenish-white, fragrant; pedicel short, twisted; sepals linear-spatulate to narrowly oblong-spatulate, 1.5–5.5 cm long, about equal in length; petals obliquely linear-spatulate to obliquely obovate, about as long as sepals, labellum spatulate, 1.5–5 cm long, with 2 longitudinal keels embranching the column, and a reflexed apical lamina; column slender and straight, with 2 terminal lateral auricles; rostellum erect, bifid at apex; clinandrium ovate, marginate; anther ovate, with 2 pollinia on long slender caudicle, attached to a peltate viscidium; ovary inferior, cylindrical, stigma with 2 recurved deltoid sidelobes. Fruit a capsule up to 4 cm long, strongly 6-ribbed, crowned by the remnants of perianth and column, containing numerous seeds.

C. veratrifolia can be found flowering throughout the year, but in regions with a distinct rainy season flowering can be limited to this period. The flowers are pollinated by hawk moths, as has been observed in Java.

Corymborkis is a small genus of 6 species, and is pantropical in distribution: 3 species in tropical America, 2 in tropical Africa, and 1 in tropical Asia. It is placed in the subtribe *Tropidiinae*, and is related to *Tropidia*, which differs in the often branched stems, terminal inflorescences, spurred or saccate labellum and shorter column. *C. veratrifolia* is a variable species, especially in the size of the floral parts. Var. *lauterbachii* (Schlechter) F.N. Rasm. is distinguished from var. *veratrifolia* by narrower leaves and is endemic to New Guinea.

Ecology *C. veratrifolia* prefers shaded and moist localities on the floor of evergreen forest, from sea-level up to 2000 m altitude. It has also been recorded from secondary forest. It is locally common, sometimes even abundant (e.g. on Christmas Island), but usually occurs scattered in small clumps.

Genetic resources *C. veratrifolia* has a very large area of distribution and does not seem to be endangered. Breeding activities are not known to exist.

Prospects As far as is known, *C. veratrifolia* has never been subject to detailed phytochemical investigations or to testing for pharmacological properties. Research seems worthwhile judging from the uses in traditional medicine in South-East Asia and from medicinal applications of a related species in Africa. *C. veratrifolia* has been recommended for cultivation as an ornamental, suitable for shaded spots in tropical gardens.

Literature 121, 222, 771.

Other selected sources 62, 120, 731.

R.E. Nasution

Coscinium fenestratum (Gaertner) Colebr.

Trans. Linn. Soc. 13: 65 (1821).
MENISPERMACEAE
$2n$ = unknown

Synonyms *Coscinium wallichianum* Miers (1871), *Coscinium usitatum* Pierre (1885), *Coscinium blumeanum* auct. non Miers ex Hook.f. & Thomson.

Vernacular names Indonesia: akar kuning (Java), akar kunyit (Bangka), upak-upak (East Kalimantan). Malaysia: kunyit-kunyit babi (Peninsular), abang asuh (Sabah), perawan (Sarawak). Thailand: khruea hen (north-eastern), khamin khruea (south-eastern). Vietnam: v[af]ng d[aws]ng, ho[af]ng d[awf]ng, d[awf]ng giang.

Origin and geographic distribution *C. fenestratum* has been found in southern India, Sri Lanka, Cambodia, Vietnam, Thailand (rare), Peninsular Malaysia, Sumatra, Bangka, western Java and Borneo.

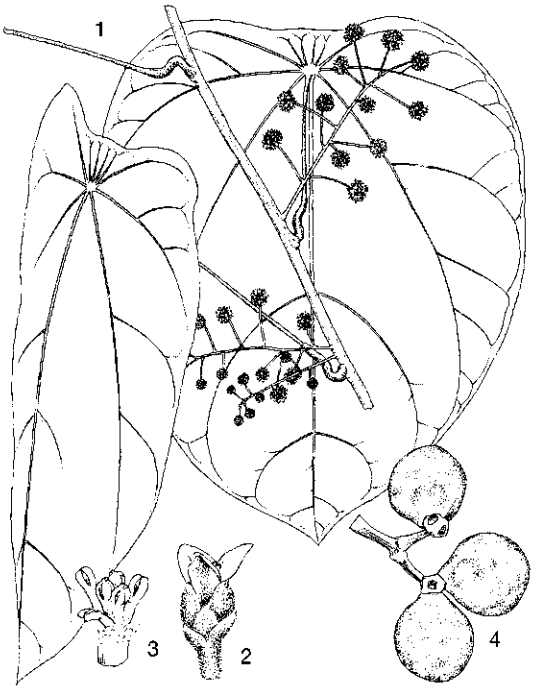
Uses The roots of *C. fenestratum* have alleged antiseptic properties and are commonly used to dress wounds, burns and ulcers, e.g. in Peninsular Malaysia. In India and Indo-China, an infusion of the root and wood of the stem is used against fever, as a stomachic, and to treat dysentery, jaundice and eye inflammations. It has also been applied in a complex decoction after childbirth in Peninsular Malaysia. In India, *C. fenestratum* is traditionally used as a prophylactic against tetanus. The roots have been sold as a substitute for 'Radix Calumba' (the roots of *Jateorhiza palmata* (Lamk) Miers, a liana of the same family originating from Africa and containing similar alkaloids). In Vietnam, tablets made from crude alcoholic *C. fenestratum* extracts are prescribed to cure dysentery.

The roots and bark are also used as piscicide and as an ingredient of dart poison. The tubers are reputedly eaten. The wood produces a yellow dye, which has been much used in Cambodia and, to a lesser extent, elsewhere.

Properties Pharmacological screening of an aqueous methanol (1:1) extract showed convulsant activity, but no antitumour activity. An aqueous extract of *C. fenestratum* revealed selective inhibitory action on *Clostridium tetani*, with the alkaloid berberine as the active constituent. In clinical tests in Vietnam, the extract also showed distinct activity on *Staphylococcus aureus* and *Streptococcus hemolyticus*, which may cause inflammation and infection especially in women after childbirth. A 50% ethanol extract of stem material showed a dose-related hypotensive action in anaesthetized dogs, rats and guinea-pigs.

Many alkaloids, mainly of the protoberberine type, have been isolated from stems and roots of *C. fenestratum*, e.g. magnoflorine, berberrubine, thalifendine, berberine, palmatine, jatrorrhizine and oxyberberine. The major alkaloids are berberine and jatrorrhizine. The pharmacological effects of berberine have been fairly well investigated. It has been found active against a number of gram-positive as well as gram-negative bacteria, and also against a number of fungi. It was also effective against experimentally induced intestinal amoebiasis in rats, and showed growth inhibition of Ehrlich and lymphoma ascites tumour cells. The antidiarrhoeal properties of berberine may be mediated, at least in part, by its ability to delay small intestinal transit time. Berberine is also present in high concentrations in other *Menispermaceae* species, e.g. in *Arcangelisia flava* (L.) Merr., which is used for similar complaints as *C. fenestratum*.

Botany A dioecious liana up to c. 10 m long, with yellow wood and sap. Leaves arranged spirally, simple, broadly ovate or ovate, rarely subpanduriform, 11–33 cm × 8–23 cm, base rounded,



Coscinium fenestratum (Gaertner) Colebr. – 1, part of male flowering stem; 2, male flower; 3, stamens; 4, infructescence.

truncate to shallowly cordate, apex acuminate, palmately 5–7-veined; petiole 3–16 cm long, often conspicuously swollen at both ends, geniculate at base, inserted up to 0.8(–2.7) cm from basal margin of leaf blade (and leaf thus often peltate); stipules absent. Inflorescence a globose head 6–7 mm in diameter on a peduncle 10–30 mm long, arranged in a raceme 5–11 cm long, supra-axillary or on older, leafless stems, brown tomentose. Flowers unisexual, small, yellowish or whitish; sepals 9, in 3 whorls, imbricate, densely sericeous-pilose; petals absent; male flowers with 6 stamens, outer 3 free, inner 3 connate; female flowers with 6 staminodes and 3 superior, densely pilose carpels. Fruit consisting of 1–3 subglobose drupes c. 3 cm in diameter, brown to orange or yellowish, drupe 1-seeded. Seed subglobose, whitish, with divaricate, much folded and divided cotyledons; endosperm present.

It has been observed that the fruits are dispersed by orang-utans, gibbons and macaques, which eat the fruits.

Coscinium comprises 2 species: the widely distributed *C. fenestratum* and *C. blumeanum* Miers ex Hook.f. & Thomson, which has a very restricted distribution (peninsular Thailand, and Penang and Pangkor Island of Peninsular Malaysia). The name *C. blumeanum* has often been wrongly applied to *C. fenestratum*, and the uses reported in the literature for *C. blumeanum* probably refer to *C. fenestratum*.

Ecology *C. fenestratum* occurs in primary lowland forest, sometimes also in brushwood, up to 200 m altitude.

Management Callus and cell suspension cultures have been established from sterile petiole segments on Murashige and Skoog medium, supplemented with 2,4-dichlorophenoxy acetic acid and benzyl amino purine. The cultured cells produced berberine as the major compound. The presence of light inhibited the growth and enhanced the berberine synthesis.

Genetic resources *C. fenestratum* is fairly widely distributed, and is locally common (e.g. in Peninsular Malaysia and southern Vietnam), but elsewhere rare (e.g. in Thailand and Java). Wild populations of *C. fenestratum* have been important in Vietnam for berberine extraction to produce drugs since the beginning of the 1980s. They have been under heavy pressure since then, and should be protected from excessive exploitation. In India and Sri Lanka, *C. fenestratum* has already been listed as an endangered species.

Prospects Like other *Menispermaceae* species, *C. fenestratum* is considered an important medicinal plant. The alkaloids of the berberine class have several pharmacologically interesting activities and are generally considered safe at doses used in clinical situations. Large-scale production of alkaloids from *C. fenestratum* seems possible through tissue culture, and this might also lower the pressure on wild populations of the species.

Literature 247, 660, 862, 871.

Other selected sources 62, 121, 249, 334, 592, 671, 717, 731, 906.

Andria Agusta

Crassocephalum crepidioides (Benth.) S. Moore

Journ. Bot. 50: 211 (1912).

COMPOSITAE

$2n = 40$

Synonyms *Gynura crepidioides* Benth. (1849).

Vernacular names Papua New Guinea: thick head (Pidgin), marago beja (Kaluli, Southern Highlands), yogobikabika (Bwaidoga, Goodenough Island, Milne Bay). Thailand: phakphet chaang (Mae Hong Son), yaa kho on (Chiang Mai), phakhaan (Loei). Vietnam: rau t[aaf]u bay.

Origin and geographic distribution *C. crepidioides* originates from Africa and Madagascar, but is now naturalized throughout tropical and subtropical Asia, Australia, the New Hebrides, Fiji, Tonga and Samoa. It was found near Medan (northern Sumatra) in 1926, was introduced in Java, and subsequently spread throughout Indonesia. It is now found throughout South-East Asia.

Uses In Papua New Guinea *C. crepidioides* leaves are used externally to treat sores and irritation of the penis. The leaves are considered mildly stomachic in Africa, and are applied to treat indigestion, colic and flatulence. In Africa the leaves are also used as an analgesic to treat headache and epilepsy, whereas powdered leaves are administered as a snuff to stop nosebleeds and smoked to treat sleeping sickness.

Young plants are used as a vegetable in Vietnam and Japan, and in Africa the mucilaginous leaves are eaten in soups and sauces, and with groundnuts. The plants are readily eaten by livestock, and they are considered a useful green fodder for poultry. *C. crepidioides* has been used successfully as a trap plant to collect adult corm weevils in banana plantations.

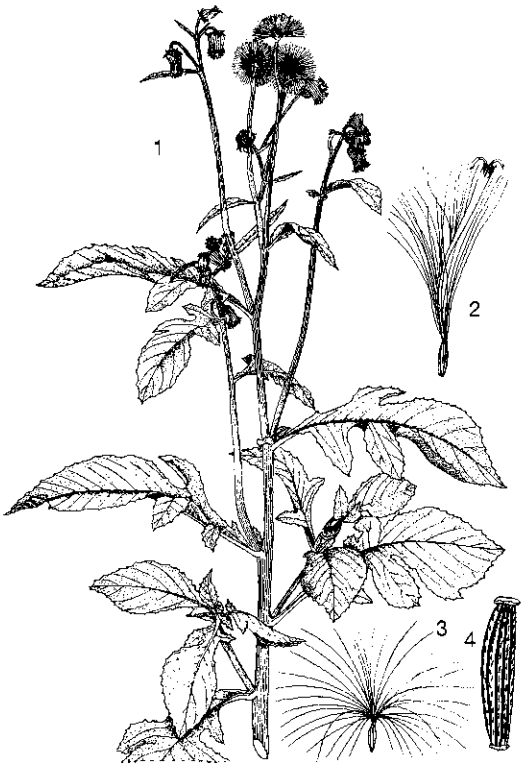
Some other *Crassocephalum* species are used in traditional medicine in Africa, e.g. *C. rubens*

(Juss. ex Jacq.) S. Moore internally as a stomachic and to treat liver complaints and colds, and externally to treat burns, sore eyes, earache and breast cancer, and *C. vitellinum* (Benth.) S. Moore to treat infected eyes, gonorrhoea and suppurations, and as a galactagogue.

Properties *C. crepidioides* extracts showed moderate antimutagenic activity in *Salmonella typhimurium* TA98 and TA100. The roots have been reported to contain tannin. The pyrrolizidine alkaloids jacobine and jacoline were isolated from the aerial parts of Japanese *C. crepidioides*; jacobine proved to be hepatotoxic.

Botany An erect, sparingly branched annual herb up to 100 cm tall; stem rather stout, soft, ribbed, branches pubescent. Leaves arranged spirally, elliptical, oblong or obovate-elliptical in outline, 8–18 cm × 2–5.5 cm, pinnately lobed or pinnatifid, irregularly serrate, base tapered and often long-decurrent into the petiole, upper leaves sessile; stipules absent. Inflorescence a head arranged in terminal, rather small corymbs, cylindrical, 13–16 mm × 5–6 mm, nodding during anthesis, afterwards erect, many-flowered; inner involucral bracts 1–2-seriate, initially coherent, lanceolate, 8–12 mm long, pellucid-marginate, outer involucral bracts linear, unequal, 1–4 mm long; hypanthium flat, epaleate. Flowers bisexual, equal; corolla tubular, 9–11 mm long, yellow with reddish-brown top, tube long and slender, limb short, 5-fid; anthers 5, united, purplish; ovary inferior, 1-celled, style bifid, arms long, having apical appendages. Fruit a cylindrical-linear, ribbed achene c. 2 mm long, crowned by numerous white, minutely toothed, caducous pappus hairs 9–12 mm long. Seedling with epigeal germination; hypocotyl long, up to 2 cm long; cotyledons broad-ovate, glabrous, shortly petiolate.

The fruits with the long pappus are dispersed by wind over long distances. In Indonesia *C. crepidioides* is often confused with *Erechtites valerianifolia* (Wolf) DC.



Crassocephalum crepidioides (Benth.) S. Moore – 1, upper part of flowering and fruiting plant; 2, flower; 3, fruit with pappus; 4, fruit without pappus.

Ecology *C. crepidioides* occurs as a weed on arable land, riversides, roadsides, tea, coffee, cinchona, sweet potato, taro and citrus plantations, and in upland rice fields, particularly in wetter localities, at 200–2500 m altitude. It may also be a dominant pioneer species in shifting cultivation sites that have been recently burned.

Management *C. crepidioides* is usually a weed of minor importance that can be easily eradicated. However, in young tea plantations it may become a serious weed. Paraquat is often used to control *C. crepidioides* as a weed, but resistance to this herbicide has developed in several South-East Asian countries.

Under experimental conditions, seeds stored under dry conditions still germinated after 20 months, but after 22 months of dry storage they began to lose their viability.

Genetic resources *C. crepidioides* is certainly not endangered. On the contrary, it has recently become a widespread weed of the Old World tropics, and it is still extending its area of distribution.

Prospects The fact that *Crassocephalum* species are used in traditional medicine in different parts of the world, often for comparable complaints such as stomach troubles, justifies more research. Research on the safe use as a vegetable is desirable since pyrrolizidine alkaloids, which are hepatotoxic or even carcinogenic, are present.

Literature 52, 347.

Other selected sources 120, 879, 1033.

R.H.M.J. Lemmens

Crocosmia ×crocosmiiflora (Lemoine ex E. Morren) N.E.Br.

Trans. Roy. Soc. S. Africa 20: 264 (*'crocosmiaeflora'*, 1932).

IRIDACEAE

$2n = 22$

Synonyms *Montbretia ×crocosmiiflora* Lemoine ex E. Morren (1881), *Tritonia crocosmiiflora* G. Nicholson (1887).

Vernacular names Garden montbretia, autumn gold (En). Papua New Guinea: etaetava (Central Province). Vietnam: ngh[eej] h[uw][ow]ng.

Origin and geographic distribution *C. ×crocosmiiflora* developed as a hybrid between *C. aurea* (Pappe ex Hook.) Planchon and *C. pottsii* (M'Nab ex Baker) N.E.Br. in 1880 in France and became a popular garden plant. In South-East Asia it is also frequently cultivated as an ornamental, usually in mountainous regions, e.g. in Java. Escapes from gardens occur worldwide, also in South-East Asia, e.g. in Peninsular Malaysia, Sumatra, Flores and New Guinea.

Uses In Papua New Guinea crushed leaves are inhaled to free the nasal passage when blocked due to a head cold. In East Africa leaf-sap and a decoction of the corms are drunk to treat malaria and arthritic rheumatism. *C. ×crocosmiiflora* is an important garden ornamental, and cultivated globally for this purpose. The flowers yield a yellow dye, which is sometimes used as a substitute for saffron (*Crocus sativus* L.).

Properties The naphthazarin derivatives tricrozarin A and B have been isolated from *C. ×crocosmiiflora* corms. Tricrozarin A showed antimicrobial activity against gram-positive bacteria, fungi and yeasts, and tricrozarin B displayed marked antitumour activity against HeLa S3 cells in vitro.

A series of acylated saponins, masonosides A–C, have been isolated from corms of *C. masonorum* (L. Bolus) N.E.Br., together with two desacylmasonosides and desacylcrocosmioside A.

Botany A herb up to 50(–125) cm tall, with depressed-globose to ovoid corms 1.5–2.5 cm in diameter, having brown membranous tunics, often in groups of 2–3 or connected by slender stolons. Leaves basal and cauline, distichously alternate, simple, basal leaves linear-lanceolate to ensiform, 30–75 cm × 1–2.5 cm, acute, veins numerous and parallel, middle vein prominent, cauline leaves few, smaller than basal ones, sheathing at base. Inflorescence a large, laxly branched panicle, slightly zigzag branched; peduncle 25–50(–125) cm long, 2–3-ribbed; bracts up to 1 cm long, reddish. Flowers bisexual, slightly zygomorphic, 3-merous; perianth funnel shaped, tube 1–1.5 cm long, slightly curved, with 6 widely spreading lanceolate to oblong segments 1.5–2.5 cm long in 2 whorls, orange or reddish-orange, often red-blotched; stamens 3, inserted near the mouth of the perianth tube opposite the outer tepals, widely exserted; ovary inferior, 3-celled, style 3–3.5 cm long, 3-branched at apex, branches often shortly forked. Fruit an ellipsoid-obovoid, deeply 3-lobed capsule up to 7 mm × 9 mm, usually without viable seeds. *C. ×crocosmiiflora* rarely sets seed and spreads mainly by its stolons and corms.

Crocosmia comprises 9 species and is restricted to southern Africa and Madagascar. It is closely related to *Tritonia* and *Chasmanthe*. *C. ×crocosmiiflora* has characters intermediate between its two parent species (*C. aurea* and *C. pottsii*). However, sometimes cultivated plants closely resemble one of the parents, although they may also differ considerably from both. It would be better to consider *C. ×crocosmiiflora* as a cultivar group.

Ecology *C. ×crocosmiiflora* prefers damp habitats. In Malesia it can be found as a garden escape in open forest, moist grassland, roadsides and on waste ground, at 250–3500 m altitude, and it can be locally abundant. Under favourable conditions it may form large clumps. It is hardy to frost, and can stand temperatures as low as –15°C. *C. ×crocosmiiflora* is grown in well-drained but moisture-retentive soils enriched with organic matter.

Management *C. ×crocosmiiflora* can be propagated by division of established clumps, but sporadically also by seed sown fresh into a loam-based propagating mix with additional sharp grit.

Genetic resources *C. ×crocosmiiflora* is commonly cultivated in many regions of the world. The genetic diversity of these cultivated plants is unknown, but it is a variable hybrid forming the basis for a wide range of selections. In southern Africa 3 species, amongst which the parents of *C. ×crocosmiiflora*, have a wide distribution range, but the others are local endemics.

Prospects *C. ×crocosmiiflora* will remain important as an ornamental. Its possible applications as a medicinal plant merit further research because it has shown interesting pharmacological properties, e.g. antimicrobial and antitumour activities, and it is easy to cultivate.

Literature 347, 601, 602, 962.

Other selected sources 120, 204.

R.P. Escobin

Crossostephium chinense (L.) Makino

Bot. Mag. Tokyo 20: 33 (1906).
COMPOSITAE
$2n = 18$

Synonyms *Artemisia chinensis* L. (1753), *Crossostephium artemisioides* Less. (1831).

Vernacular names Philippines: ajenjo (Sp, Tagalog). Vietnam: nguy[eej]t b[aj]ch, c[us]c m[oos]c.

Origin and geographic distribution *C. chinense* occurs in southern China, the Ryukyu Islands, Taiwan and the Philippines (Batan Islands). It is cultivated in Vietnam, China and the Philippines (often in flower pots), and also for ornamental or medicinal purposes in Java, where it was already present around 1740.

Uses In the Philippines, an infusion of the leaves and branch tips is considered carminative and useful as an emmenagogue. In Vietnam and China, an infusion of the leaves (usually sweetened) is used in traditional medicine to treat congestions, cough and irregularity of the menstrual cycle. The leaves are also used as a carminative and emmenagogue in Thailand.

Properties The triterpenes taraxerol, taraxeryl acetate and taraxerone have been isolated from *C. chinense*. Anti-carcinogenic and anti-inflammatory activities have been reported in tests with mice for the triterpene alcohol taraxerol, isolated from *Compositae* and some other plant species.

Botany A small aromatic shrub up to 30 cm tall, much branched often with spreading branches leafless below, densely leafy near apex. Leaves alternate, narrowly spatulate or oblanceolate, 2–5 cm × 0.2–1.2(–2) cm, fleshy, entire or 3-lobate, long-tapering at base into petiole, hairy on both surfaces; stipules absent. Inflorescence a shortly peduncled head c. 7 mm broad, racemosely arranged in the axils of reduced leaves towards the apex of branches, involucre hemispherical, 3-seriate, outer bracts densely tomentose. Flowers all with tubular corolla c. 1.5 mm long, yellowish, glandular; ray flowers pistillate, 1–3-seriate, with 2–4-dentate corolla; disk flowers numerous, bisexual, with 5-lobed corolla; stamens 5, anthers connate, with large appendages at apex; ovary inferior, 1-celled, style shortly bifid. Fruit an ovoid-oblong achene, c. 1.5 mm long, 5-angular, glandular, truncate at apex with short irregular paleaceous pappus c. 0.5 mm long.
When cultivated in Java, fruits do not develop, but the plants may flower throughout the year.
Crossostephium belongs to the tribe *Anthemideae* and consists of a single species. Some American species formerly included in this genus are now usually considered to belong to *Artemisia*. *Crossostephium* differs from *Artemisia* in its larger heads, stamens with larger appendages and scaly pappus.

Ecology *C. chinense* occurs in coastal areas, often in pitted surfaces on limestone or raised coral formations, also in coastal forest.

Management Propagation by softwood or semiripe cuttings is possible as practised for the commonly cultivated shrubby *Artemisia* species.

Genetic resources *C. chinense* is often cultivated and may thus be protected against genetic erosion. However, the genetic diversity of neither cultivated nor wild plants is known.

Prospects Very little is known about *C. chinense*, but the medicinal properties and uses indicated seem to justify more research.

Literature 62, 671, 760, 818.

Other selected sources 117, 544, 974.

R.H.M.J. Lemmens

Cryptocoryne cordata Griffith

Not. pl. asiat. 3: 138 (1851).
ARACEAE
$2n = 34, 68, 102$

Synonyms *Cryptocoryne siamensis* Gagnep. (1941), *Cryptocoryne blassii* de Wit (1960).

Vernacular names Malaysia: hati-hati paya, keladi paya (Peninsular). Thailand: waa nam (Surat Thani), u-bee kaling-ai (Malay, Narathiwat).

Origin and geographic distribution *C. cordata* occurs in southern Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia the leaves are applied to the head to treat vertigo. *C. cordata* is a well-known aquarium plant.
Rhizomes of *C. spiralis* (Retz.) Fisch. ex Wydler are used, in combination with other medicinal plants, in traditional medicine in Sri Lanka, as a remedy for vomiting and cough, and to treat fever and abdominal complaints.

Properties There is no information on the phytochemistry of *C. cordata*, but the flavones luteolin and chrysoeriol have been recorded for *C. wendtii* de Wit, and lipids such as sitosterin, hentriacontan and oxoacids for *C. spiralis* rhizomes.

Botany A small, aquatic, perennial herb up to 40 cm tall, with creeping rhizome. Leaves in a rosette, simple and entire, ovate to narrowly ovate, 5–30 cm × 2.5–10 cm, rounded to cordate at

Cryptocoryne cordata Griffith – 1, plant habit; 2, spatha; 3, opened basal part of spatha showing spadix.

base, acute at apex, often more or less bullate, dark green above, often purplish below; petiole 15–40 cm long, with sheath at base. Inflorescence a spadix with few female flowers in a single whorl and few olfactory bodies at base, and with numerous male flowers and a club-shaped appendix at apex, female and male flowers separated by a long, naked axis; spadix completely enclosed by a spathe up to 35 cm long, consisting of a swollen basal part ('kettle'), a long-tubular middle part and a spreading, yellowish to purplish blade up to 6 cm long, entrance of kettle with a lateral flap covering the male zone of the spadix. Flowers unisexual, without perianth; male flowers with a single stamen; female flowers with connate, 1-celled ovaries, styles curved, stigmas large. Fruit a berry connate into an ovoid, fleshy syncarp, dehiscing apically, many-seeded.

The olfactory bodies situated near the female flowers spread a carrion smell attracting flies, which enter the kettle of the spathe and act as pollinators. The female flowers are full-grown a few hours to one day before the male ones, promoting cross-fertilization.

Cryptocoryne comprises about 50 species and occurs throughout tropical Asia, including the whole Malesian region. It belongs to the tribe *Cryptocoryneae*, together with *Lagenandra*, which also comprises aquatic herbs, differing in its spirally arranged female flowers and its free fruits. A few species closely related to *C. cordata* (or perhaps conspecific) occur in Borneo.

Ecology *C. cordata* occurs in streams in forest.

Management Plants can be propagated by rhizome division. In-vitro propagation techniques are being practised for mass production of aquarium plants. *C. cordata* can easily be cultivated in an aquarium; it prefers moderate light and a temperature of 20–28°C.

Genetic resources Many *Cryptocoryne* species, including *C. cordata*, have limited distribution areas, and are therefore liable to genetic erosion. They are vulnerable to exploitation and demolition of forest, resulting in strong erosion and rushing, muddy water in streams, which may cause a total washout of aquatic plants and prohibit the establishment of new populations. Moreover, more sunlight facilitates dramatic changes in the vegetation, further enforced by an abundant supply of washed-in nutrients. Collecting for commercial aquarium use may locally endanger *Cryptocoryne* species.

Prospects It is unlikely that the use of *C. cordata* in medicine will increase. It will remain important as an aquarium plant.

Literature 121, 207.

Other selected sources 181, 331, 611, 789.

R.H.M.J. Lemmens

Cuscuta australis R.Br.

Prodr.: 491 (1810).

CONVOLVULACEAE

$2n$ = unknown

Synonyms *Cuscuta hygrophilae* Pearson (1901).

Vernacular names Indonesia: majamuju, jamuju, cacingan (Java). Vietnam: t[ow] h[oof]ng nam.

Origin and geographic distribution *C. australis* occurs in large parts of tropical and subtropical Asia and Australia, and also in Africa and southern Europe. In Malesia, it has been recorded for Peninsular Malaysia, Singapore, Sumatra, Java and New Guinea. Its seeds and those of *C. chinensis* Lamk are often imported from China for medicinal purposes, and it is likely that the species have spread through wasted seeds, e.g. in-

to Malesia. In fact, they have been one of the most commonly used drugs of Chinese traditional medicine since ancient times.

Uses In Indonesia, *C. australis* is used in traditional medicine as an emollient, sedative, sudorific and tonic, and to treat urinary complaints. In Chinese traditional medicine, the seeds are applied as a sedative, against diabetes, urinary complaints, impotency and opacity of the cornea; they are often used in combination with other plant products. The seed is also used in Vietnam for similar purposes. Seed extracts of *C. chinensis* are applied to treat acne and dandruff.

Properties An ether-insoluble resin glycoside fraction from *C. australis* seeds is considered to be a complex mixture of glycosidic ester-type oligomers with a core consisting of a number of cuscutic acids each acylated with one or two carboxylic acid moieties. An alcoholic extract increased the percentage and index of phagocytosis of macrophages as well as hemolysin and proliferation of lymphocytes up to normal level in mice with burn injury. *C. australis* may serve as a kind of immunopotentiator for mammals. Tests on mice have also shown that a C3-binding glycoprotein obtained from the European *C. europaea* L. has strong immunostimulatory properties both in vivo and in vitro.

The alkaloid cuscutamine, 5 lignans (e.g. cuscutosides A and B), some flavonoids and cinnamic acid derivatives have been isolated from *C. chinensis* seeds. *C. chinensis* is reputed to have antitumour activity in the Unani system of medicine in India. In tests with mice, a hot water extract markedly delayed the appearance and retarded the growth of skin papillomas and the incidence of carcinoma induced by 7,12-dimethylbenz[a]anthracene; its prophylactic effect was found to be statistically significant. An aqueous extract of whole *C. chinensis* plants exhibits anticonvulsant, analgesic and hypotensive activities when administered by gastric intubation.

An antiviral protein, showing a highly significant virus-inhibiting property, has been isolated from an aqueous extract of *C. reflexa* Roxb. plants. This species has also been found in Java.

Botany A parasitic herb; stem slender, filiform, twining, up to 1 m long, greenish-yellow, golden or orange, with haustoria. Leaves reduced to minute scales. Inflorescence a lateral, compact cymose glomerule, subsessile, few to many-flowered. Flowers bisexual, regular, usually 5-merous; pedicel 1–2.5 mm long; calyx cupular, about as long as corolla tube; corolla cupular, c. 2 mm long, the tube inside with bifid and fimbriate scales, lobes about as long as tube, persistent, white or creamy white; stamens inserted on corolla above the scales; ovary superior, depressed globose, 2-celled, styles 2. Fruit a depressed globose capsule 3–4 mm in diameter, enclosed by corolla, irregularly opening, (3–)4-seeded. Seeds ovoid, c. 1.5 mm long, brownish.

Cuscuta is sometimes considered to represent a separate family *Cuscutaceae*, differing from *Convolvulaceae* in its completely parasitic habit, lacking green leaves. It is sometimes confused with *Cassytha* (*Lauraceae*), which is similar in habit but has 3-merous flowers and berries. *Cuscuta* comprises approximately 170 species and is cosmopolitan. Its main centre of speciation is North and South America. In the Malesian region, 4 species have been found, of which only *C. australis* is more widely distributed. *C. australis* is often confused with *C. chinensis*, which differs in its circumscissile fruit and keeled corolla lobes. In a major part of the areas of distribution of the species both occur, and they are probably used indiscriminately in traditional medicine. *C. chinensis* has not yet been recorded in the Malesian region.

Ecology *C. australis* occurs as a parasite on numerous dicotyledonous herbaceous or shrubby plants, in Malesia up to 500 m altitude, but in China up to 2000 m. It has a preference for wetter places, e.g. along watercourses.

Management *C. australis* is liable to become a pest of crops in the Malesian region, like *C. chinensis*, which is sometimes a problematic parasite of soya bean in China.

Genetic resources *C. australis* is extremely widely distributed and not in danger of genetic erosion.

Prospects *Cuscuta* has several interesting medicinal properties, including immunostimulatory, antitumour and antiviral properties, which deserve more attention. A taxonomical study of *Cuscuta* in South-East Asia is desirable because some species (e.g. *C. australis* and *C. chinensis*) are commonly confused and the literature is consequently often difficult to interpret.

Literature 210, 221, 247, 1016.

Other selected sources 60, 121, 334, 671, 682, 889, 1013, 1026.

Djadja Siti Hazar Hoesen

Cyathostemma micranthum (A.DC.) J. Sinclair

Gard. Bull. Sing. 14(2): 225 (1955).
ANNONACEAE
$2n$ = unknown
Synonyms *Uvaria micrantha* (A.DC.) Hook.f. & Thomson (1855).
Vernacular names Malaysia: daun ekur bukit kampong, daun larak (Peninsular). Thailand: nom maeo (Prachuap Khiri Khan), namtao noi (Prachin Buri). Vietnam: k[yf] k[uw][ow]ng, b[uf] qu[ar] hoa nh[or].
Origin and geographic distribution *C. micranthum* is the most widely distributed *Cyathostemma* species. It occurs in the Andaman Islands, Burma (Myanmar), Indo-China, Thailand, throughout the Malesian region and northern Australia.
Uses In Peninsular Malaysia a decoction of the leaves or roots is given as a protective medicine after childbirth. In Thailand the roots are ground with a small amount of water and applied topically to treat insect stings.
Properties There is currently no information available on the phytochemistry and pharmacological activity of *C. micranthum*. The shikimic acid derivative cyathostemmine has been isolated from *C. viridiflorum* Griff. bark in Malaysia.
Botany A liana up to 10(–15) m long; twigs initially pubescent, later glabrous, brownish-black and finely striate, lenticellate. Leaves alternate, simple and entire, oblong-elliptical, 2.5–8(–14) cm long, shortly cuneate to rounded at base, acuminate to acute at apex, thinly leathery, sparsely pubescent, pinnately veined with 8–15 pairs of indistinct veins; petiole 1.5–3 mm long; stipules absent. Inflorescence a subterminal monochasial cyme, later appearing extra-axillary or opposite due to continued sympodial growth, consisting of 2 flowers; peduncle woody, up to 3 mm long; bracts c. 5 mm long. Flowers bisexual, regular, 3-merous; pedicel up to 7(–10) mm long; sepals free, broadly ovate-rounded, c. 2.5 mm long; petals 6, free, ovate, 4–5 mm long, pubescent, greenish-yellow to red or brown; stamens numerous, with connective apex arching over and concealing anthers; carpels numerous, pubescent, style absent, stigma U-shaped. Fruit consisting of several stiped monocarps 12–20 mm × c. 10 mm, glabrous, yellow to red or black, 1–2(–4)-seeded.
Cyathostemma comprises 10 species, and is distributed from eastern India and southern China to northern Australia. It belongs to the tribe *Uvarieae*, and is closely related to, possibly even congeneric with, *Uvaria*. *C. micranthum* is distinguished from other *Cyathostemma* by its comparatively small leaves, small monocarps and terminal or extra-axillary inflorescence.
Ecology *C. micranthum* occurs in forest and thickets at low altitudes.
Genetic resources *C. micranthum* does not seem to be in danger of genetic erosion because of its wide distribution and seemingly wide ecological adaptability.
Prospects The utilization of *C. micranthum* as a medicinal plant is unlikely to increase unless future research reveals interesting pharmacological properties.
Literature 121, 173, 947.
Other selected sources 587.

R.H.M.J. Lemmens

Cymbidium Sw.

Nova Acta Regiae Soc. Sci. Upsal. 6: 70 (1799).
ORCHIDACEAE
x = 20; *C. aloifolium*: $2n$ = 40, *C. ensifolium*: $2n$ = 40
Origin and geographic distribution *Cymbidium* comprises approximately 50 species, and occurs throughout tropical Asia, from India to China, Japan and the whole of Malesia, as well as in Australia.
Uses There are no reliable records of medicinal applications of *Cymbidium* in the Malesian region, but whole plants are used in traditional medicine in Vietnam, Thailand, as well as India, China and Australia. Crushed leaves and sometimes roots are used externally to treat arthritis, sores, burns and otitis media. Decoctions of roots and rhizomes are used in China to treat gonorrhoea, syphilis, stomach-ache and problems of the respiratory tract. In Ayurvedic medicine in India, *Cymbidium* plants are used in mixtures to treat tumours, diarrhoea, vertigo and paralysis. The pseudobulbs are chewed in Australia against diarrhoea and dysentery.
Cymbidium species are of great interest to horticulturists and orchid breeders. Large-flowered plants have been bred for decades, and have been cherished in China and Japan for centuries. *Cymbidium* hybrids are among the most important commercially grown orchids. They are also commonly grown for cut flowers. The breeding of small-flowered species started on a large scale by the beginning of the 1980s.

Properties Mannose-specific lectins isolated from a *Cymbidium* hybrid were highly inhibitory to human immunodeficiency virus type 1 (HIV-1) and type 2 (HIV-2), and showed additionally marked anti-human cytomegalovirus, respiratory syncytial virus and influenza A virus activity in vitro. They presumably interact at the level of fusion with the target cell. Contact allergy from handling *Cymbidium* cultivars has been reported, probably due to the presence of the quinone derivative 2,6-dimethoxy-1,4-benzoquinone. Several benzenoids including aloifol, coelonin, 6-methylcoelonin and gigantol were isolated from the roots of *C. aloifolium*.

Botany Terrestrial or epiphytic (sometimes lithophytic) perennial, usually tufted herbs, usually with a short stem, with pseudobulbs at base usually hidden by leaf sheaths, each pseudobulb with a tuft of leaves. Leaves alternate, simple, articulate, duplicative, leathery; stipules absent. Inflorescence a raceme borne at the base of a pseudobulb, erect to pendulous, few- to many-flowered. Flowers bisexual, zygomorphic, often very showy, resupinate, lacking a spur, mostly fragrant; tepals free, subequal, lip (labellum) borne on a short column foot, 3-lobed, usually conspicuously bicarinate at base, median segment recurved; stamen 1, anther proclined, with 2 more or less deeply cleft or furrowed pollinia placed on a common stipe; ovary inferior, 1-celled. Fruit a usually fusiform capsule opening by longitudinal fissures, many-seeded. Seeds minute.

Three subgenera are distinguished within *Cymbidium*. Subgenus *Cymbidium* contains many comparatively small-flowered epiphytic or lithophytic species with usually pendulous inflorescences (e.g. *C. aloifolium* in section *Cymbidium*). Subgenus *Jensoa* contains terrestrial species with upright inflorescences and comparatively small flowers (e.g. *C. ensifolium*). Subgenus *Cyperorchis* comprises the species used in the breeding of large-flowered modern hybrids. *Grammatophyllum* is apparently closely allied to *Cymbidium*.

Ecology *Cymbidium* can be epiphytic (e.g. *C. aloifolium*) or terrestrial (e.g. *C. ensifolium*). Epiphytic species are sometimes also found on rocks, whereas terrestrial ones often occur in damp forest in a deep leaf litter. *Cymbidium* plants prefer some shade, and in cultivation they are best grown in light shade (about 40% sunlight) and high relative humidity.

Management Although *Cymbidium* can be propagated by divisions, mass in-vitro propagation is often practised for ornamental *Cymbidium*. Shoot meristems and axillary buds of *C. ensifolium* and several other species can be cultured on modified Murashige and Skoog medium. The explants form protocorm-like bodies within 4–6 months. When the medium is supplemented with growth hormones buds are formed, and plantlets can be transferred into pots when 3–4 leaves are formed. In general, *Cymbidium* is fairly easy to cultivate. Black streak virus is a major disease in cultivation. For medicinal purposes, plant parts are often dried after collecting for later use.

Genetic resources Some institutes have living orchid collections in which many *Cymbidium* species are represented, e.g. in the Royal Botanic Gardens Kew, United Kingdom. Many smaller-scale *Cymbidium* collections are maintained by orchid growers. An enormous number of cultivars have been developed ranging from dwarf to robust plants of almost 2 m tall, and to plants with flowers of 10 cm in diameter. Some species may have become rare and endangered because of collecting from the wild for ornamental purposes, which is locally common practice.

Prospects *Cymbidium* is highly appreciated for its flowers and sometimes also foliage (the leaves may be variegated), and it will maintain its importance. In addition to to the large-flowered hybrids which have already been grown for decades, smaller-flowered species have also become popular recently. Too little is known about the phytochemistry and pharmacological activities to judge the medicinal prospects, but the few tests that have been carried out showed some interesting antiviral activities.

Literature 69, 831.

Selection of species

Cymbidium aloifolium (L.) Sw.

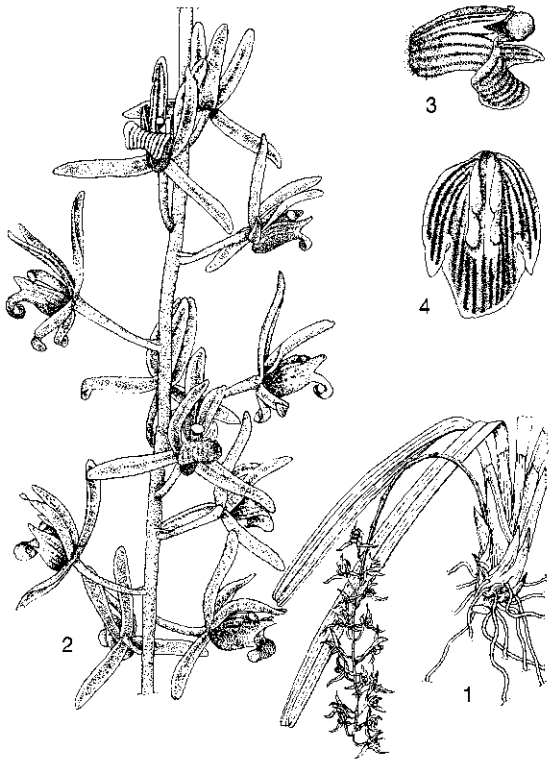
Nova Acta Regiae Soc. Sci. Upsal. 6: 73 (1799).

Synonyms *Cymbidium pendulum* (Roxb.) Sw. (1799), *Cymbidium simulans* Rolfe (1917).

Vernacular names Thailand: kare karon (Nakhon Ratchasima), kluai haang lai (Chumphon), ueang paakpet (Chiang Mai). Vietnam: lan l[oo] h[ooj]i, do[ar]n ki[ees]m.

Distribution Nepal, India, Sri Lanka, Burma (Myanmar), the Andaman Islands, Indo-China, southern China, Taiwan, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines.

Uses In Thailand juice expressed from heated leaves is dropped into the ear to treat otitis media.



Cymbidium aloifolium (L.) Sw. – 1, plant habit; 2, part of inflorescence; 3, lip in side view; 4, expanded lip.

In Vietnam the plant is used to treat colds and irregular menses, and as a tonic, whereas crushed leaves are applied externally to treat arthritis, sores and burns.

Observations An epiphytic herb; leaves up to 50 cm × 3 cm, with unequally 2-lobed tip; inflorescence pendulous, up to 40 cm long; flowers up to 4.5 cm in diameter, tepals pale greenish to cream with a central purple stripe, lip with all lobes striped purple and midlobe yellow but having white margins. *C. aloifolium* occurs in mixed forest and teak forest up to 1000 m altitude.

Selected sources 62, 173, 223, 441, 732, 831, 832, 839, 971.

Cymbidium ensifolium (L.) Sw.

Nova Acta Regiae Soc. Sci. Upsal. 6: 77 (1799).

Synonyms *Cymbidium sundaicum* Schlechter (1919).

Vernacular names Vietnam: lan ki[ees]m, thanh ng[oj]c.

Distribution India, Sri Lanka, Indo-China, China, Taiwan, southern Japan, Thailand, Sumatra, Java, Borneo and New Guinea.

Uses In Vietnam the leaves are used as a diuretic, the roots as a pectoral and the flowers to treat eye problems. In Taiwan entire plants are used in traditional medicine to treat cough, and lung and gastro-intestinal complaints, and as a sedative and diuretic.

Observations A terrestrial herb up to 100 cm tall; leaves up to 100 cm × 1.5 cm, with acute tip; inflorescence upright, up to 70 cm long; flowers 3–5 cm in diameter, tepals greenish or yellowish, often each with 1–5 reddish stripes, lip often dotted with red spots or blotches. *C. ensifolium* is a variable species for which several varieties have been distinguished. It occurs in forest in New Guinea and northern Borneo up to 2000 m altitude.

Selected sources 62, 223, 555, 732, 831, 832, 971, 979, 1007.

Dzuong Duc Huyen

Cynoglossum L.

Sp. pl. 1: 134 (1753); Gen. pl. ed. 5: 168 (1754).

BORAGINACEAE

$x = 12$; *C. amabile*: $2n = 24$, *C. lanceolatum*: $2n = 24$

Origin and geographic distribution *Cynoglossum* comprises about 70 species, and has a worldwide distribution, from tropical to temperate regions. In the Malesian region, 13 species have been found, but several are only known from a single collection.

Uses The roots and aerial parts of *Cynoglossum* are used in traditional medicine in various parts of the world, e.g. to treat cough, scrofula, tuberculosis, wounds, ulcers and eye infections. Information on medicinal applications in South-East Asia is very limited, but *Cynoglossum* is more commonly used in China and eastern Africa.

The roots of *C. officinale* L. have been used in Europe as a sedative, phlegm-discharging and mildly constipating remedy, to treat pulmonary tuberculosis and cough, and to stop bleeding. These uses are now largely abandoned because of the presence of toxic alkaloids. The foliage may repel moles in gardens and protect stored fruit and vegetables from rodents. The root juice of *C. wallichii* G. Don is applied in India to check vomiting in children.

Some species are occasionally planted as an ornamental in gardens, e.g. *C. amabile*.

Properties *Cynoglossum* is highly toxic for

horses and cattle, mainly during the early growth stage (rosette stage), due to the presence of pyrrolizidin alkaloids with a strong hepatotoxic activity. The contamination of green fodder with *Cynoglossum* can be a serious problem, as well as the presence of toxicants in milk. Five pyrrolizidine alkaloids have been recorded from *C. amabile*: supinine, amabiline, rinderine, echinatine and 3'-O-acetylechinatine. Altogether, 14 pyrrolizidine alkaloids have been isolated and separated from *C. officinale*, and 13 from *C. creticum* Miller. The roots of *C. officinale* also contain bitter substances, choline and tannins, the leaves mucilage, traces of essential oils and bactericidal compounds, and the seeds a number of lipids and fatty acids.

A gallic acid salt of the cynoglossophin-heliosupine alkaloid (cyngal) has been isolated from *C. officinale*. This compound showed a high stimulatory activity on the gastro-intestinal motor function in tests with dogs and rats.

Furthermore, the isohexenylnaphthazarins, more commonly known as alkannins, are lipophilic red pigments found in the outer layer of the roots of many *Boraginaceae*, including *Cynoglossum*. They have pronounced antibacterial, wound-healing and antitumour activities.

Botany Annual, biennial or perennial herbs. Leaves alternate, simple and entire, basal leaves usually already withered at flowering time, basal and lower stem leaves usually long petiolate, upper stem leaves often sessile; stipules absent. Inflorescence a terminal and axillary cyme, bracteate or ebracteate. Flowers bisexual, regular, 5-merous, pedicellate; calyx deeply divided, enlarged in fruit; corolla cylindrical, campanulate to funnel-shaped or rotate, with 5 distinct scales in the throat, white, blue or purple; stamens inserted on corolla below the scales, included, filaments very short; ovary superior, 4-parted, style long or short, with or without a distinct stigma. Fruit consisting of 4 nutlets attached to the conical receptacle, covered by glochids.

The flowers are pollinated by various groups of insects, also depending on the species. The nutlets have barbid bristles which adhere to the fur of mammals and are thus dispersed.

Ecology *Cynoglossum* usually occurs in meadows on hillsides, roadsides, river banks and in open forest.

Management Formerly, the roots of *C. officinale* were collected in Europe in autumn, and dried rapidly.

Genetic resources The *Cynoglossum* species treated here are the more common ones in South-East Asia (at least locally), except *C. amabile*, which is only planted in Java. About half of the Malesian species are only known from few collections, and field studies are needed to determine the threats for these species. Large ex situ germplasm collections of *Cynoglossum* do not exist.

Prospects Very little is known about *Cynoglossum* in South-East Asia. However, studies in species from elsewhere showed interesting properties, e.g. wound healing and antibacterial activities. Research on these aspects in South-East Asia is desirable, and might enhance the medicinal importance in the region.

Literature 247, 331, 720.

Selection of species

Cynoglossum amabile Stapf & J.R. Drumm.

Bull. Misc. Inform. Kew: 202 (1906).

Distribution Native to southern China but widely cultivated as an ornamental, occasionally also in Java.

Uses *C. amabile* is used in traditional Chinese medicine to treat cough, scrofula, and to stop bleeding of wounds.

Observations A perennial herb up to 60 cm tall, often with single, densely spreading, pubescent stem; leaves oblong-lanceolate to lanceolate, basal ones 5–20 cm × 2–4 cm, densely pubescent and grey-green to greyish-white; inflorescence paniculate, branches crowded at apex, ebracteate; corolla 5–6 mm long, blue, rarely white; nutlets ovoid, 3–4 mm long, covered all over by glochids. In China, *C. amabile* occurs in hillside meadows, open forest, roadsides and river banks in the mountains, at 2600–3700 m altitude.

Selected sources 228, 247, 1013.

Cynoglossum hellwigii Brand

Fedde, Repert. 13: 546 (1915).

Synonyms *Cynoglossum javanicum* auct. non Thunberg ex Lehm.

Vernacular names Papua New Guinea: semongokina (Anji, Enga), dekemp (Mount Hagen, Western Highlands).

Distribution Endemic to New Guinea, and widespread there.

Uses In Papua New Guinea, fresh leaves are tied onto ulcers until they heal. The plant is also used to adorn wigs.

Observations An annual or biennial herb up to

100 cm tall, much branched, hirsute with retrorse hairs in the lower part of stems and antrorse hairs in the upper part; leaves elliptical to oblong or lanceolate, basal ones 12–15 cm × 3.5–5 cm, strigose with antrorse hairs; inflorescence much branched, cymes divaricate, ebracteate; corolla 2.5–3 mm long, white or pale blue; nutlets ovoid, 2–3 mm long, covered all over by glochids. *C. helwigii* occurs in open locations, e.g. in swampy grassland along rivers, at 1200–1300 m altitude.

Selected sources 247, 347.

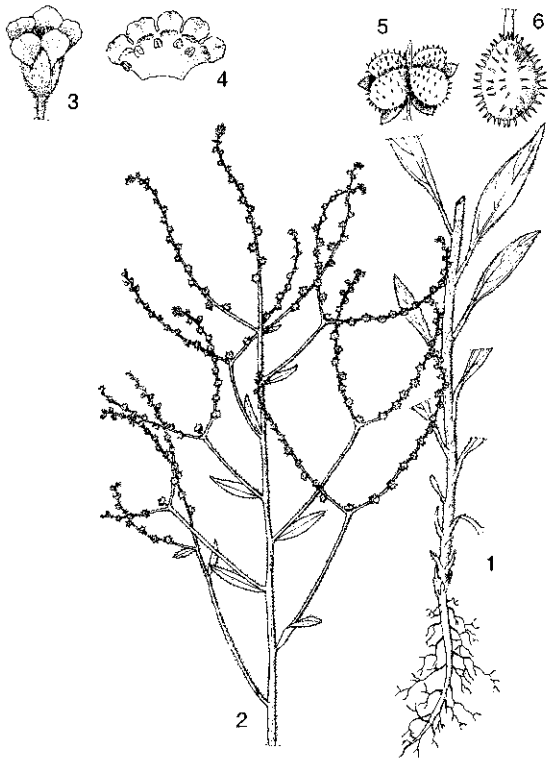
Cynoglossum lanceolatum Forssk.

Fl. aegypt.-arab.: 41 (1775).

Synonyms *Cynoglossum micranthum* Desf. (1804).

Vernacular names Vietnam: tro bu[oof]n, khuy[eer]n thi[eej]t.

Distribution Distributed in an extremely large area in Africa and Asia; in South-East Asia, occurring in Burma (Myanmar), Indo-China, northern Thailand, and in western Malesia in Sumatra, Java, Borneo, Sulawesi and the Philippines.



Cynoglossum lanceolatum Forssk. – 1, lower part of plant; 2, upper part of plant; 3, flower; 4, opened corolla showing stamens; 5, fruit; 6, nutlet.

Uses *C. lanceolatum* is considered diaphoretic and expectorant in southern Africa, and the crushed plant is used there to treat wounds and colic, and the root to treat eye infections and as a vermifuge. In Vietnam, it is considered diuretic.

Observations A biennial or perennial herb up to 100(–150) cm tall, much branched, stems with longer, patent hairs and shorter, antrorse hairs; leaves lanceolate or oblong-lanceolate, basal ones 8–14 cm × 3–3.5 cm, strigose with hispid and pubescent hairs; inflorescence furcate, cymes divaricate, ebracteate; corolla 2–3(–4) mm long, white or pale blue; nutlets ovoid, 1.5–2.5 mm long, covered all over by glochids. *C. lanceolatum* occurs in hillside meadows, open forest and roadsides, in China up to 2800 m altitude.

Selected sources 120, 247, 732, 1013.

Ch.B. Lugt & R.H.M.J. Lemmens

Cyrtandra J.R. Forster & J.G. Forster

Char. gen. pl.: 5 (1775).

GESNERIACEAE

$x = 17$

Origin and geographic distribution *Cyrtandra* is an extremely large genus of about 600 species and is distributed in South-East Asia from the Nicobar Islands, southern Burma (Myanmar) and Thailand, throughout Malesia, to the islands of the Pacific and Queensland (Australia). Centres of diversity are eastern Malesia (particularly the Philippines, Borneo, Sulawesi and New Guinea) with in total about 300 species, and the islands in the Pacific Ocean with about 200 species of which approximately 100 are endemic to Hawaii.

Uses There are a few records of medicinal uses of *Cyrtandra* in Malaysia: after childbirth, as an abortivum and emmenagogue, and against fever. An infusion of crushed young leaves of a *Cyrtandra* species is used by the Kenyah Dayak people in Borneo as a wash to reduce fever in the case of pox and measles. External uses have been recorded in the Philippines for treating itch, and in the Solomon Islands for treating swellings.

The sourish leaves are sometimes used for flavouring and as a vegetable, e.g. those of *C. pendula* Blume in Java and *C. decurrens* de Vriese in the Moluccas. A few species are cultivated as an ornamental, e.g. *C. pendula*.

Botany Herbs or shrubs, sometimes small trees or vines. Leaves usually opposite, those of a pair equal to very unequal, sometimes alternate or whorled, simple; stipules absent. Inflorescence a

fascicle or umbelliform, in the axil of present, fallen or rudimentary leaves; bracts caducous or persistent. Flowers bisexual or unisexual, usually zygomorphic, 5-merous; calyx tubular, often with triangular lobes, caducous or persistent; corolla with terete-infundibuliform tube and 2-lipped limb, sometimes almost regular; stamens usually 2, inserted in or above the middle of the corolla tube, usually included and having coherent anthers, staminodes usually 3; disk annular or unilateral; ovary superior, ovoid to linear, 1-celled, stigma more or less distinctly 2-lobed. Fruit a fleshy or leathery indehiscent berry, many-seeded. Seeds small, ellipsoid, smooth.

The dispersal seems to be accomplished by frugivorous birds adapted to the conspicuous, fleshy fruits with very small seeds. *Didymocarpus* is closely related to *Cyrtandra*.

Ecology *Cyrtandra* is adapted to almost continually humid, well-shaded habitats in forested ravines and gullies.

Genetic resources *Cyrtandra* species seem easily liable to genetic erosion because they show a high degree of endemism and are adapted to a specific habitat.

Prospects There is no information on the phytochemistry and properties of *Cyrtandra*. The uses in traditional medicine seem very limited and it is unlikely that the genus will gain importance in the future.

Literature 121, 534, 731.

Selection of species

Cyrtandra cupulata Ridley

Journ. Linn. Soc. 32: 527 (1896).

Vernacular names Malaysia: meroyan kabut, bebangun (Peninsular). Thailand: ta-po leh-mai (Malay, Pattani).

Distribution Peninsular Malaysia and peninsular Thailand.

Uses In Peninsular Malaysia, a decoction used to be drunk after childbirth and to treat fever.

Observations A small shrub up to 100 cm tall; leaves obovate to oblanceolate, 22.5–30 cm × 7–10 cm, serrate, narrowed at base; bracts connate in a large white cup; corolla with funnel-shaped tube, silky hairy, whitish with yellow and brown marks in the mouth; fruit fusiform, c. 1.5 cm long. *C. cupulata* occurs in humid ravines in dense rain forest up to 1300 m altitude.

Selected sources 121, 789.

Cyrtandra oblongifolia (Blume) C.B. Clarke

A.DC., Monogr. phan. 5: 206, t. 24 (1883).

Vernacular names Malaysia: kudakalang (Sarawak).

Distribution Sumatra, Java and Borneo.

Uses In Sarawak, boiled roots are taken orally as an abortivum up to 5 months pregnancy, and also to treat menstrual irregularity.

Observations A shrub up to 200 cm tall; leaves of a pair very unequal, obovate to elliptical-lanceolate or narrowly lanceolate, smaller ones 2–9 cm × 1–3 cm, larger ones 16–23 cm × 3.5–6 cm, narrowed and unequal at base, entire; bracts 2, acuminate, 2–3 cm long; corolla with funnel-shaped tube, whitish or pale pink; fruit linear-lanceolate, curved, 4–6 cm long. *C. oblongifolia* occurs in forest up to 1200 m altitude, and is usually epiphytic.

Selected sources 62, 241.

Cyrtandra wallichii (C.B. Clarke) B.L. Burtt

Notes Roy. Bot. Garden Edinb. 36(1): 179 (1978).

Synonyms *Cyrtandra grandiflora* Ridley (1909) non Gaud., *Cyrtandra pilosa* auct. non Blume.

Vernacular names Malaysia: gegunjah puteh, lemak batu (Peninsular).

Distribution Peninsular Malaysia.

Uses A decoction has been recorded as being used after childbirth.

Observations A small shrub up to 100 cm tall; leaves obovate to oblanceolate, 20–45 cm × 7.5–10 cm, serrate, narrowed at base into a winged petiole; bracts free or cup-shaped connate; corolla with short funnel-shaped tube, silky hairy, whitish but yellowish in the mouth; fruit ovoid-conical to cylindrical-conical, 1.5–2.5 cm long. *C. wallichii* is locally abundant along streams in rain forest up to 1300 m altitude.

Selected sources 121, 789.

Zumaidar

Cyrtandromoea Zoll.

Syst. Verz. 3: 58 (1855).

GESNERIACEAE

x = unknown; *C. grandis*: $2n = 22–24$

Origin and geographic distribution *Cyrtandromoea* comprises approximately 10 species and occurs in the Andaman and Nicobar Islands, Burma (Myanmar), southern China, Thailand and western Malesia (Peninsular Malaysia, Sumatra,

Java and Borneo). Sumatra seems to be richest in species.

Uses Two *Cyrtandromoea* species are known to be used in traditional medicine in Peninsular Malaysia for treating fever.

Botany Perennial herbs with erect, often unbranched stems, woody at base. Leaves opposite, simple, serrate, petiolate; stipules absent. Inflorescence an axillary cyme, few- to many-flowered, or flowers solitary, sometimes cauliflorous; bracts small. Flowers bisexual, 5-merous; calyx tubular, truncate at apex with 5 short teeth; corolla infundibuliform, limb slightly 2-lipped, upper lip 2-lobed, lower lip 3-lobed; stamens 4, inserted at base of the corolla tube, didynamous, pairs of anthers confluent at apex; ovary superior, conical or cylindrical, 2-celled, style filiform, stigma 2-lamellate. Fruit a globose or ellipsoid capsule included in the enlarged calyx, loculicidally dehiscent, many-seeded. Seeds ellipsoid, with reticulate testa.

Cyrtandromoea has been placed in the families *Gesneriaceae* and *Scrophulariaceae*, depending on the author. Chemotaxonomical and cytological characteristics seem to point to a place in *Scrophulariaceae*, but a recent study on cladistic relationships indicates that it belongs to *Gesneriaceae*, in the tribe *Klugieae*.

Ecology *Cyrtandromoea* occurs in lowland evergreen forest, often in edges and other more open locations.

Genetic resources The distribution of *Cyrtandromoea* is insufficiently documented. Several species seem to have rather limited areas of distribution in lowland evergreen forest, and may be easily liable to genetic erosion.

Prospects It is interesting to note that both *Cyrtandromoea* species used in traditional medicine in South-East Asia are used to treat fever. Research is needed to confirm their febrifugal activity.

Literature 121, 874.

Selection of species

Cyrtandromoea grandis Ridley

Journ. Straits Branch Roy. Asiat. Soc. 43: 87 (1905).

Vernacular names Malaysia: bayam beraleh, setawar (Peninsular). Thailand: cha sam kaeo, phak nom hin (peninsular).

Distribution Peninsular Thailand, Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia, a poultice of the leaves is applied to treat fever.

Observations A large perennial herb up to 3 m tall; leaves oblong to broadly oblong, 20–30 cm × 5–12 cm, glabrous; inflorescences clustered at woody part of stem, many-flowered; flowers with 3–5 cm long, white corolla; fruit globose, c. 1 cm in diameter. *C. grandis* occurs in evergreen forest up to 1000 m altitude.

Selected sources 121, 249.

Cyrtandromoea subsessilis (Miq.) B.L. Burtt

Bull. Bot. Survey India 7: 86 (1965).

Synonyms *Cyrtandromoea acuminata* C.B. Clarke (1883).

Vernacular names Malaysia: pokok sampu menahun, sepugit bukit (Peninsular).

Distribution Burma (Myanmar), south-western Thailand, Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia, a decoction of the leaves is used in a bath to treat fever; powdered leaves are also rubbed over the body.

Observations A perennial herb up to 1.5 m tall; leaves oblong to broadly oblong, 8–16 cm × 3.5–7 cm, sparsely pubescent; inflorescences in leaf-axils, 1–2-flowered; flowers with c. 3 cm long, white or pinkish corolla; fruit ellipsoid or globose, 1–1.5 cm long. *C. subsessilis* occurs in evergreen forest, often in edges, up to 1500 m altitude.

Selected sources 121, 249.

Zumaidar

Dalbergia L.f.

Suppl. pl.: 52 (1782).

LEGUMINOSAE

$x = 10$

Origin and geographic distribution *Dalbergia* comprises almost 200 species and is found in tropical and subtropical regions of all continents. Most species are found in Asia (about 100). Africa and tropical America comprise each about 40 species. About 70 species have been recorded for the Malesian region, and about 30 each for Indo-China and Thailand.

Uses *Dalbergia* is apparently not much used in traditional medicine in South-East Asia. A poultice of leaves is most commonly used to treat skin diseases, sores and varicose veins, whereas a decoction of the wood is used internally against stomach-ache and as an emmenagogue. In Thailand, the wood of *D. candenatensis* (Dennst.)

Prain is applied as a blood tonic and expectorant, and the roots of *D. velutina* Benth. as a fish poison.

Elsewhere, *Dalbergia* is commonly used medicinally. In Africa, the roots and leaves of several species are used to treat a wide variety of complaints including leprosy, wounds, ulcers, fever, colds and bronchitis, and they are also used as a vermifuge. In tropical America, a root decoction is prescribed internally against dysentery. The heartwood of *D. odorifera* T. Chen is a Chinese drug applied for stagnation of disordered blood. It is used to stop bleeding, to treat wounds, bruises, swellings, abscesses, sores and haemoptysis, and as a sedative. In India, the roots of *D. stipulacea* Roxb. are effective as a fish poison, and the bark as an insecticide.

The tree-like species, particularly *D. latifolia* Roxb. and *D. sissoo* Roxb. ex DC., are popular for their decorative wood, which is in high demand for carving, turnery and furniture.

Properties Almost nothing is known about the phytochemistry or properties of the *Dalbergia* species of Malesia. The wood of *D. ferruginea* yields the sterols sitosterol and friedelin, and the wood of *D. cumingiana* an essential oil (c. 0.5%).

The chalcone butein (2',3,4,4'-tetrahydroxy chalcone) has been isolated from the Chinese *D. odorifera*. It showed antioxidant properties: it inhibited iron-induced lipid peroxidation in rat brain homogenate, and inhibited copper-catalyzed oxidation of human low-density lipoprotein. Butein also produced endothelium-dependent relaxation of rat aorta preparations. Many other flavonoids have been isolated from D. *odorifera*, several of which showed significant anti-allergic and anti-inflammatory activities. Several phenolic compounds isolated from this species significantly inhibited prostaglandin biosynthesis as well as platelet aggregation induced by arachidonic acid. Phenolic constituents with potent inhibitory activity towards 5α-dihydrotestosterone, which binds with an androgen receptor to form a complex that causes androgen-dependent disease, have been isolated from *D. cochinchinensis* Pierre from Indo-China and Thailand. An extract of Indian plant material of *D. volubilis* Roxb. showed anti-inflammatory and anti-arthritic activities. A leaf extract of *D. sissoo* possessed significant anti-inflammatory activity when tested in rats. Acetone and alcohol extracts of the bark and roots of *D. stipulacea* showed insecticidal properties against *Clostera cupreata*, a defoliator of poplar (*Populus*) in India. The triterpenoid glycoside dalsaxin has been isolated from the root of the African *D. saxatilis* Hook.f.; this compound stimulated uterine muscle contraction in tests with rats. Extracts of *D. melanoxylon* Guill. & Perr. bark showed antimicrobial activity. An aqueous extract of *D. monetaria* L. from Brazil showed anti-ulcerogenic activity in tests with rats, mice and guinea-pigs.

Dalbergiones, dalbergichinols and related neoflavanoids have been isolated from many *Dalbergia* species. Dalbergiones in the wood have toxic activity on termites and may cause dermatitis.

Botany Lianas, shrubs or small to large trees. Leaves alternate, imparipinnate; stipules usually small, caducous; leaflets alternate, reticulately veined, without stipels. Inflorescence a terminal or axillary cyme or panicle; bracts and bracteoles usually small and subpersistent. Flowers bisexual, small, papilionoid; calyx 5-merous, the teeth prominent with the lower one usually longest; corolla with distinctly clawed standard, narrow wings and sickle-shaped keel, white to red or violet; stamens 9 or 10, filaments usually all connate, anthers small; ovary superior, 1-celled, stipitate, style short, incurved, stigma small. Fruit an indehiscent pod, stipitate, thin-walled, usually 1-seeded. Seed reniform, compressed, lacking albumen. Seedling with hypogeal germination.

Ecology The *Dalbergia* species treated here are all lianas or straggling shrubs, and they are found in open locations and borders of lowland forest, or in thickets in grassland.

Genetic resources There are no germplasm collections of the species treated here, but these do exist for some important timber-producing *Dalbergia* species. The Malesian species used for medicinal purposes seem not to be immediately endangered because they are usually fairly widespread and often occur in secondary habitats. Moreover, they are not extensively used. However, stands of *Dalbergia* trees all over the world have been depleted considerably for the decorative wood.

Prospects Little attention has been given to the medicinal applications of *Dalbergia* in South-East Asia. The fact that *Dalbergia* is extensively used in traditional medicine elsewhere, often for similar purposes (e.g. as a styptic and anti-inflammatory), warrants more research.

Literature 5, 136, 158, 179, 331, 721, 878, 940.

Selection of species

Dalbergia cumingiana Benth.

Miq., Pl. jungh.: 255 (1852).

Vernacular names Philippines: ganak (Ibanag), hamurauon (Samar-Leyte Bisaya), tahid-labuyo (Tagalog).

Distribution The Philippines.

Uses *D. cumingiana* is used to treat stomachache in young children.

Observations A liana; leaves with 5–9 leaflets; flowers clustered towards the apex of a compound inflorescence, whitish; fruit elliptical or oblong, 2–3 cm long. *D. cumingiana* is locally common in secondary forest and thickets at low and medium altitudes.

Selected sources 760.

Dalbergia ferruginea Roxb.

Fl. ind. (ed. 1832) 3: 228 (1832).

Vernacular names Indonesia: akar langsa (Kalimantan). Philippines: balibagan (Panay Bisaya), balintodok (Bagobo), balitadhan (Manobo).

Distribution The Philippines, Borneo, Sulawesi, New Guinea, Australia (Queensland) and the Caroline Islands.

Uses In the Philippines, a decoction of the wood is used as an emmenagogue; a large dose may act as an abortive.

Observations A straggling shrub up to 6 m tall or liana, young stems often rusty pubescent; leaves with (13–)15–21(–25) leaflets; inflorescence axillary, up to 6 cm long, bracts persistent and wedge-shaped; flowers c. 5 mm long, white to pink; fruit obliquely elliptical or oblong, 2.5–7 cm long. *D. ferruginea* occurs in lowland forest including secondary forest, but sometimes also in thickets in grassland.

Selected sources 760, 901, 902, 965.

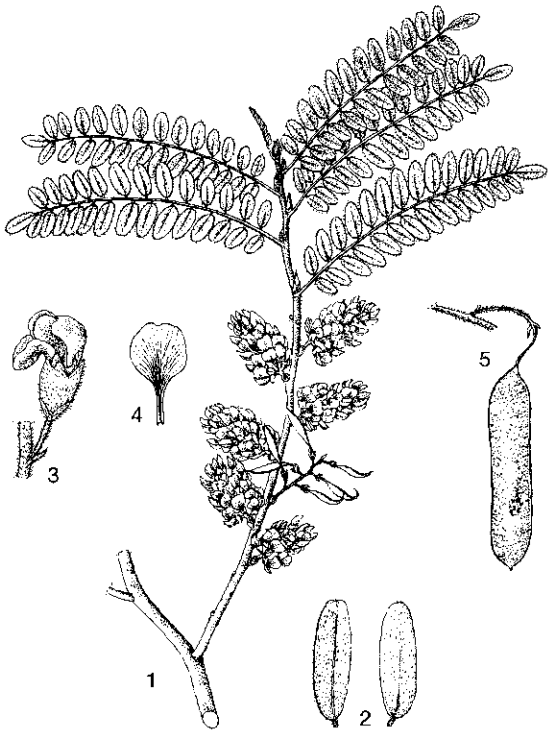
Dalbergia pinnata (Lour.) Prain

Ann. Roy. Bot. Gard. Calc. 10(1): 48 (1904).

Synonyms *Dalbergia tamarindifolia* Roxb. (1832).

Vernacular names Indonesia: areuy ki loma (Sundanese), oyod sambang (Java), jampak luyak (Lampung). Malaysia: semelit jangkar, lorotan haji (Peninsular). Philippines: tikos-maiadon (Manobo). Vietnam: ch[af]m b[if]a [aw]n tr[aa]u (Vinh Phu), tr[aws]c l[as] me.

Distribution India, Burma (Myanmar), Laos, Vietnam, southern China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines and Sulawesi.



Dalbergia pinnata (Lour.) Prain – 1, branch with inflorescences; 2, leaflets from below and above; 3, flower; 4, standard; 5, fruit.

Uses In Java, a poultice of the leaves has been used to treat scabies and fever, and in Peninsular Malaysia against varicose veins and nervous disorders. In Indo-China, the branches are applied for binding purposes.

Observations A shrub with climbing branches or small tree up to 12 m tall; leaves with (13–)21–35(–61) leaflets; inflorescence axillary, sometimes terminal, up to 6 cm long; flowers c. 6 mm long, whitish, calyx teeth short, subequal, stamens 9(–10); fruit linear-oblong, 5–6 cm long. *D. pinnata* occurs in mixed deciduous forest and in open localities in evergreen forest, up to 1400 m altitude.

Selected sources 62, 121, 250, 334, 789, 901, 902.

Dalbergia stercoracea Maingay ex Prain

Journ. As. Soc. Beng., pt. 2, Nat. Hist., 70: 58 (1901).

Vernacular names Peninsular Malaysia: akar urat-urat, akar saga paya, bunga pitam (Peninsular).

Distribution Peninsular Malaysia, Singapore and Sumatra.

Uses In Peninsular Malaysia, the leaves are used as a poultice to treat sores on the legs.

Observations A shrub with climbing branches up to 10 m tall; leaves with 7–9 leaflets; inflorescence axillary and terminal, up to 10 cm long; flowers c. 2.5 mm long, whitish, calyx with lower tooth longest, stamens 9; fruit ellipsoid, c. 6 cm long. *D. stercoracea* is locally common, especially along the coast and near streams.

Selected sources 121, 789.

Ning Wikan Utami

Dalea cliffortiana Willd.

Sp. pl. 3(2): 1336 (1802).

LEGUMINOSAE

$2n = 14$

Synonyms *Parosela glandulosa* (Blanco) Merr. (1910).

Vernacular names Philippines: kamangi, agogo, sampalok-sampalokan (Tagalog).

Origin and geographic distribution *D. cliffortiana* originates from Central America but has been introduced and become naturalized in the Philippines.

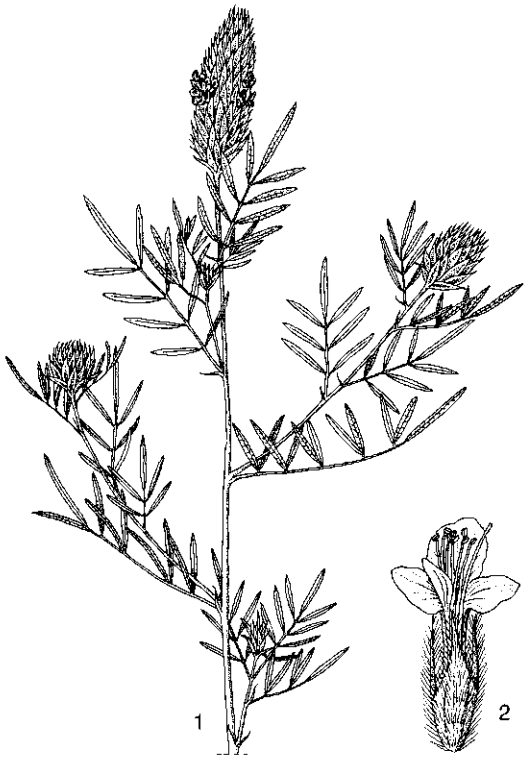
Uses In the Philippines a decoction of *D. cliffortiana* roots is taken to treat haemoptysis. The juice of the fresh leaves is used as a vulnerary and as a poultice on wounds. The ash of leaves and stems is applied as a cicatrizant.

Some *Dalea* species are used in traditional medicine in Central America, e.g. to treat rheumatism and as a sudorific.

Properties In a general screening for molluscicidal activity, a leaf extract of *D. cliffortiana* showed activity against golden snail (*Pomacea* sp.) at concentrations of 4000–8000 ppm. Flavonoid and coumarin derivatives have been found in several other *Dalea* species.

Botany An erect, much-branched herb up to 70 cm tall; stems reddish, glandular-dotted. Leaves alternate, imparipinnate, (1–)1.5–3(–5) cm long; rachis narrowly winged; stipules narrow; leaflets 5–15(–19), linear to narrowly elliptical, (2–)4–8(–15) mm long, entire, gland-dotted below; stipels represented by paired glands. Inflorescence a narrow, compact, terminal spike 0.8–3.5 cm long; bracts abruptly acuminate, pubescent, gland-dotted. Flowers bisexual; calyx 3–5 mm long, 5-toothed, densely pilose; corolla papilionaceous, standard 3–5 mm long, clawed, white often tinged rose, wings 2–2.5 mm long, keel 2–3.5 mm long, wings and keel blue to pink or white; stamens 9–10, all connate; ovary superior, pubescent, 1-celled. Fruit an obovoid pod 2–2.5 mm long, indehiscent, 1-seeded. Seed oblong, c. 1.5 mm long.

Dalea comprises some 150 species and is largely confined to the New World.



Dalea cliffortiana Willd. – 1, flowering branch; 2, flower.

Ecology In the Philippines *D. cliffortiana* is found on dry fields, roadsides and other open disturbed habitats from sea-level up to 1300 m altitude.

Genetic resources *D. cliffortiana* is widely distributed in Central America and common in disturbed habitats, therefore the risk of genetic erosion seems limited.

Prospects Research on the phytochemistry and pharmacological properties is needed to evaluate the efficacy of *D. cliffortiana* as a medicinal plant, and to determine its prospects.

Literature 646, 760, 781.

Other selected sources 35, 331, 989.

L.J.G. van der Maesen

Dasymaschalon (Hook.f. & Thomson) Dalla Torre & Harms

Gen. siphon.: 174 (1901).
ANNONACEAE
x = unknown; *D. blumei*: $2n = 16$

Origin and geographic distribution *Dasymaschalon* comprises approximately 10 species, and occurs in India, Burma (Myanmar), Indo-China, Hainan, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines.

Uses Although information on medicinal uses is scarce, *Dasymaschalon* is probably used in traditional medicine in the same way as *Desmos*, e.g. to treat dysentery, vertigo, fever, and after childbirth. In the Philippines, the leaves of *D. clusiflorum* are used externally to treat wounds, whereas a decoction of the roots or leaves is reputedly a good diuretic.

Properties Several isoquinoline-type alkaloids, predominantly of the oxoaporphine type, have been isolated from leaves and stem bark of *D. blumei*. Among the alkaloids isolated from the leaves are dicentrinone and dasymachaline.
From methanolic extracts of the leaves of *D. sootepense* Craib from Thailand, 8 alkaloids have been isolated, and also 2 flavonol glycosides. Isoquinoline alkaloids with in-vitro antibacterial and antifungal activity have been isolated from stem bark of *D. longiflorum* (Roxb.) Finet & Gagnep. from Bangladesh. The flavone dasytrichone has been found in *D. macrocalyx* Finet & Gagnep. from Indo-China.

Botany Shrubs up to 8 m tall, often scandent, sometimes a small tree. Leaves alternate, distichous, simple and entire, pinnately veined, subsessile or shortly petiolate; stipules absent. Flowers solitary, axillary or extra-axillary, opposite the leaves, pendulous, bisexual, often fragrant; sepals 3, free, valvate; petals (2–)3(–4), valvate, clawed, cohering at margins, hood-shaped and falling off together; stamens numerous, cuneate, with broad connective concealing the anther cells; ovaries numerous, superior, stigmas bent with a U-shaped opening and a groove. Fruit consisting of numerous, stalked, moniliform carpels with up to 8 segments; segments each with one seed, separating at maturity.
Dasymaschalon is closely related to *Desmos*, and is often considered congeneric (but then usually distinguished as a section within *Desmos*). It differs in the usually 3 petals (inner series absent), which are cohering at the edges; *Desmos* has 6 petals in 2 series, with limbs free.

Ecology *Dasymaschalon* occurs particularly in lowland forest, usually in shady localities.

Genetic resources The *Dasymaschalon* species treated here are common, at least locally. However, their exact distribution and ecological requirements are not known because no recent taxonomic monograph of the genus is available.

Prospects Little is known about Malesian *Dasymaschalon*. The chemical and pharmacological research on other species of the genus shows some interesting results, and this indicates the desirability of more studies.

Literature 368, 868, 869.

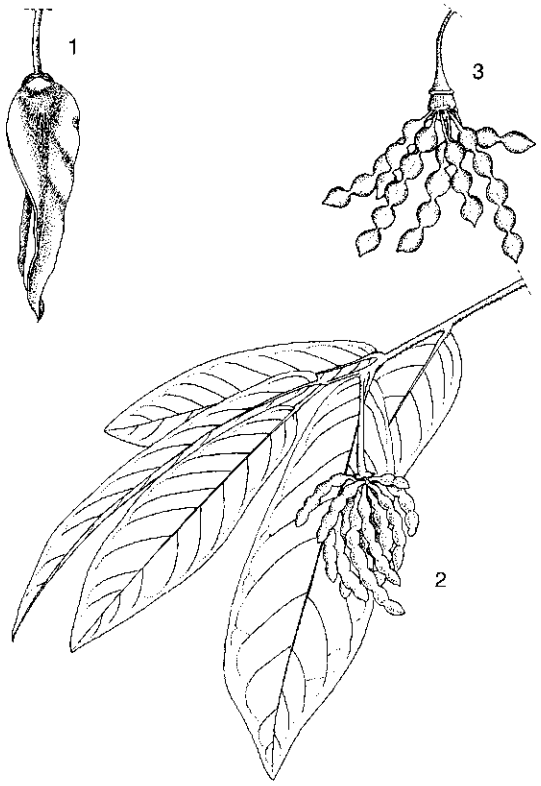
Selection of species

Dasymaschalon blumei Finet & Gagnep.

Bull. Soc. Bot. Fr. Mém. 4: 143 (1906).

Synonyms *Desmos dasymaschalus* (Blume) Safford (1912).

Vernacular names Malaysia: kenanga hutan,



Dasymaschalon blumei Finet & Gagnep. – 1, flower; 2, fruiting twig; 3, fruit.

kenanga paya, larak api (Peninsular). Thailand: buu ngong (Bangkok).

Distribution Burma (Myanmar), Thailand, Peninsular Malaysia, Singapore, Sumatra, western Java and northern Borneo (Sarawak).

Uses Although medicinal uses have not been recorded for *D. blumei*, the vernacular names for Malaysia, which are also applied to *Desmos*, suggest that it is used for similar complaints as the *Desmos* species, e.g. to treat dysentery, vertigo, fever, and after childbirth.

Observations A bushy shrub up to 8 m tall, sometimes developing scandent branches; leaves elliptical-oblong to oblong-lanceolate, 8–22 cm × 4–8.5 cm; flowers cream-coloured, sepals triangular, 3–5 mm long, petals ovate, 4–13 cm long; ripe carpels with (1–)2–6(–7) distinct segments, bright red with waxy bloom. *D. blumei* occurs in lowland forest, and is locally common (e.g. in Peninsular Malaysia) but elsewhere rare (e.g. in Java).

Selected sources 62, 121, 135, 309, 860.

Dasymaschalon clusiflorum (Merr.) Merr.

Philipp. Journ. Sci., Bot. 10: 237 (1915).

Synonyms *Dasymaschalon oblongatum* Merr. (1915).

Vernacular names Philippines: malaatis (Tagalog), malasagiat (Iloko), panagit (Cebu Bisaya).

Distribution The Philippines (from Luzon to the Babuyan Islands, Palawan and Mindanao).

Uses The leaves are used externally to treat wounds, whereas a decoction of the roots or leaves is reputedly a good diuretic.

Observations A large shrub; leaves oblong-elliptical, 11–15 cm × 3.5–5 cm; flowers yellowish-green, sepals kidney-shaped, c. 2 mm × 4 mm, petals ovate-lanceolate, 5–6 cm × 2 cm; ripe carpels with 1–2 indistinct segments. *D. clusiflorum* is common in forest at low and medium altitudes, up to 1300 m; also on limestone.

Selected sources 731, 760.

R.E. Nasution

Dendrophthoe Mart.

Flora 1: 109 (1830).

LORANTHACEAE

$x = 8, 9$; *D. pentandra*: $2n = 16$

Origin and geographic distribution *Dendrophthoe* consists of some 38 species, distributed in tropical Africa, southern Asia and Australia. In Malesia 21 species occur, with no obvious centre of diversity.

Uses *Dendrophthoe* species are only occasionally used in South-East Asian folk medicine. In general they are applied in poulticing, and in Thailand an infusion of *D. pentandra* is used to relieve hypertension. In Java, dried stems of aerial stem-parasitic *Loranthaceae* (including *Dendrophthoe* and *Scurrula*) enter into traditional prescriptions for the treatment of smallpox, and for a vermifuge for children. More recently, they have been mentioned as a traditional medicine for cancer.

In India *D. falcata* (L.f.) Ettingsh. and *D. longiflora* (Desr.) Ettingsh., by some considered as one species, are used in the Ayurvedic system of medicine. The bark of *D. falcata* is astringent and used to treat wounds, menstrual disorders and asthma. The plant is also used as an abortifacient.

Properties Research in Indonesia on the use of *D. pentandra* in complementary and alternative medicine (CAM) therapy in cancer focuses on its effect on enzymes that are associated with liver diseases and cell proliferation (e.g. alkaline phosphatase and glutamate pyruvate transaminase). Aqueous extracts of *D. pentandra* leaves can reduce blood pressure in rats at high, nearly toxic doses; a methanol extract is less effective. The mechanism of action is through muscle relaxant activity.

An orally administered aqueous extract of *D. falcata* showed significant diuretic effects in the rat. Prophylactic or curative treatment with orally administered aqueous or alcoholic extracts of *D. falcata* showed a considerable reduction in artificially induced urinary bladder stones in rats. *D. falcata* extracts also exhibit hypotensive activity.

Botany Stem-parasitic shrubs, often robust, usually with runners on the bark of the host, bearing secondary haustoria. Leaves usually alternate, sometimes opposite, simple and entire, petiolate; stipules absent. Inflorescence an axillary or terminal raceme or spike, sometimes few-flowered and umbellate, bracteate. Flowers bisexual, (4–)5-merous; calyx reduced to a limb; corolla gamopetalous, usually weakly zygomorphic; stamens inserted on the corolla opposite the lobes; ovary inferior, style simple, usually with a knob-like stigma. Fruit berry like, ovoid, 1-seeded. Seed covered by a sticky layer.

After germination of the seed, it takes 1.5–3 years before plants start flowering and fruiting. Pollination is by birds or insects and effective seed dispersal is by fruit-eating birds. Fruits may be either swallowed whole and excreted or the seed is

rubbed off their beaks after feeding on the surrounding fruit pulp.
Dendrophthoe seems related to African as well as Asian genera, e.g. *Scurrula*.

Ecology *Dendrophthoe* occurs in habitats ranging from humid to open forests as well as in disturbed sites. Although more common in lowlands, it can be found up to over 2500 m altitude. Host specificity of most *Dendrophthoe* species is generally low and in Malesia many species are aggressive and also found on cultivated trees. Locally they can be considered a serious pest in plantations.

Management Seeds of *D. pentandra* have no dormant period and can germinate within the fruit, although this affects vigour. Germination takes 2–8 days at 18–32°C, with over 90% success rate. Germination can occur on any natural substrate, and artificial propagation is possible. However, best results are obtained with seeds from fresh fruits sown on small branches of hosts.

Genetic resources *Dendrophthoe* species treated here are widely distributed and occur on a wide range of host plants. Therefore they do not appear to be threatened by genetic erosion.

Prospects Little is known on the pharmacology of *Dendrophthoe*. More research is needed to evalute its potential in complementary and alternative medicine and as an antihypertensive agent.

Literature 32, 74, 181, 247, 731, 758, 1002, 1018.

Selection of species

Dendrophthoe incarnata (Jack) Miq.

Fl. Ind. Bat. 1, 1: 821 (1856).

Synonyms *Loranthus grandifrons* King (1887), *Dendrophthoe villosa* Danser (1931).

Vernacular names Malaysia: dedalu api gajah, mendalu (Peninsular).

Distribution Thailand, Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia the leaves are mixed with turmeric (*Curcuma longa* L.) and rice to make a poultice for treating ringworm.

Observations A hemiparasitic shrub up to 2.5 m tall, glabrous but the young parts with a short, dense, white or ochrous stellate tomentum; leaves narrowly to broadly ovate, 10–30 cm × (2–)4–16 cm, base attenuate to truncate or slightly cordate, apex acuminate, petiole 0.7–1(–3) cm long; inflorescence a 12–40-flowered raceme, axis 5–8.5 cm long; corolla weakly clavate, relatively slender, (40–)50–110 mm long, acute at apex, mostly pink or red below and green above, tube in open flower 40–85 mm long; fruit ovoid, up to 12 mm × 7 mm. *D. incarnata* is common on a wide range of host plants at 0–200(–1050) m altitude.

Selected sources 121, 247, 731.

Dendrophthoe pentandra (L.) Miq.

Fl. Ind. Bat. 1, 1: 818 (1856).

Synonyms *Loranthus pentandrus* L. (1767).

Vernacular names Indonesia: benalu (Javanese). Malaysia: dedalu api jantam, sulur api jantan, dedalu api puteh (Pensinsular). Philippines: agoago, bogto (Tagbanua). Thailand: kaafaak ma muang (central). Vietnam: m[ooj]c k[ys] n[ow]m nh[ij], tang k[ys] sinh.

Distribution From eastern India to Indo-China and western Malesia (Peninsular Malaysia, Sumatra, Java, the Lesser Sunda Islands, Borneo and the Philippines).

Uses In Peninsular Malaysia the leaves are pounded and made into a poultice for treating small sores, ulcers and other skin affections. A decoction of the leaves is administered in Perak (Malaysia) as a protective medicine after childbirth. In Thailand an infusion of the dried whole plant is drunk to relieve hypertension. In Vietnam the leaves are mixed with those of regular tea to obtain an infusion to soothe cough.

Observations A hemiparasitic shrub up to 1.5 m tall, glabrous but the young parts with a somewhat silky off-white to grey or less often brown tomentum; leaves variable, mostly narrowly to broadly elliptical, 6–13 cm × (1.5–)3–8 cm, base attenuate to cuneate, apex rounded to rarely acuminate, petiole 0.5–2 cm long; inflorescence a 6–12-flowered raceme, axis 1–2(–3.5) cm long; corolla clavate, inflated in the lower part, 12–20(–28) mm long, obtuse or rounded at apex, mostly green or yellow to orange, rarely red, tube in open flower (2–)6–12 mm long; fruit ovoid, up to 10 mm × 6 mm. *D. pentandra* occurs in humid and open forest, and is common in lowlands up to 500 m altitude, but occurs occasionally up to 1650 m altitude.

Selected sources 121, 173, 247, 456, 731, 732, 760, 816.

J.L.C.H. van Valkenburg

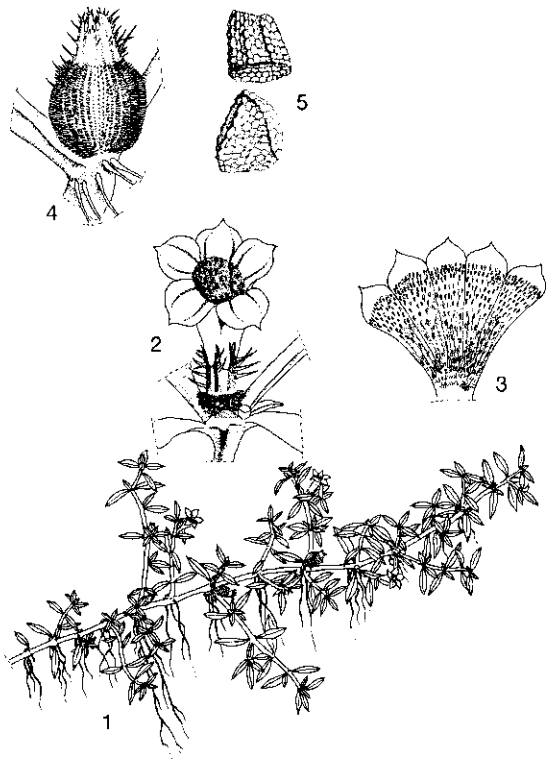
Dendrotrophe umbellata (Blume) Miq.

Fl. Ned. Ind. 1, 1: 779 (1856).
SANTALACEAE
$2n$ = unknown
Synonyms *Henslowia umbellata* (Blume) Blume (1851), *Henslowia monticola* Gamble (1912), *Dendrotrophe monticola* (Gamble) Danser (1940).
Vernacular names Malaysia: dalu-dalu, akar ara batu, akar api-api (Peninsular). Cambodia: selam-phao. Thailand: ti mia muea yang (Songkhla). Vietnam: d[aa]y c[oor] tay, hen t[as]n.
Origin and geographic distribution *D. umbellata* occurs in Indo-China, Thailand, Peninsular Malaysia, Sumatra and western Java; possibly also Flores.
Uses In Peninsular Malaysia, a decoction of the roots and leaves is used to treat fever, and a poultice of the leaves is applied against headache.
D. buxifolia (Blume) Miq. (synonym: *Henslowia buxifolia* Blume) is also used in Peninsular Malaysia as a poultice to treat headache. *D. frutescens* (Benth.) Danser (synonym: *Henslowia frutescens* Benth.) is applied to wounds in Vietnam.
Properties In a general screening assay against a variety of fungi and bacteria in Malaysia, a methanolic extract of *D. umbellata* showed negative results against all organisms tested.
Botany An epiphytic scandent shrub, with branches up to 7 m long. Leaves arranged spirally, simple and entire, obovate, 2.5–7 cm × 2–4 cm, cuneate at base, rounded at apex, leathery, with 3–5 main veins; petiole up to 0.5 cm long; stipules absent. Inflorescence umbel-like, with scaly peduncle, usually 2–5-flowered. Flowers apparently bisexual or functionally unisexual, very small, 5-merous, greenish; male flowers with stamens inserted at base of the perianth lobes, pistil rudimentary; female flowers with inferior, 1-celled ovary and very short style having 5 obscure stigmas on top, stamens more or less developed. Fruit a globose-ellipsoid or ovoid drupe 4–10 mm long; pyrene with longitudinal rows of tubercles, 1-seeded. Seed with many rounded lobes, endosperm abundant.
Dendrotrophe comprises about 30 species and occurs from the Himalayas, throughout South-East Asia, to northern Australia (1 species in Queensland).
Ecology *D. umbellata* is epiphytic, perhaps parasitic, rooting in the bark of trees. In Java and Indo-China it occurs in mixed forest in the mountains, in Java at 1400–2200 m altitude. In Peninsular Malaysia, it is often found in sandy locations near the sea, but also in mountains up to 1600 m altitude.
Genetic resources *D. umbellata* does not seem to be threatened as its occurrence is rather widespread.
Prospects Although little is known about *D. umbellata*, its prospects as a medicinal plant seem to be very limited; the uses are restricted, and a first screening on antimicrobial activity showed negative results.
Literature 33, 121.
Other selected sources 62, 264, 789, 990.

Wongsatit Chuakul,
Noppamas Soonthornchareonnon
& Orawan Ruangsomboon

Dentella repens (L.) J.R. Forster & J.G. Forster

Char. gen. pl.: 26, tab. 13 (1776).
RUBIACEAE
$2n$ = 36
Synonyms *Oldenlandia repens* L. (1767).
Vernacular names Indonesia: kremah, krokot putih, mata yuyu (Java). Malaysia: bunga karang (Peninsular). Philippines: dilang-butiki (Tagalog).
Origin and geographic distribution *D. repens* occurs in tropical Asia, tropical Australia, Micronesia and Polynesia. It is common throughout South-East Asia.
Uses In Peninsular Malaysia, the plant is used for poulticing sores.
Botany A small creeping annual or perennial herb up to 30 cm tall, prostrate stems abundantly rooting, strongly branched, forming large flat cushions. Leaves opposite, simple and entire, elliptical-oblong to oblong-obovate, 4–10 mm × 2–5 mm, sessile or shortly petiolate; stipules interpetiolar, connate, with few hairs. Flowers solitary in leaf axils, bisexual, regular, 5-merous; pedicel very short; calyx tubular, deeply 5-fid, persistent; corolla gamopetalous, funnel-shaped, 5–15 mm long, much longer than calyx, tube yellowish, hairy inside, lobes acute, white, usually with a purple spot and hairy at base; stamens inserted near the base of the corolla tube, included, with very short filaments; ovary inferior, 2-celled, style deeply bifid. Fruit an indehiscent, subglobose capsule 3–4 mm long, crowned by the calyx, usually densely hairy, many-seeded. Seeds small, angular, reticulate, dark brown. Seedling with epigeal germination; cotyledons elliptical to ovate; hypocotyl 2–6 mm long, epicotyl absent.



Dentella repens (L.) J.R. Forster & J.G. Forster – 1, plant habit; 2, flower; 3, corolla opened, showing stamens; 4, fruit; 5, seeds.

The seeds are often dispersed by water.

Dentella belongs to the tribe *Hedyotideae*, together with e.g. *Hedyotis* and *Oldenlandia*. It is characterized by the 5-merous flowers and indehiscent capsule. *D. repens* is the only species of the genus. A form with glabrous fruits is sometimes considered to represent a distinct species: *D. serpyllifolia* Wallich ex Craib.

Ecology *D. repens* is a minor weed and occurs in fallow land, waste places, rice fields, sugar cane plantations and dry riverbeds, especially on heavy soils. It is locally abundant.

Management As a weed, *D. repens* is usually easily controlled manually.

Genetic resources Being a common and widespread weed, there is no danger of genetic erosion for *D. repens*.

Prospects The use of *D. repens* for treating sores externally is similar to *Hedyotis* and *Oldenlandia* species. Its affinity to these genera suggests the presence of similar compounds with possible antiphlogistic activity such as iridoids. Research might confirm this hypothesis.

Literature 121, 879.
Other selected sources 760.

R.H.M.J. Lemmens

Desmos Lour.

Fl. cochinch.: 329 (*'Desmis'*), 352 (1790).

ANNONACEAE

x = unknown; *D. chinensis*: $2n = 20$, *D. cochinchinensis*: $2n = 16$

Origin and geographic distribution *Desmos* comprises approximately 20 species, and occurs in Nepal, India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines; possibly also elsewhere in Malesia and in tropical Australia.

Uses Decoctions of the roots of both *Desmos* species treated here are commonly used in traditional medicine in Indo-China, China, Thailand and Peninsular Malaysia to treat fever, and have also been given to treat dysentery and vertigo, and after childbirth. Dried flowers of *D. cochinchinensis* are used in Vietnam to treat repletion and cough, and the roots are used in a complex mixture against rheumatism.

A fragrant essential oil can be obtained from the flowers of *D. chinensis*. Sometimes the stems of lianescent *Desmos* plants are cut to obtain drinking water in the forest.

Properties The chloroform-soluble fraction of an ethanolic extract of *D. chinensis* showed significant antibacterial activity against a wide range of gram-positive and gram-negative bacteria, with the flavonoids 5-methoxy-7-hydroxyflavanone and 6'-hydroxydehydrouvaretin as the active compounds. The same fraction also showed considerable in-vitro antileishmanial activity, with 6'-hydroxydehydrouvaretin as the main active compound. Several other flavonoids have been identified in *D. chinensis*. One of these, desmal (8-formyl-2,5,7-trihydroxy-6-methylflavanone), is a strong tyrosine kinase inhibitor, which may help to suppress the development of neoplasms including tumours and breast carcinomas. Several flavonoids have been isolated and identified from *D. cochinchinensis*. A petroleum-ether extract of its roots showed antimalarial activity. Cytotoxic compounds found in *D. cochinchinensis* include desmosic acid and heynic acid.

The sterol stigmast-4-ene-3,6-dione isolated from *D. dumosus* (Roxb.) Safford from China exhibited cytotoxicity.

Botany Shrubs, often with scandent branches, or lianas up to 30 m long. Leaves alternate, distichous, simple and entire, pinnately veined, subsessile or shortly petiolate; stipules absent. Flowers solitary, axillary or extra-axillary, opposite the leaves, pendulous, bisexual, often fragrant; sepals 3, free, valvate; petals 6 in 2 series, valvate, clawed, limbs free; stamens numerous, cuneate, with broad connective concealing the anther cells; ovaries numerous, superior, stigmas bent with a U-shaped opening and a groove. Fruit consisting of numerous, stalked, moniliform carpels with up to 8 segments; segments each with one seed, separating at maturity.

Desmos is closely related to *Dasymaschalon*, which is often considered congeneric (but then usually distinguished as a section within *Desmos*). *Dasymaschalon* differs having usually 3 petals (inner series absent), which are cohering at the edges.

What has been reported as *D. cochinchinensis* in Peninsular Malaysia possibly refers to *D. pedunculosus* (A.DC.) Bân.

Ecology Both *Desmos* species treated occur in open locations and borders of lowland forest, but also in living fences, thickets and brushwood, up to 600 m altitude.

Genetic resources *D. chinensis* and *D. cochinchinensis* are both widespread and occur commonly in secondary habitats. They consequently do not seem endangered or liable to genetic erosion. A complete taxonomic revision of the genus is still missing, and is needed to judge the needs for conservation of species.

Prospects *Desmos* includes interesting medicinal plants containing flavonoids with antibacterial, antileishmanial, anticancer and antimalarial activities. More research seems worthwhile, also in view of the wide use of *Desmos* in traditional medicine, e.g. as a febrifuge.

Literature 444, 759, 860.

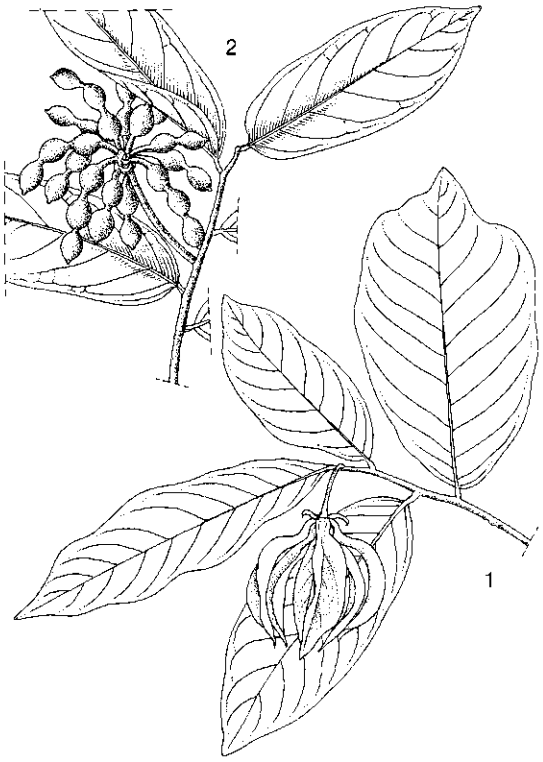
Selection of species

Desmos chinensis Lour.

Fl. cochinch.: 352 (1790).

Vernacular names Malaysia: akar pisang-pisang, kenanga hutan, akar darah (Peninsular). Philippines: ilang-ilang gubat (Tagalog). Thailand: kluai khruea (Saraburi), khruea khao klaep (Loei), saao yut (central, peninsular). Vietnam: hoo gi[er] th[ow]m, n[oos]i c[oo]i.

Distribution Nepal, eastern India, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines.



Desmos chinensis Lour. – 1, twig with flower; 2, twig with fruit.

Uses In Peninsular Malaysia a decoction of the root has been given to treat dysentery and vertigo, and after childbirth. The roots are used in traditional medicine in China to treat malaria. A fragrant essential oil can be obtained from the flowers. *D. chinensis* is sometimes planted in gardens for its fragrant flowers.

Observations A scandent shrub with straggling branches, up to 5 m tall; leaves oblong to lanceolate, 5.5–25 cm × 2.5–7.5 cm, membranous; flowers greenish-yellow, sepals ovate-lanceolate, 0.5–1 cm long, petals oblong-lanceolate, 4–13 cm long; ripe carpels with 1–7 segments, shining black. *D. chinensis* occurs in open locations and borders of lowland forest, but also in living fences and brushwood, up to 600 m altitude.

Selected sources 62, 121, 444, 759, 760, 860.

Desmos cochinchinensis Lour.

Fl. cochinch.: 352 (1790).

Vernacular names Malaysia: larak salai, larak api, kenanga hutan (Peninsular). Thailand: naang dam (Nakhon Ratchasima), yom (Malay, Pattani), saa lao (Prachuap Khiri Khan). Vietnam: hoa d[er] l[oo]ng den.

Distribution Indo-China, southern China, Thailand and northern Peninsular Malaysia.

Uses In Peninsular Malaysia a decoction of the roots has been given against fever. Dried flowers are used in Vietnam to treat repletion and cough, and the roots in a complex mixture against rheumatism. The roots are used in traditional medicine in China to treat malaria.

Observations A scandent shrub or liana; leaves oblong to oblong-elliptical, 10–22 cm × 5–10 cm, thin-leathery; flowers greenish-yellow then yellow, sepals ovate-lanceolate, c. 7 mm long, petals broadly ovate, c. 4 cm long; ripe carpels with 2–5 segments. *D. cochinchinensis* occurs in open locations in lowland forest and in thickets.

Selected sources 121, 547, 860.

R.H.M.J. Lemmens

Dichapetalum griffithii (Hook.f.) Engl.

Engl. & Prantl, Nat. Pflanzenfam. 3(4): 348 (1896).

DICHAPETALACEAE

$2n$ = unknown

Synonyms *Chailettia griffithii* Hook.f. (1875), *Chailettia setosa* King (1896).

Vernacular names Malaysia: meroyan kabut, akar peleh angin, kedondong bulan (Peninsular).

Origin and geographic distribution *D. griffithii* is restricted to Peninsular Malaysia.

Uses In Peninsular Malaysia, a decoction of the roots of *D. griffithii* is drunk as a stimulant during the first 3 days after childbirth. The fruits are edible.

In Africa, several *Dichapetalum* species are used in traditional medicine, e.g. for the treatment of infectious diseases, rheumatism and sores. An example is *D. madagascariense* Poir., which is applied to treat jaundice, sores and urethritis. The fruits of some African species (particularly *D. toxicarium* (G. Don) Baillon) are used as a rodenticide.

Properties Several *Dichapetalum* species in Africa are notorious poisonous plants. However, there are no reports of poisoning by *Dichapetalum* in South-East Asia. It may be that there are no poisonous compounds in the plants there, but this may also be caused by the fact that in South-East Asia *Dichapetalum* usually occurs scattered in closed forest and not in pastures. Numerous cases of poisoning of livestock have been documented, particularly by *D. cymosum* (Hook.) Engl. in eastern and southern Africa and *D. barteri* Engl. and *D. toxicarium* in western Africa. Fluoroacetate has been recorded as the lethal toxin in *D. cymosum*, *D. barteri* and *D. toxicarium*; this compound is converted by enzymes into fluorocitrate, which upsets the Krebs cycle in heart cells. Fluoro-fatty acids are present in the seeds of *D. toxicarium*, which may cause death in doses as low as 10 mg/kg. Triterpenoids called dichapetalins have been isolated from African *Dichapetalum*. Dichapetalin A isolated from *D. madagascariense* exhibits strong and selective cytotoxicity against brine shrimps and some selected cell lines. There are some reports of high levels of metallic substances in *Dichapetalum* leaves, e.g. for lead in *D. madagascariense*, and for nickel in the Malesian *D. gelonioides* (Roxb.) Engl.

Antimicrobial activity has been demonstrated for a *D. madagascariense* extract, both against bacteria and pathogenic fungi.

Botany A climbing or creeping shrub, sometimes erect and up to 4 m tall; twigs rusty and shaggy pilose. Leaves alternate, pseudo-distichous, subsessile, simple and entire, lanceolate to elliptical, 12–22 cm × 4–11 cm, cordate at base, acuminate at apex, usually shaggy pilose on veins below, often with orbicular, flat glands below; stipules narrowly triangular to subulate. Inflorescence an axillary glomerule up to 1 cm long, many-flowered, shaggy pilose. Flowers bisexual, 5-merous; sepals ovate; petals free, spatulate, c. 3.5 mm long, c. 1 mm incised, whitish or creamy; stamens free; disk consisting of 5 lobes alternating with the stamens; ovary superior, 3-celled, woolly pubescent, style 3-partite at apex. Fruit drupaceous, obovoid, (2–)3-lobed, 3.5–4 cm long, c. 1 cm long stalked, rusty and shaggy pilose, yellow or orange when ripe, 1–2(–3)-seeded. Seeds lacking albumen, cotyledons planoconvex, fleshy.

D. griffithii flowers mainly during May–July, whereas ripe fruits are most common in September–January.

Dichapetalum is a large genus of approximately 120 species and with a pantropical distribution. The main centre of speciation is Africa, where about 90 species are found. Approximately 15 species occur in Malesia.

Ecology *D. griffithii* occurs in mixed primary

and secondary lowland forest, also in bamboo forest, up to 200 m altitude.

Genetic resources *D. griffithii* has a very limited area of distribution, but within those areas it is not uncommon in different forest types including secondary forest. At present, there seems to be no reason to consider it endangered.

Prospects Too little is known about *D. griffithii* to assess the scientific basis of its (very limited) applications in traditional medicine.

Literature 121, 247.

Other selected sources 331, 789.

R.H.M.J. Lemmens

Didissandra frutescens (Jack) C.B. Clarke

A.DC. & C.DC., Monogr. phan. 5(1): 67, t. 7 (1883).

GESNERIACEAE

$2n = 20$

Vernacular names Malaysia: tarom hutan (Peninsular).

Origin and geographic distribution *D. frutescens* occurs in north-western Peninsular Malaysia (Penang and Perak).

Uses The roots of *D. frutescens* were once administered to women during and after childbirth.

Botany A shrubby herb up to 150 cm tall, with erect or decumbent stem. Leaves opposite, in distant pairs, simple, elliptical to lanceolate, 15–30 cm × 5–12 cm, base cuneate, apex acute to shortly acuminate, minutely crenulate-dentate, hairy at both surfaces; petiole 3–10 cm long; stipules absent. Inflorescence an axillary cyme with short peduncle, (1–)3(–4)-flowered. Flowers bisexual, 5-merous; pedicel c. 1.5 cm long; sepals free, narrowly lanceolate, lilac to dark purple; corolla c. 4.5 cm long, 2-lipped, with funnel-shaped, curved tube and rounded lobes, pubescent, white with yellowish mouth; stamens 4, didynamous, anthers cohering in pairs; disk forming a cylindrical cup around the ovary; ovary superior, 1-celled, style pilose, stigma slightly 2-lobed. Fruit a slender cylindrical capsule 8–10 cm long, glabrous, with longitudinal ribs, many-seeded.

The flowers are probably pollinated by insects such as bees.

Many species originally described in *Didissandra* have been referred to various other genera, of which the most important is *Ridleyandra*. *Didissandra* in the emended sense comprises 8 species and occurs in Peninsular Malaysia, Sumatra, Java and Borneo. *Ridleyandra* is larger with 23 species. Flowering *D. frutescens* closely resembles *Henckelia* species, but it can be distinguished by its 4 stamens (2 in *Henckelia*).

Ecology *D. frutescens* is locally common on stream banks and in damp ravines in primary hill forest.

Genetic resources *D. frutescens* has a very limited area of distribution and might easily become endangered.

Prospects A poorly known species, it is unlikely that *D. frutescens* will gain importance as a medicinal plant.

Literature 121, 985.

Other selected sources 789.

R. Kiew

Dieffenbachia seguine (Jacq.) Schott

Wiener Z. Kunst 1829(3): 803 (1829).

ARACEAE

$2n = 34, 68$

Synonyms *Dieffenbachia maculata* (Lodd.) D. Don (1839), *Dieffenbachia picta* (Lodd.) Schott (1852).

Vernacular names Dumb cane (En). Vietnam: m[oo]n tr[uw][owf]ng sanh.

Origin and geographic distribution *D. seguine* originates from tropical America, and is commonly cultivated as an ornamental in gardens elsewhere in the tropics, including South-East Asia. It is a common indoor potplant in colder regions.

Uses *D. seguine* is a popular ornamental, especially those forms with variegated leaves. The sap is used in tropical America as an antidote (counter-irritant) against snakebites, and to treat rheumatism and gout externally. It is also used to treat tumours and warts. The seed oil is applied on wounds, burns and inflammations. In Brazil a leaf decoction is gargled to relieve angina. However, the plant is better known for its toxic properties. It is used to poison rats and cockroaches, and for making arrow poison.

Properties *D. seguine* is notorious for its toxic effects. It may cause dermatitis, corneal injury and has a toxic effect on mucous membranes, probably by ejection of calcium oxalate crystals (raphides) leading to injury of mast cells and a subsequent massive histamine release. When parts of the plant are ingested, this can lead to significant toxicity, especially in children. However, in most cases the symptoms are of short dura-

tion and the outcome can be classified as minor. The toxic manifestations have been partly attributed to proteolytic activity, but the exact principle is not yet known. Contraceptive activity in rats has been recorded.

Botany A herb with ascending to erect stem, having distinct, smooth and green internodes. Leaves alternate, simple and entire, oblong-ovate to elliptical, 15–50 cm × 7.5–20 cm, fleshy, often variegated; petiole usually long, with petiolar sheath almost reaching blade. Inflorescence a spadix, several together, short-peduncled; spathe tubular at base, upper part expanded into a short blade, green; spadix cylindrical, shortly stalked, female zone at base, adnate to spathe, laxly flowered, male zone at apex, densely flowered. Flowers unisexual, without perianth; male flowers with 4–5 connate stamens, anthers sessile; female flowers with subglobose ovary, 1–3-celled, stigma sessile, broad, staminodes 4–5. Fruit a subglobose berry, orange to red at maturity, 1–3-seeded. Seeds ovoid-globose, without endosperm.
Dieffenbachia comprises about 30 species native to the American tropics.

Ecology In tropical America, *D. seguine* occurs in mixed evergreen lowland forest and lower montane forest, up to 1300 m altitude.

Management Propagation of ornamental *Dieffenbachia* can be practised by tip cuttings, stem cuttings 5–8 cm long, air layering and division of basal shoots, using a 1:1 peat/sand mix.

Genetic resources There is no information about the genetic variability of cultivated *D. seguine*, although it is commonly cultivated as an ornamental, also in South-East Asia.

Prospects Although *D. seguine* can be dangerous for children, it will maintain its importance as an attractive and hardy foliage ornamental in South-East Asia. The prospects as a medicinal plant seem limited due to its toxic properties.

Literature 62, 163, 268, 647, 892.
Other selected sources 121, 611, 646.

R.H.M.J. Lemmens

Dioclea hexandra (Ralph) Mabb.

Taxon 29: 605 (1980).
LEGUMINOSAE
$2n = 22$

Synonyms *Dioclea reflexa* Hook.f. (1849), *Dioclea javanica* Benth. (1852).

Vernacular names Marbles vine (En). Malaysia: kacang laut, pinang kesa, kacang pinggang.

Origin and geographic distribution *D. hexandra* has an extremely wide area of distribution: West and Central Africa, tropical America, throughout tropical Asia, and tropical Australia.

Uses In Peninsular Malaysia the root of a papilionaceous liana, probably *D. hexandra*, is boiled and the decoction drunk for pain in the region of the heart. In West and Central Africa the powdered seed is used as an external application for itch and rheumatism; it is also included in prescriptions to be taken orally to treat cough and asthma. The seed, alone or together with *Aframomum* seeds, is taken as a tonic and stimulant, and in Nigeria it is used against splenitis and applied externally to kill head lice. Locally, the seeds, either roasted or boiled, are used as a thickener for soup. In Africa the seeds are widely used in games (e.g. as marbles), as ornaments (e.g. in necklaces) and as a good-luck charm.

Properties Research on *Dioclea* has focused on neotropical species, in particular on their lectins, which, for example, induce histamine release (interacting with sugars in the antibodies bound to the mast cells), and their flavonoids, such as dioclein, which showed analgesic and vasorelaxant effects.
A root extract of *D. hexandra* (at 100 ppm) resulted in 70% mortality in the freshwater snail *Bulinus globulus*. Roots contain considerable amounts of rotenone. The seeds contain toxic substances such as phytic acid (320 mg/100 g), tannin (150 mg/100 g) and hydrogen cyanide (2 mg/100 g). Heating apparently reduces the toxic effects for human consumption.

Botany A large liana up to 30 m long; young stems covered with spreading, brown, short and long hairs, later glabrescent, ridged and lenticellate. Leaves alternate, 3-foliolate; petiole up to 15 cm long; stipules 8–12 mm long; leaflets oblong to oblong-elliptical, 6.5–15 cm × 4–12 cm, base rounded to slighly subcordate, apex acuminate, variably hairy on both surfaces. Inflorescence an axillary pseudoraceme, rachis 10–30 cm long, peduncle 15–55 cm long; bracts 4–16(–20) cm long, patent, early caducous. Flowers bisexual, pedicellate; calyx campanulate, 1–1.5 cm long, 5-toothed with 2 upper teeth connate, pubescent; corolla papilionaceous, 1.5–2.5 cm long, purple-blue, standard rounded or ovate, with basal auricles, wings about as long as keel, keel incurved, obtuse or beaked; fertile stamens 6, sterile ones 4, 9 connate and 1 free; ovary superior, subsessile, 1-celled, style incurved. Fruit a linear-oblong to semi-orbicular pod, compressed or turgid, 6.5–12(–16) cm ×

2–6.5 cm, indehiscent,1–5-seeded. Seeds rounded, compressed, 2.7–3.5 cm × 2.4 cm, with very large hilum encircling c. 3/4 of the seed.

D. hexandra can be found flowering and fruiting throughout the year. *Dioclea* is primarily a neotropical genus comprising some 50 species, with 3 species indigenous in South-East Asia. *D. hexandra* is a very variable species, formerly proposed to be divided, but no combination of characters can be found to justify a division at any level in South-East Asia.

Ecology *D. hexandra* is often encountered in forest margins, often not far from water, but also in open forest and brushwood, from sea-level up to 450(–1100) m altitude. The seed has considerable buoyancy and can be dispersed by sea currents.

Genetic resources In view of its wide distribution and presence in secondary habitats, *D. hexandra* does not appear to be threatened by genetic erosion. The genetic diversity is probably considerable, considering its extremely wide distribution and variability.

Prospects Future research on the pharmacological activities of *Dioclea* in South-East Asia seems justified, given the wide application in traditional medicine in Africa and the interesting compounds and activities found in tropical American species. The future use of the roots of *D. hexandra* in South-East Asia for their rotenone content is not expected to be important.

Literature 62, 120, 121, 965.

Other selected sources 7, 25, 75, 244, 935.

L.J.G. van der Maesen

Diospyros L.

Sp. pl. 2: 1057 (1753); Gen. pl. ed. 5: 478 (1754).

EBENACEAE

$x = 15$; *D. montana*: $2n = 30$

Origin and geographic distribution *Diospyros* consists of over 300 species and occurs throughout the tropics. Some 170 species have been recognized within the Malesian region; 70 species occur within Peninsular Malaysia and about 100 in Indonesia.

Uses In South-East Asia various parts of numerous *Diospyros* species are used medicinally; especially unripe fruits are used in traditional medicine. The fruit juice is applied to wounds and ulcers and is drunk in cases of dysentery and fever; it possesses antibacterial and anthelmintic activities. Bark extracts are also widely administered, e.g. a decoction of *D. pilosanthera* Blanco bark as a bechic in the Philippines. Fruits are used as a source of fish poison, e.g. fruits of *D. montana* and *D. wallichii*, as are those of *D. ehretioides* Wallich ex G. Don, *D. lanceifolia* Roxb., *D. maritima* Blume, *D. rufa* King & Gamble and *D. toposia* Buch.-Ham. Pounded bark is sometimes employed for the same purpose.

In Indo-China the fruits of *D. decandra* Lour. are prescribed to treat restlessness, insomnia, and diarrhoea. Fruit pulp is used as a vermifuge for children, and ashes of the rind are applied to wounds and inflammation of the skin. Finely cut, roasted leaves are used as cataplasms on ulcers and sores. In Thailand the bark and wood of *D. rhodocalyx* Kurz is applied as a general tonic and in the treatment of impotence and leucorrhoea. The fruit is used as an antinauseant, antidiarrhoeal, anthelmintic and anti-inflammatory; externally it is applied to abscesses and infected wounds. The roasted fruit rind is taken as a diuretic and to treat leucorrhoea. In Taiwan the stems of *D. maritima* are used as a traditional remedy for rheumatism.

The fruits of many *Diospyros* species are edible; the most important fruit trees are *D. blancoi* A.DC., *D. digyna* Jacq. and *D. kaki* L.f. Some of these species are also well known medicinally. In Malaysia the dried calyces and peduncles of *D. kaki* are used for treating coughs and difficult breathing. The fruit is considered stomachic, astringent and pectoral. The juice from unripe fruits reduces blood pressure, stops haemorrhages and acts as a laxative. The peduncle is considered stomachic, anti-emetic and bechic. The bark and wood are applied as a styptic on wounds and ulcers. A leaf decoction is used as a bechic and antifebrile, and in Japan as a traditional remedy for hypertensive diseases. Various preparations of bark and leaves of *D. digyna* are used to treat fever and skin diseases.

The unripe fruits of a few species (*D. malabarica* (Desr.) Kostel. and *D. mollis* Griffith) are used to dye cloth black and for tanning nets and sometimes hides. They are also applied medicinally. The unripe fruits of *D. malabarica* are used to treat diarrhoea, dysentery and leucorrhoea. Fruit juice is applied to wounds and sores. The fresh fruit or a fruit extract of *D. mollis* is used as an anthelmintic, being effective against hookworm and tapeworm but not ascarids.

The fancy wood of large-diameter *Diospyros* is in great demand for high quality sculptures and carving. It is also valued for furniture, cabinet work, household utensils, and toys, sometimes also for boxes and construction.

Properties *Diospyros* fruits used as a fish poison are generally poor in tannin content. *D. decandra* fruits contain a glucosidic tannin yielding a pyrocatechic derivative, or phlobaphene, credited with anthelmintic properties. *D. mollis* fruits contain diospyrol diglycoside as the active principle responsible for the anthelmintic activity. Decomposition of the active compound to diospyrol causes systemic toxicity to visual nerves and the retina. This may result in temporary or permanent blindness depending on the dose.

Tannin from the leaves of *D. kaki* increases the lifespan and decreases haemorrhage and infarction in stroke-prone spontaneously hypertensive rats. A methanol extract from the leaves showed hypotensive activity in urethane anaesthetized rats. Flavonoids isolated from the leaves inhibited angiotensin-converting enzyme activity in a dose-dependent manner. In a screening programme for Acyl-CoA:cholesterol acyltransferase (ACAT) inhibitors, using ACAT extracted from rat liver microsomes, *D. kaki* extract inhibited more than 90% of ACAT activity. ACAT is a key enzyme responsible for cholesteryl ester formation in atherogenesis and in cholesterol absorption from the intestines. Under pathological conditions, formation and accumulation of cholesteryl ester constitute a characteristic feature of early lesions of atherosclerotic plaques. ACAT inhibitors are expected to be effective in the treatment of atherosclerosis and hypercholesterolaemia.

Various extracts from the leaves of *D. montana* show broad-range antibacterial activity. Alcohol extracts from the bark exhibit central nervous system depressant activity in mice and rats, spasmolytic activity in rabbits and guinea-pigs, and hypotensive activity in anaesthetized dogs. An ethanol extract from the bark further showed potent anti-inflammatory and antipyretic activities in rats and analgesic activity in mice. The growth of Ehrlich ascites carcinoma in mice was also inhibited, diospyrin being the active principle. Diospyrin exhibits in-vitro anti-protozoal activity against *Leishmania donovani*. Diospyrin and some of its derivatives also show in-vitro antiplasmodial effects.

Alcohol extracts of *D. malabarica* have anti-amoebic, antiviral and hypoglycaemic activities, and an ether extract from the fruit displays antibacterial activity. An ethanol extract of aboveground parts showed activity on human epidermoid carcinoma of the nasopharynx in tissue culture, and diuretic activity. The extract significantly prevented rats from stress, gastric ulcers and hepatotoxicity.

Isodiospyrin isolated from *D. maritima* stems exhibited strong in-vitro cytotoxicity against hepatoma, colon carcinoma and cervical carcinoma.

Botany Evergreen, usually dioecious or sometimes monoecious or polygamous shrubs or small to large trees up to 40(–50) m tall. Leaves alternate, distichous, simple and entire, pinnately veined, without stipules. Inflorescence axillary or cauliflorous on older branches or rarely on the trunk, cymose, 1–many-flowered, bracteate. Flowers usually unisexual, regular, 3–5(–8)-merous; pedicel articulate; sepals united at base, sometimes free, the lobes valvate or imbricate, persistent in fruit; petals basally united into a tube, with patent lobes; stamens (3–)12–20(–100), often inserted at the base of the corolla tube, sometimes on the receptacle, rarely higher up on the corolla tube, often in 2 whorls, staminodes usually present in female flowers; ovary superior, 2–16-celled, rudimentary in male flowers, styles (1–)2–8. Fruit a berry, with fibrous to fleshy pericarp, 1–16-seeded. Seeds with a thin leathery testa, and thick, horny, smooth or ruminate endosperm; cotyledons leafy, flat. Seedling usually with epigeal germination, sometimes hypogeal; first 2 leaves opposite or alternate, subsequent leaves alternate.

All *Diospyros* species are characterized by the architectural growth model of Massart, i.e. an orthotropic, monopodial trunk with rhythmic growth producing regular tiers of branches. The seeds are dispersed by birds, bats and monkeys.

Diospyros has been subdivided into 5 subgenera: *Diospyros*, *Maba*, *Hierniodendron*, *Cargillia*, and *Mabacea*. The first two are subdivided further into many sections. The distinction between the subgenera and sections is not always clear. Several cultivars of species producing edible fruits are known, including cultivars with seedless fruits.

Ecology *Diospyros* usually occurs in primary lowland evergreen rain forest up to 900 m altitude. Some species occur in secondary forest, lower montane or montane forest up to 1700 m altitude, in peat-swamp forest, kerangas forest or on limestone hills and ultrabasic soils.

Management Propagation of *Diospyros* is by seed or stumps. Species producing edible fruits may also be propagated by air layering, budding, grafting or separation of root suckers. *Diospyros* can be coppiced well.

Genetic resources The *Diospyros* species treated here are not sought for their timber, are relatively widespread and occur in both primary and secondary forest; therefore the risk of genetic

erosion seems to be limited. However, in general *Diospyros* prefers primary lowland rain forest as its habitat, which is under increasing pressure, and protection is needed for many species.

Prospects Several *Diospyros* species tested showed interesting pharmacological properties, e.g. anthelmintic, hypotensive, antibacterial, anti-inflammatory, antipyretic, analgesic and anti-tumour activities, supporting many uses in traditional medicine. In most cases fruits and leaves constitute the medicinal plant parts, and this facilitates sustainable exploitation of the resources. Therefore, promotion of *Diospyros* as a medicinal plant seems desirable, but more pharmacological investigations are still needed.

Literature 479, 517, 541, 542, 594, 946, 967.

Selection of species

Diospyros montana Roxb.

Pl. Coromandel 1: 37 (1795).

Synonyms *Diospyros cordifolia* Roxb. (1795), *Diospyros diversilimba* Merr. & Chun (1935), *Diospyros calcarea* Fletcher (1937).

Vernacular names Indonesia: bidara gunung (Java), morotoalah (Sumba), morotombo (Sulawesi). Malaysia: mentua pungsu (Peninsular). Philippines: antinagam (Ilocos Norte), kamagong-bundok, kamagong-liitan (Filipino). Burma (Myanmar): gyok tawbut. Thailand: tan-dam, thanfaiphi. Vietnam: th[ij] n[us]i, nh[oo]n.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, Hainan, Thailand, Peninsular Malaysia, Sumatra, Java, the Lesser Sunda Islands, the Philippines, Sulawesi, and northern Australia.

Uses In Thailand and India fruits are used to treat hiccups, ulcers, diseases of the urinary passages, biliousness, dysentery and bile tract stones. In India the bark is used to treat delirium in high fevers, vomiting and jaundice. The root has abortifacient activity.

Observations A small tree up to 15 m tall, bole up to 60 cm in diameter, twigs and trunk with occasional spines; leaves ovate to obovate, 1.5–15 cm × 1–7.5 cm, base rounded to cordate, apex obtuse to obtusely acuminate, initially sparsely pubescent above and pubescent below but later glabrescent on both surfaces, tertiary venation reticulate, impressed above, inconspicuous below; male flowers in 3–10-flowered cymes, 4(–5)-merous, stamens 16–20, female flowers solitary, 4-merous, ovary with 4 styles; fruit globose, 1–4 cm in diameter, glabrous. *D. montana* is found in monsoon forest, primary as well as secondary, up to 600 m altitude.

Diospyros montana Roxb. – 1, twig with male flowers; 2, male flower; 3, female flower; 4, twig with fruits.

Selected sources 121, 249, 541, 731, 732, 990.

Diospyros multiflora Blanco

Fl. Filip ed. 1: 303 (1837).

Synonyms *Diospyros canomoi* A.DC. (1844), *Diospyros lotus* Blanco (1845) non L.

Vernacular names Indonesia: kayu bolomongkoeni (Sulawesi). Philippines: kanumai (Tagalog, Iloko), maratampui (Iloko).

Distribution The Philippines (Luzon, Leyte, Mindanao) and Sulawesi.

Uses Bark and leaves are caustic, and are used as a cure for e.g. furfuraceous herpes, erysipelas and ringworm. The bark is also applied as a fish poison, and is included in a recipe for arrow poison. The fruit juice is used as an antipyretic, but is irritating when in contact with the skin.

Observations A medium-sized tree up to 25 m tall, bole up to 60 cm in diameter, twigs glabrescent; leaves ovate-oblong to broadly lanceolate,

7–20 cm × 3–9 cm, base rounded, apex bluntly acuminate, glabrescent on both sides; male flowers in dense many-flowered cymes, 4(–5)-merous, stamens 16, female flowers in (1–)5–15-flowered cymes, ovary with 1 style; fruit globose, 2–3 cm in diameter. *D. multiflora* occurs in thickets, secondary forest and primary forest at low and medium altitudes.

Selected sources 65, 621, 731, 760.

Diospyros wallichii King & Gamble ex Williams

Bull. Herb. Boiss. sér. 2, 5: 429 (1905).

Vernacular names Malaysia: tuba buah, pokok ikan mati, taring pelandok (Peninsular). Thailand: ku-mung, dam khao, nian paa (peninsular).

Distribution India, Thailand, Peninsular Malaysia, Sumatra and Borneo.

Uses In Malaysia the leaves are applied as a poultice on yaws. The fruits are used as a fish poison.

Observations A small tree up to 15 m tall, bole up to 12 cm in diameter, twigs and trunk unarmed; leaves oblong to lanceolate, 10–45 cm × 3–24 cm, base obtuse or acute, apex acuminate, glabrous above, initially pubescent below but later glabrescent, tertiary venation vaguely transverse to vaguely reticulate; male flowers in many-flowered cymes, 4(–5)-merous, stamens 14–18, female flowers solitary or in an up to 5-flowered cyme, 4(–5)-merous, ovary with 4 styles; fruit depressed-globose, 2–3 cm × 1.5–3 cm, velutinous or tomentose but glabrescent, the sides of the calyx lobes proliferating into callus-like woody tissue. *D. wallichii* occurs in both primary and secondary lowland rain forest up to 700 m altitude.

Selected sources 121, 249, 731, 990.

Wardah

Diplectria (Blume) Reichenb.

Deut. Bot. Herb.-Buch: 174 (1841).

MELASTOMATACEAE

x = unknown

Origin and geographic distribution *Diplectria* comprises 11 species and is distributed from eastern India and Burma (Myanmar), through Indo-China, Hainan (China) and Thailand, to Malesia (but absent in central and eastern Java, the Lesser Sunda Islands, the northern Philippines, and rare in New Guinea).

Uses A decoction, usually of the roots, is applied in Peninsular Malaysia after childbirth. It is also used to treat fever and ague, and for fomenting sprains.

The boiled leaves of *D. barbata* (C.B. Clarke) Franken & Roos from Burma (Myanmar), Laos, Vietnam, Hainan and Thailand, are used in Vietnam to treat scabies; the acidulous leaves are edible and are used particularly in fish dishes.

Diplectria is occasionally cultivated as an ornamental.

Properties Tannins are common in *Melastomataceae*, particularly of the ellagitannin type. The presence of ellagic acid has been demonstrated in the wood, bark and twigs of almost all species investigated of the tribe *Dissochaeteae* (to which *Diplectria* belongs).

Botany Straggling shrubs or lianas; nodes with interpetiolar ridges; indumentum consisting of stellate hairs, often mixed with normal hairs or bristles. Leaves opposite, simple and entire, 3–5-veined; stipules absent. Inflorescence a terminal or axillary thyrse. Flowers bisexual, regular, 4-merous; calyx collar-shaped, truncate, irregularly undulate or minutely lobed; petals free; stamens unequal, 4 fertile and 4 staminodial, each stamen usually having an apical and 2 lateral appendages and opening by a pore; ovary inferior, 4-celled. Fruit a rather dry pome, many-seeded. Seeds straight to slightly curved, lacking endosperm.

Diplectria belongs to a close-knit group of genera in the tribe *Dissochaeteae*, which also includes e.g. *Dalenia*, *Dissochaeta* and *Medinilla*. *Diplectria* is distinguished by the presence of 4 epipetalous fertile stamens and 4 alternipetalous staminodes.

Ecology The *Diplectria* species treated here all occur in primary as well as secondary lowland forest, but occasionally up to 1500 m altitude.

Genetic resources *D. divaricata*, *D. stipularis* and *D. viminalis* all have a wide distribution and also occur in secondary forest, and would consequently seem not to be endangered. However, several other *Diplectria* species are narrow endemics and may be liable to genetic erosion, e.g. *D. conica* Bakh.f. in Sumatra, *D. latifolia* (Triana) O. Kuntze and *D. micrantha* Veldk. in Borneo, *D. furfurascens* (Elmer) Nayar in the Philippines, and *D. papuana* (Mansf.) Bakh.f. in Irian Jaya.

Prospects Nothing is known about the phytochemistry or pharmacological properties of *Diplectria*. Research is needed to confirm the attributed medicinal activities.

Literature 121, 331, 964.

Selection of species

Diplectria divaricata (Willd.) O. Kuntze

Revis. gen. pl. 1: 246 (1891).

Synonyms *Anplectrum divaricatum* (Willd.) Triana (1871), *Anplectrum glaucum* (Jack) Triana (1871).

Vernacular names Brunei: uduk-uduk hutan. Indonesia: luhu-luhu akar, sidodo akar, ihadud (Sumatra). Malaysia: sendudok rimbah, sendudok halus, akar keremunting (Peninsular). Thailand: phlong in (Trang).

Distribution Burma (Myanmar), peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra, western Java, Borneo, the Philippines, the Moluccas and New Guinea.

Uses In Peninsular Malaysia, a decoction of the roots is used to treat fever and ague, whereas a poultice of the leaves is applied to the head to treat giddiness. A hot decoction is used for fomenting sprains and as an alterative during the first 3 days after childbirth. *D. divaricata* is occasionally planted as ornamental.

Observations A straggling, much-branched shrub or liana to 15 m long, stem up to 8 cm in diameter, interpetiolar ridges on nodes inconspicuous to linear; leaves ovate-oblong to lanceolate, (3.5–)5–13(–17) cm × (1.5–)2.5–6.5(–8) cm, petiole 3–10 mm long; flower buds 6–12(–15) mm long, corolla white, pink, purple, blue or violet, stamens with long-beaked anthers, lateral appendages on staminodes usually absent; fruit subglobose, 4–8 mm in diameter. *D. divaricata* occurs in primary as well as secondary lowland forest, often along rivers and roads and on open locations, sometimes up to 1500 m altitude.

Selected sources 121, 964.

Diplectria stipularis (Blume) O. Kuntze

Revis. gen. pl. 1: 246 (1891).

Synonyms *Anplectrum annulatum* Triana ex C.B. Clarke (1879), *Backeria stipularis* (Blume) Bakh.f. (1943).

Vernacular names Malaysia: kayu mata hari (Peninsular).

Distribution Peninsular Malaysia, Singapore, Sumatra, western Java and Borneo.

Uses In Peninsular Malaysia, a decoction is used as an alterative during the first 3 days after childbirth.

Observations A liana up to 15 m long, stem up to 7.5 cm in diameter, interpetiolar ridges on nodes strongly pulvinate; leaves oblong to lanceolate, 7.5–16.5(–18) cm × (3–)3.5–6 cm, petiole 4–13 mm long; flower buds up to 7 mm long, corolla white tinged with pink, red or mauve, stamens with not-beaked anthers, lateral appendages on staminodes usually present; fruit subglobose, up to 7 mm in diameter. *D. stipularis* occurs in primary and secondary rain forest up to 750 m altitude.

Selected sources 121, 964.

Diplectria viminalis (Jack) O. Kuntze

Revis. gen. pl. 1: 246 (1891).

Synonyms *Anplectrum viminale* (Jack) Triana (1871), *Backeria viminalis* (Jack) Bakh.f. (1943).

Vernacular names Indonesia: kadudu besar (Sumatra), karamunting akar (Belitung), harendong (Java). Malaysia: sendudok akar, akar sindodo (Peninsular).

Distribution Peninsular Thailand, Peninsular Malaysia, Sumatra, Belitung, western Java, Borneo and New Guinea.

Uses A decoction is used in Peninsular Malaysia as an alterative during the first 3 days after childbirth.

Observations A shrub or liana up to 6 m long, sometimes an epiphyte, interpetiolar ridges on nodes linear; leaves ovate-oblong to lanceolate, (3.5–)4.5–10.5 cm × (1–)1.5–4.5 cm, petiole 3–9 mm long; flower buds up to 7 mm long, corolla white, sometimes with pinkish hue, stamens with not-beaked anthers, lateral appendages on staminodes usually absent; fruit urceolate, up to 6 mm in diameter. *D. viminalis* occurs in primary as well as secondary forest up to 1000 m altitude.

Selected sources 964.

R.H.M.J. Lemmens

Dipteracanthus repens (L.) Hassk.

v.d. Hoeve & de Vriese, Tijdschr. Natuurl. Gesch. 10: 129 (1843).

ACANTHACEAE

$2n$ = unknown

Synonyms *Ruellia repens* L. (1767).

Vernacular names Indonesia: plinten, remah, sekatan (Java). Malaysia: akar keremak, deras malam, rumput halyor (Peninsular). Thailand: chaa hom, faa maeng (Nakhon Ratchasima). Vietnam: qu[ar] n[oor] b[of], song d[uwj]c.

Origin and geographic distribution *D. repens* is widely distributed in India, Burma (Myanmar), Indo-China, southern China, Taiwan, Thai-

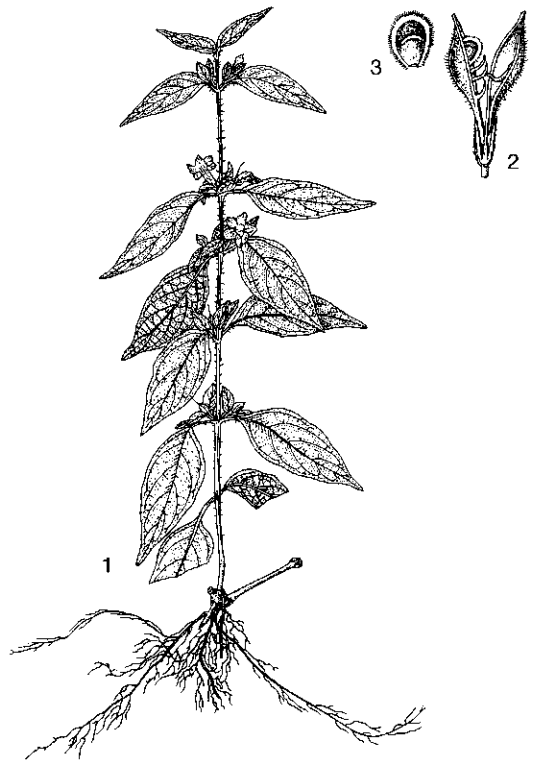
land and throughout the Malesian region except New Guinea.

Uses In Malaysia, pounded leaves are used externally as a poultice to treat sore legs, ulcers and cuts, as a cooling agent and as an anodyne e.g. to relieve toothache. In China, bruised plants are fried with eggs and taken internally to treat cough.

D. patula (Jacq.) Nees is used as a medicinal plant in India. Pounded roots and leaves of *Ruellia praetermissa* Schweinf. ex Lindau (a species close to and sometimes confused with *D. patula*, but never described in *Dipteracanthus*) are applied to swellings and boils in eastern Africa.

Properties There is no information on the phytochemistry or pharmacological properties of *D. repens*, but some data exist on presumably closely related species. Preliminary cardiovascular screening of butanol and aqueous extracts of *D. patula* suggested possible cardiotonic activity. A series of extracts of the African *R. praetermissa* showed inhibitory effects on angiotensin-converting enzyme (ACE). Lupeol may be one of the constituents responsible for the effect in the n-hexane extract, and the flavonoids luteolin and apigenin may be responsible for the activity in methanol and aqueous extracts. Saponigenins may also play a role in the ACE inhibitory activity of the aqueous extract, which was most active, and for which a cardiovascular effect has also been suggested. Methanol, ethyl acetate and aqueous extracts of *R. praetermissa* also showed in-vitro purgative effect. Together with luteolin and apigenin, two iridoid glycosides (taxiphilin and 8-epi-deoxyloganic acid) were isolated as possible active constituents.

Botany An erect or ascending herb up to 70 cm tall, with subquadrangular, finely pubescent or glabrous stem thickened above the nodes. Leaves opposite, simple and entire, ovate to ovate-lanceolate or linear-lanceolate, 1.5–10 cm × 0.5–3 cm, rounded to acute at base, obtuse to acuminate at apex, sparingly hairy, with cystoliths; petioles connected by transverse ridges; stipules absent. Flowers solitary in the leaf-axils, bisexual, 5-merous, subsessile; bracteoles ovate or ovate-oblong, 1–2 cm long; calyx c. 4 mm long, with lanceolate to narrowly triangular, subequal segments; corolla c. 2 cm long, campanulate with narrow base, subequally lobed with ovate-suborbicular lobes separated by convexities, violet to white, pubescent; stamens 4, inserted at base of corolla tube, didynamous, not exserted; ovary superior, 2-celled, style subulate, hairy with 2 unequal stigmatic lobes. Fruit a clavate capsule 1–1.5 cm long,



Dipteracanthus repens (L.) Hassk. – 1, plant habit; 2, dehisced fruit; 3, seed.

many-seeded. Seeds orbicular, compressed, ringed with hygroscopic hairs.

The flowers are ephemerous, but plants may be found flowering throughout the year.

Most *Dipteracanthus* species have been described in *Ruellia*, which was considered a large and variable genus. Several attempts have been made to split it up into segregate genera which form more natural groups, one of these being *Dipteracanthus*, which comprises about 10 species occurring in tropical Africa (where they are usually still maintained under *Ruellia*), Asia and Australia. However, there is still disagreement among taxonomists about the generic concept within the group of *Acanthaceae* to which *Ruellia*, *Dipteracanthus* and related genera like *Hemigraphis* and *Pararuellia* belong.

Ecology *D. repens* occurs in moderately shaded, often grassy localities, in roadsides, brushwood, sometimes in abandoned fields, up to 700 m altitude. It is common in many regions.

Genetic resources There are no indications that *D. repens* is threatened by collection for medicinal or other purposes, or by habit destruction,

and its wide distribution seems to counteract genetic erosion.

Prospects The applications of *D. repens* in traditional medicine are comparable to those of several other *Acanthaceae* with accepted medicinal value, and this seems to justify more pharmacological research.

Literature 62, 121, 731.

Other selected sources 13, 807, 808.

Yun Astuti Nugroho

Dischidia R.Br.

Prodr.: 461 (1810); Asclepiadeae: 21 (1810).

ASCLEPIADACEAE

x = unknown; *D. major*: $2n = 22$

Origin and geographic distribution *Dischidia* comprises about 40 species and occurs in eastern India, Burma (Myanmar), Indo-China, southern China, Thailand, throughout the Malesian region, and north-eastern Australia. Peninsular Malaysia is richest in species (23), followed by Borneo (about 13), and Sumatra and the Philippines (each about 11).

Uses *Dischidia* is commonly used in traditional medicine in South-East Asia; mostly the latex and leaves in external applications, e.g. to treat ringworm, eczema, herpes, burns, wounds and goitre. Decoctions of leaves and whole plants are used internally against gonorrhoea, framboesia (yaws), liver dysfunction and peptic ulcers, and as an anti-inflammatory, and a decoction of the roots is used to cure cough.

Whole plants of *D. chinensis* Champ. ex Benth. are used in Vietnam to treat cough, pimples, wounds and snake bites. In Vietnam, a decoction of whole *D. acuminata* Costantin plants is taken as a diuretic in cases of urethritis. Whole plants of this species, mixed with *Hoya kerrii* Craib, are used in Thailand to treat enlarged liver and cirrhosis, whereas the leaves are applied against liver dysfunction in a mixture with *Coelogyne trinervis* Lindley stems and *Hoya kerrii* leaves. In Taiwan *D. formosana* Maxim. is used in traditional medicine as an anti-inflammatory and diuretic. *Dischidia* is occasionally cultivated as an ornamental.

Properties A 50% hydro-ethanolic extract of dried whole plants of *D. bengalensis* showed no antitumour activity against Leuk-P388 cell lines in mice in vivo.

A steroid, disformone, and a triterpenoid, dischidiol, together with salicylic acid, friedelin, friedelinol, β-amyrin acetate, glutinone, taraxerol, kaempferol, quercetin, isorhamnetin and sitosteryl-3-O-β-glucopyranoside, were isolated from whole *D. formosana* plants from Taiwan.

Botany Epiphytic succulent herbs, with slender, twining stems up to 4 mm in diameter, and nodal roots, with or without adventitious roots; white latex present. Leaves opposite, rarely also alternate leaves on same plant, simple, usually ovate or elliptical in outline and flat or lens-shaped in cross-section, but sometimes with shell-like leaves convex in cross-section, or with pitcher leaves in tight clusters together with flat, ovate leaves on elongate stems, or with oblanceolate leaves flat to round in cross-section, entire, usually glabrous, usually with extrafloral nectary at base of lamina, petiolate or not; stipules absent. Inflorescence an axillary or terminal, often umbelliform raceme, up to 10-flowered. Flowers bisexual, regular, 5-merous; calyx small, often with a gland in the angles of the lobes; corolla urceolate, fleshy, sometimes corolline corona present as small lobes alternating with the corolla lobes or as an annulus in the corolla throat, staminal corona composed of hyaline appendages with 2 incurved or reflexed lobes often present, with nectary at base of each appendage; stamens inserted at base of corolla tube, shortly connate at base, with solitary pollinium in each anther cell; ovaries 2, free, superior, 1-celled, stigma conical, enclosed by stamens. Fruit consisting of 1–2 follicles, terete, reniform or semi-terete in cross-section, usually acuminate at apex, usually pendent, many-seeded. Seeds ovate, flat, comose.

The flowers are probably pollinated by insects with a long proboscis, such as moths. Ants often inhabit leaf cavities, but probably do not play a role in pollination. Fruits are rarely produced. Germination is rapid, and there is no apparent resting period.

Ecology *Dischidia* comprises both lowland and mountain species. It usually climbs on the trunk and branches of trees, often in sunny or slightly shaded localities, and attaches by its roots. The leaves are often closely appressed, providing a dark and humid environment for the roots. In some species (e.g. *D. major*) the roots grow into the cavity of pitcher-like leaves, which are often inhabited by ants. Nitrogen is derived from debris deposited into the leaf cavities by the ants, whereas the inner surface of the cavities has numerous stomata, through which the plant utilizes the carbon dioxide respired by the ants.

Management Brick fragments or wood crumbs,

with the addition of nutrients from commercial fertilizer in the recommended amount for epiphytic orchids, are optimum substrates for establishing *Dischidia* seedlings. When moistened, seeds of *D. nummularia*, showed 100% germination in this medium.

Genetic resources The *Dischidia* species treated here (except *D. purpurea*) are widely distributed and locally common, and consequently not in danger of genetic erosion. However, several other species are endemic to comparatively small regions (e.g. 8 species are only found in Peninsular Malaysia) and may easily become endangered. Some destruction of local populations is reported from Australia due to popularity in horticulture.

Prospects For plants with such a widespread application in traditional medicine, surprisingly little research has been done on the phytochemistry and pharmacological properties of *Dischidia*. They may be interesting medicinal plants for controlled use, particularly for external applications, also because they seem easy to cultivate.

Literature 157, 169, 170, 671, 793.

Selection of species

Dischidia bengalensis Colebr.

Trans. Linn. Soc. 12: 357, t. 15 (1817).

Vernacular names Thailand: thao wan duan (Prachuap Khiri Khan), thao hua duan (Surat Thani), o lop (Trang).

Distribution Eastern India, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, New Guinea and the Bismarck Archipelago.

Uses In Thailand the latex is applied externally to treat ringworm. The roots are used as a tonic.

Observations An epiphytic, climbing herb with glabrous stem; leaves oblanceolate, 2–3 cm long, flat, with retuse apex when young, becoming orbicular with obtuse apex with age; inflorescence sessile, simple or bifid; corolla 5–6 mm long, pale yellow or white, lobes pilose inside at base. *D. bengalensis* is locally common in sunny and slightly shaded localities in open forest up to 1700 m altitude, also on limestone hills and rocky ridges.

Selected sources 54, 793.

Dischidia imbricata (Blume) Steudel

Nomencl. bot., ed. 2, 1: 519 (1840).

Vernacular names Indonesia: daun boba, lola paka, gogotifo (Moluccas). Thailand: kipma lom (Chiang Mai), bia mai (northern), prue-proh (Khmer). Vietnam: song ly k[ees]t h[onj]p.

Distribution Eastern India, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi and the Moluccas.

Uses In the Moluccas heated leaves are applied externally as a poultice to heal burns and wounds, and a decoction of leaves is used to treat gonorrhoea and framboesia (yaws). In Thailand pills are produced from whole plants, which are used to treat nasal polyps, and the leaves are applied against the fungal skin infection tinea versicolor. A hot water extract of dried whole plants and heated fresh stems macerated in alcohol are used as an anti-inflammatory.

Observations An epiphytic, climbing herb with glabrous stem; leaves convex-orbicular, c. 2 cm × 2.5 cm, green above, deep red with a green margin below; inflorescence with 1–2.5 cm long peduncle, often multi-fid; corolla c. 5 mm long, pale yellow, lobes inside with reflexed white hairs. *D. imbricata* occurs in lowland forest up to 400 m altitude.

Selected sources 169, 171, 334, 793.

Dischidia major (Vahl) Merr.

Interpr. Herb. amboin.: 437 (1917).

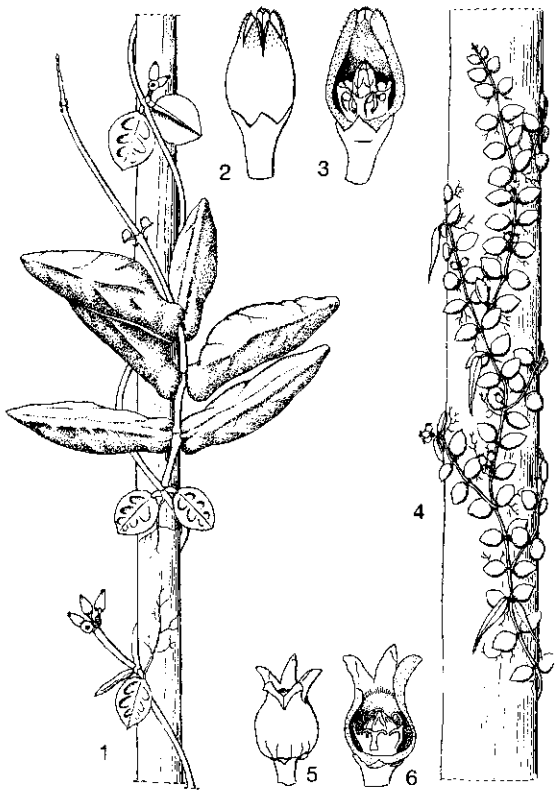
Synonyms *Dischidia rafflesiana* Wallich (1831).

Vernacular names Malaysia: akar kul, akar banok, akar bani (Peninsular). Thailand: chuk rohini (central), kluai mai (northern), thao phung pla (eastern, Ranong). Vietnam: song ly to, d[aa]y m[or] qu[aj].

Distribution Eastern India, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines, Timor, Sulawesi, New Guinea and north-eastern Australia.

Uses In Peninsular Malaysia the roots are added to betel quid to cure cough. A decoction of whole plants is used to treat peptic ulcers in Thailand, whereas the leaves are used in a mixture with *Hoya kerrii* Craib leaves and *Vanilla aphylla* Blume stems to treat liver dysfunction. The roots are used to treat fever. In the Philippines the leaves of a *Dischidia* species, possibly *D. major*, are applied externally, crushed with salt, to treat goitre.

Observations An epiphytic, climbing herb with glabrescent stem; leaves of 2 types: flat-orbicular, 2–3 cm in diameter, and pitcher-form ones 6–12 cm long, appressed to the host surface; inflorescence with 0.5–5 cm long peduncle, simple or bifid; corolla 8–10 mm long, yellow-green, lobes inside



Dischidia major (Vahl) Merr. – 1, habit of flowering plant; 2, flower; 3, flower with opened corolla. Dischidia nummularia R. Br. – 4, habit of flowering and fruiting plant; 5, flower; 6, flower with opened corolla.

with short white hairs. *D. major* is locally common in sunny and slightly shaded localities in open forest up to 1000 m altitude, also in secondary forest and mangrove forest, and on roadside trees, often hanging down in long garlands.

Selected sources 121, 169, 173, 760, 793, 934.

Dischidia nummularia R.Br.

Prodr.: 461 (1810).

Synonyms *Dischidia gaudichaudii* Decne. (1844), *Dischidia minor* (Vahl) Merr. (1939).

Vernacular names Indonesia: daun pitis kecil (Moluccas). Malaysia: pitis-pitis kecil (Peninsular). Thailand: klet khai (general), bia (central), top tan ruesi (north-eastern). Vietnam: song ly, m[ooj]c ti[eef]n nh[or].

Distribution Eastern India, Burma (Myanmar), Indo-China, Thailand, throughout the Malesian region and north-eastern Australia.

Uses In the Moluccas the latex is applied as an anodyne to wounds caused by fish spines, whereas a decoction of the leaves is taken internally to treat gonorrhoea. In Java the latex is applied to treat sprue in children. A decoction of the whole plant is used in Thailand against cirrhosis.

Observations An epiphytic, climbing herb with glabrous stem; leaves flattened-orbicular or ovate, 0.5–1.5 cm long, mucronate at apex; inflorescence with c. 3 mm long peduncle, simple; corolla 3–5 mm long, white, lobes inside at base with a ring of hairs. *D. nummularia* is often very common in different types of more or less open forest, but also on roadside trees, in plantations and on limestone hills, up to 1700 m altitude.

Selected sources 121, 174, 334, 763, 793.

Dischidia purpurea Merr.

Publ. Bur. Sci. Gov. Lab. 17: 39 (1904).

Vernacular names Philippines: kalipkip (Tagalog), talokop (Samar-Leyte Bisaya).

Distribution The Philippines.

Uses Crushed leaves are applied externally as a poultice or, cooked in coconut oil, as a pomade to treat eczema and herpes.

Observations An epiphytic, climbing herb with glabrous stem; leaves flattened-orbicular, 3.5–5 cm long, deep purple; inflorescence with slender peduncle, simple; corolla c. 4 mm long, pink to white. *D. purpurea* occurs in forest in lower mountains, up to 1200 m altitude.

Selected sources 760.

Wongsatit Chuakul, Noppamas Soonthornchareonnon & Orawan Ruangsomboon

Dissochaeta Blume

Flora 14: 492 (1831); Bijdr. Natuurk. Wetensch. 6: 234 (1831).

MELASTOMATACEAE

x = unknown; *D. celebica*: $2n = 40$

Origin and geographic distribution *Dissochaeta* comprises approximately 30 species, and is confined to tropical Asia from Burma (Myanmar) and Thailand to the whole of Malesia.

Uses In Peninsular Malaysia, several *Dissochaeta* species are used in traditional medicine during the first 3 days after childbirth to protect the mother against infections, and also for treating sexually-transmitted diseases. Usually a decoction of stems or roots is used. However, the leaves of *D. gracilis* have been applied as an antidote against dart and arrow poison.

Properties A general phytochemical screening

of the leaves and stem of *D. celebica* and of the stem of *D. gracilis* indicated the presence of terpenes, but alkaloids and saponins have not been detected. Alkylated ellagic acids have been isolated from *D. bracteata* wood.

Botany Scandent shrubs or lianas. Leaves opposite, simple and entire, 5(–7)-veined; stipules absent. Inflorescence a terminal panicle. Flowers bisexual, rather small, 4-merous, pink or white; hypanthium campanulate or cylindrical, hairy or glabrous; sepals short; petals ovate or ovate-oblong, glabrous; stamens 4 or 8, mostly equal, filaments glabrous, anthers linear, rostrate, connective dorsally provided with a single triangular appendage, ventrally with 2 linear appendages; ovary inferior, 4-celled, scaly or pubescent at apex, with 4 extra-ovarial cavities, style stout. Fruit a subglobular, ovoid or ellipsoid, sometimes urceolate berry, many-seeded. Seeds cuneate, rostrate. *Dissochaeta* belongs to the most difficult and confusing genera of *Melastomataceae*. Already in 1943, *Neodissochaeta* was separated from *Dissochaeta*, comprising the small-flowered species with extra-ovarial cavities reaching at most the middle of the ovary (far below the middle in *Dissochaeta* s.s.). This has, however, not been commonly followed up to the present, and future taxonomical studies, which are badly needed, should prove whether this subdivision is correct.

Ecology *Dissochaeta* is locally common in forest, particularly in edges, in the lowland, hills and lower mountains. It is also commonly found in secondary forest.

Genetic resources The *Dissochaeta* species treated here do not seem to be very liable to genetic erosion. However, information on the genetic diversity is lacking, and a thorough botanical study of the genus is desirable.

Prospects Too little is known about the chemistry and pharmacological properties of *Dissochaeta* to judge its prospects as a medicinal plant. The uses of *D. celebica* for treating sexually-transmitted diseases and of *D. gracilis* as antidote for poison deserve more attention.

Literature 121, 282, 731.

Selection of species

Dissochaeta bracteata (Jack) Blume

Flora 14: 495 (1831); Bijdr. Natuurk. Wetensch. 6: 238 (1831).

Vernacular names Malaysia: akar meroyan sejuk (Peninsular).

Distribution Peninsular Malaysia, Sumatra; said to have been collected in Java and Borneo.

Uses In Peninsular Malaysia, it is used medicinally after childbirth.

Observations A slender, twining shrub, young parts deciduously rusty tomentose; leaves ovate-oblong or ovate-lanceolate, 7.5–11 cm × 3–5.5 cm, petiole 0.5–1 cm long; inflorescence with large, ovate bracts; flowers c. 15 mm long, stamens 8, unequal; fruit ellipsoid, 10–15 mm long, brown-scaly. *D. bracteata* occurs in hill forest.

Selected sources 62, 66, 121, 789.

Dissochaeta celebica Blume

Mus. Bot. Lugd.-Bat. 1(3): 36 (1849).

Synonyms *Neodissochaeta celebica* (Blume) Bakh.f. (1943).

Vernacular names Malaysia: akar meroyan jantan, akar meroyan paya (Peninsular). Philippines: tolasola (Bagobo). Thailand: en aa thao (Surat Thani).

Distribution Southern Thailand, Peninsular Malaysia, Singapore, Sumatra, the Riau Archipelago, Bangka, Borneo, the Philippines (Mindanao) and Sulawesi.

Uses In Peninsular Malaysia, it is used medicinally after childbirth. A decoction of the climbing stems is still applied locally after childbirth and also for treating sexually-transmitted diseases.

Observations A slender liana or scandent shrub, branchlets, lower surface of leaves and inflorescences densely reddish tomentose; leaves lanceolate to ovate-oblong, 6–12.5 cm × 2.5–6.5 cm, petiole 0.5–1 cm long; inflorescence without conspicuous bracts; flowers c. 8 mm long, stamens 4; fruit subglobular, c. 4 mm in diameter, purplish. *D. celebica* occurs in forest up to 1000 m altitude; it is locally common in edges of forest.

Selected sources 66, 121, 621, 705, 789.

Dissochaeta gracilis (Jack) Blume

Flora 14: 498 (1831); Bijdr. Natuurk. Wetensch. 6: 239 (1831).

Synonyms *Neodissochaeta gracilis* (Jack) Bakh.f. (1943).

Vernacular names Malaysia: akar senduduk (Peninsular).

Distribution Southern Thailand, Peninsular Malaysia, Singapore, Sumatra, western Java and Borneo; perhaps also in the Philippines.

Uses In Peninsular Malaysia, the leaves have been used as an antidote for dart and arrow poison from *Antiaris toxicaria* Lesch. (ipoh).

Observations A slender liana up to 5 m long,

young parts scaly, not tomentose; leaves lanceolate, 7–15 cm × 3–7 cm, petiole c. 0.5 cm long; inflorescence without conspicuous bracts; flowers c. 6 mm long, stamens 8, 4 large and 4 small and reduced; fruit subglobular, 5–10 mm in diameter, dark purple. *D. gracilis* occurs in forest, forest edges and brushwood up to 1500 m altitude.

Selected sources 62, 66, 121, 789.

Dissochaeta punctulata Hook.f. ex Triana

Trans. Linn. Soc. 28(1): 83 (1871).

Vernacular names Malaysia: akar meroyan busuk, akar sial menahun, akar senduduk (Peninsular).

Distribution Peninsular Malaysia, Singapore and the Riau Archipelago.

Uses In Peninsular Malaysia, a decoction of the roots is given during the first 3 days after childbirth, and is also used as a wash after confinement.

Observations A slender liana, branchlets, lower surface of leaves and inflorescences persistently rusty tomentose; leaves oblong-ovate to elliptical, 6–11 cm × 2–6.5 cm, petiole 0.5–1 cm long; inflorescence without conspicuous bracts; flowers c. 18 mm long, stamens 8; fruit urceolate or ovoid, c. 8 mm long, rusty pubescent. *D. punctulata* occurs particularly in forest edges.

Selected sources 66, 121, 789.

H.C. Ong

Dracaena L.

Syst. nat., ed. 12, 2: 246; Mant. pl. 1: 63 (1767).

DRACAENACEAE

$x = 19, 20, 21$; *D. angustifolia*: $n = 20$

Origin and geographic distribution *Dracaena* comprises about 60 species and has a pantropical natural distribution with the exception of South America, where however a few species are locally naturalized. A few species can survive in subtropical climates. The majority of the species occurs in Africa, with a somewhat less important centre of distribution in South-East Asia.

Uses Records of medicinal applications of *Dracaena* in the Malesian region are limited. A root decoction is sometimes used to treat gonorrhoea and rheumatism, and the leaves are applied externally against beri-beri.

In Indo-China, Thailand and southern China *D. cambodiana* Pierre ex Gagnep. and *D. cochinchinensis* (Lour.) S.C. Chen (synonym: *D. loureiri* Gagnep.) are used in traditional medicine. A decoction of the woody stem is administered to treat rheumatism, to improve blood circulation, to regulate menstruation and as an antipyretic and antidiaphoretic.

Dragon's blood is the red resin from the woody stem of some *Dracaena* species, mainly *D. draco* (L.) L. from the Canary Islands and *D. cinnabari* Balf. from Sokotra, but also *D. cochinchinensis*. It has much been used as a dry powdered herbal remedy in traditional medicine, mainly to stop haemorrhages, but it is no longer important in contemporary medical care.

Leaves of *D. angustifolia* are also used in South-East Asia as a green dye, and young ones are sometimes cooked to serve as a vegetable. Some *Dracaena* species are commonly cultivated as foliage ornamentals, often cultivars with variegated patterns on the leaves, and they are also planted in hedges. In Africa *Dracaena* has a strong reputation as a fetish plant, probably because of its longevity and vitality.

Properties A number of chalcones, homoisoflavones and aromatic compounds have been isolated from *D. cochinchinensis* resin and wood. Some of the aromatic compounds showed antifungal activities, a chalcone and a homoisoflavone exibited oestrogenic activity comparable to that of isoflavonoids such as genistein and daidzein, whereas an aqueous extract of *D. cochinchinensis* wood showed antipyretic activity in animal tests. It also decreased the clotting time of blood in mice, and the recalcification and euglobinlysis time of plasma in rabbits, but had no effect on the prothrombin time. It also possesses antibacterial activity.

Several saponins have been isolated from *D. cambodiana*, *D. draco* and the African species *D. arborea* (Willd.) Link and *D. mannii* Baker. Some of these exhibited antileishmanial, antimalarial, molluscicidal and cytostatic activities.

Botany Trees, shrubs or subshrubs, usually entirely glabrous; roots generally orange, sometimes tuberous; stem mostly with conspicuous leaf scars, sometimes with red resin; bark smooth. Leaves usually arranged spirally, sometimes distichously alternate or in pseudowhorls on tops of branches, simple and entire, more or less sheathing at base, sometimes narrowed into a pseudopetiole, mucronate at apex, more or less leathery, closely parallel-veined; stipules absent. Inflorescence a terminal, simple to branched raceme or panicle, congested or not, with or without bracts, with flowers singly, in pairs or few- to many-flowered

glomerules. Flowers bisexual, regular, fragrant, nocturnal and flowering for several hours only; pedicel jointed; perianth tubular at base, with 6 lobes recurved at anthesis; stamens 6, inserted near the throat of the perianth tube; ovary superior, 3-celled, style filiform, stigma capitate, usually 3-lobed. Fruit a globose to ellipsoid berry, sometimes 2–3-lobed, usually bright orange when ripe, up to 3-seeded. Seeds lacking a testa but enclosed in an obsolescent layer of sclerotic endocarp cells. The flowers are pollinated by nocturnal animals such as hawkmoths (*Sphingidae*), but successful self-pollination has also been recorded.

Dracaena has been confused in the literature with quite unrelated genera such as *Agave*, *Cordyline* and *Yucca* (especially with *Cordyline*), which means that information on aspects such as phytochemistry of *Dracaena* should be considered with care. The distinction between *Dracaena* and *Sansevieria* is purely traditional and not tenable, and the latter is synonymous with the former.

Ecology In South-East Asia *Dracaena* occurs most commonly in shaded localities in lowland rain forest up to 1000 m altitude.

Management Many cultivated *Dracaena* species are propagated by stem cuttings, which usually root easily. Propagation by tissue culture is often practised for *Dracaena* cultivated as an ornamental plant.

Genetic resources The two *Dracaena* species treated here are locally common and there seems no reason to consider them as threatened, although *D. umbratica* has a small area of distribution and occurs in a type of habitat under pressure, i.e. lowland rain forest.

Prospects There is no information on the phytochemistry and pharmacological properties of *D. angustifolia* and *D. umbratica*. However, research might be useful considering the interesting pharmacological activities of the related *D. cochinchinensis*. The botany of *Dracaena* in South-East Asia is very poorly understood, and a taxonomic revision is badly needed.

Literature 100, 392, 671, 817.

Selection of species

Dracaena angustifolia Roxb.

Fl. ind. (Carey ed.) 2: 155 (1832).

Synonyms *Pleomele angustifolia* (Roxb.) N.E. Br. (1914).

Vernacular names Indonesia: suji (Sundanese), semar (Javanese), pendusta utan (Ambon). Philippines: malasambal, taligbuhuk (Tagalog), pasiu (Ibanag). Thailand: khon maa khaao (central), phak kon maa (Lampang), phraao phan lam (Chiang Mai). Vietnam: ph[aas]t d[ur] h[ej]p, b[oof]ng b[oof]ng.

Distribution India, Burma (Myanmar), Indo-China, southern China, Thailand, Java, the Philippines, Sulawesi, the Moluccas, New Guinea and northern Australia.

Uses In the Moluccas a decoction of the roots is used to treat gonorrhoea, the leaves are applied externally to treat beri-beri and the leaf-sap to promote hair growth. The leaves are also used to colour vegetable oils and food green, and the leaf-sap as a dye for painting. Cooked tips of *D. angustifolia* plants are eaten as a vegetable. *D. angustifolia* is commonly planted as an ornamental and hedge plant.

Observations An erect shrub or small tree up to 6(–8) m tall, often much-branched; leaves linear-lanceolate, narrowed above the sheathing base, very acute; inflorescence paniculate, branched, up to 75 cm long; flowers yellowish-white, with perianth c. 2.5 cm long; fruit globose to 3-lobed, 1.5–2.5 cm in diameter, bright orange, 1–3-seeded. *D. angustifolia* is a variable species that occurs in open forest, forest borders and on rocky coasts, up

Dracaena angustifolia Roxb. – flowering and fruiting branch.

to 1000 m altitude; it is also cultivated in gardens and hedges.

Selected sources 62, 121, 334, 689.

Dracaena umbratica Ridley

Fl. Mal. Penins. 4: 334 (1924).

Vernacular names Malaysia: senjuang (Peninsular). Thailand: koh-naa-si (Malay, Narathiwat).

Distribution Peninsular Thailand, Peninsular Malaysia and Singapore.

Uses A decoction of the roots is used to treat rheumatism.

Observations A small little-branched shrub up to 90 cm tall; leaves elliptical to elliptical-lanceolate, cuspidate, petiole up to 5 cm long; inflorescence racemose, not or hardly branched, up to 22.5 cm long, the lower half flowerless; flowers white, with perianth c. 2.5 cm long; fruit globose to 3-lobed, c. 6 mm in diameter, orange-red, 1–3-seeded. *D. umbratica* is common in lowland forest.

Selected sources 121, 789.

R.H.M.J. Lemmens

Dregea volubilis (L.f.) Benth. ex Hook.f.

Fl. Brit. India 4(10): 46 (1883).

ASCLEPIADACEAE

$2n = 22$

Synonyms *Wattakaka volubilis* (L.f.) Stapf (1923), *Dregea formosana* T. Yamazaki (1969).

Vernacular names Laos: pak huan mu, bu oc sa. Thailand: kra thung maabaa (central), huan muu (northern). Vietnam: b[uf] [oos]c leo.

Origin and geographic distribution *D. volubilis* is recorded from Nepal, India, Bangladesh, Sri Lanka, Indo-China, southern China, Taiwan, Thailand, Peninsular Malaysia, Java and the Philippines.

Uses *D. volubilis* is mainly used as a febrifuge and emetic in South-East Asia, although numerous other medicinal uses have been reported. In Vietnam all parts of the plant are taken orally against snake bites and to treat eye diseases. In India the leaves are applied to boils and abscesses. The roots are considered emetic, expectorant and diuretic. *D. volubilis* is one of the ingredients of a mixture used in Ayurvedic medicine for its stimulant, tonic and strengthening properties. In Sri Lanka *D. volubilis* is traditionally used as a galactagogue, whereas the leaves are administered to treat fever in children and also eaten in curries. In China the young leaves are used to treat pyoderma and fever in children, and the roots as an emetic.

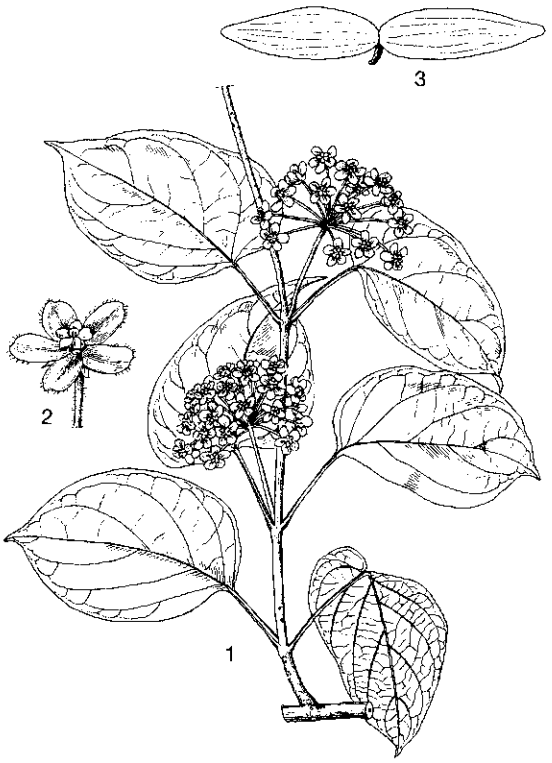
D. sinensis Hemsl. is used in traditional medicine in China. The roots are credited with anti-convulsant and anti-hepatitis activities, and the stems and leaves are used against jaundice, gonorrhoea, oedema and pyoderma.

Properties The diglycoside degreoside A, isolated from *D. volubilis*, showed in-vivo antitumour activities against Ehrlich carcinoma and melanoma B-16 in tests with mice. In a test with rats in Sri Lanka, no significant galactagogue activity of *D. volubilis* could be detected. In another experiment with rats, degenerative changes in hepatocytes were seen following administration of extracts of *D. volubilis* seeds. Flavonoid compounds such as kaempferol and trifolin have been recorded from the bark.

Several pregnane glycosides and their aglycones have been isolated from dried roots of the Indian *D. lanceolata* Sant. & Wagh. The steroidal compound dresigenin A, some aglycones and some pregnane glycosides were isolated from *D. sinensis* roots.

Botany A large, twining shrub up to 10 m tall; young stems densely pubescent, later glabrescent. Leaves opposite, simple and entire, broadly ovate, 7–18.5 cm × 5–13 cm, obtuse to truncate or subcordate at base, acuminate at apex, thinly leathery, pinnately veined; petiole 2.5–4.5 cm long, furrowed, glabrous or pubescent; stipules absent. Inflorescence an umbelliform cyme, situated between the petioles of a leaf-pair, many-flowered; peduncle 2.5–7.5 cm long. Flowers bisexual, regular, 5-merous; pedicel thin, up to 2.5 cm long; calyx on the inside with 5 basal glands, segments c. 3 mm long, spreading; corolla campanulate-rotate, 12–16 mm in diameter, bright green, glabrous, with obtuse segments; stamens inserted at the base of the corolla, filaments connate, anthers with short apical membrane overarching the stigma, with solitary pollinium in each anther cell, corona scales c. 4 mm in diameter inserted on staminal tube; ovaries 2, superior, free, 1-celled, stigma discoid. Fruit consisting of (1–)2 ovoid-lanceolate follicles 10–15 cm long, blunt to slightly acute, finely longitudinally ribbed, many-seeded. Seeds with c. 4 cm long coma.

Dregea comprises about 12 species, most of which occur in tropical Africa. Five species are found in tropical Asia, of which *D. volubilis* is the most widespread. *Wattakaka* is sometimes separated from *Dregea* because of its twisted corolla lobes and unwinged follicles, but the differences seem trivial.



Dregea volubilis (L.f.) Benth. ex Hook.f. – 1, flowering branch; 2, flower; 3, fruit.

Ecology In the Malesian region *D. volubilis* occurs in brushwood and village-groves in the lowland. However, in mainland Asia it can be found in a variety of habitats, including montane forest.

Genetic resources *D. volubilis* does not seem to be at risk of genetic erosion as it is widespread and occurs in many habitats, including anthropogenic ones. However, in the Malesian region it seems to be uncommon.

Prospects Although *D. volubilis* has been in use for centuries in India, Indo-China and China as a medicinal plant, very little is known about its biological activity and active compounds, as well as the possibilities for its cultivation. More research is needed to explore its potential for a wider use in medicine in South-East Asia.

Literature 62, 760, 919, 920, 971, 1040.

Other selected sources 782, 1013.

Tran Dinh Ly & Tran The Bach

Drosera L.

Sp. pl. 1: 281 (1753); Gen. pl. ed. 5: 136 (1754).
DROSERACEAE

x = unknown; *D. burmannii*: $2n = 20$, *D. indica*: $2n = 28$, *D. peltata*: $n = 16$, $2n = 40$

Origin and geographic distribution *Drosera* comprises about 100 species and has an almost worldwide distribution, with the highest diversity in Australia and New Zealand (about 50 species). In the Malesian region, 5 species have been found, whereas in Indo-China and Thailand only the 3 species treated here are indigenous.

Uses *Drosera* extracts and infusions serve externally as treatment for corns, warts and burns, whereas they are also used in various parts of the world against coughs, respiratory disorders, tuberculosis, arteriosclerosis, inflammations, intestinal complaints and syphilis. *Drosera* (particularly *D. rotundifolia* L.) has been used as a drug in Europe, but has become rare, being a plant found in peat bogs, and is now usually protected. A tincture or extract of the whole plants is an ingredient of proprietary drugs (especially syrups) to treat spasmodic coughs.

Properties Experiments in animals showed that *Drosera* tincture acts as an antispasmodic, preventing acetylcholine-induced bronchospasm and decreasing peristalsis in isolated guinea-pig ileum preparations.

Naphthoquinones such as plumbagin and related compounds have been isolated from several *Drosera* species. Plumbagin is present in a concentration of 0.7–1% of the dried *D. rotundifolia* drug, and it has antibacterial properties. Even at low concentrations it is active against gram-positive as well as gram-negative bacteria, and it is also active against some pathogenic fungi and parasitic protozoa (e.g. leishmania). At higher doses, plumbagin is cytotoxic. It showed antitumour activity in mice. In rats, plumbagin showed anti-implantation and abortifacient activity, and it has insecticidal properties.

Plumbagin has been demonstrated in the aerial parts of *D. peltata*, and both plumbagin and droserone in the subterranean parts (tuber). The chloroform extract of *D. peltata* showed significant antimicrobial properties against all oral bacteria tested, with plumbagin as the active principle.

Several flavonoids were isolated from *D. rotundifolia*, e.g. gossypin, gossypitrin and myricetin.

Botany Small perennial herbs, often with a subterranean tuber, with developed stems or stemless. Leaves in a basal rosette or arranged

spirally, usually simple and entire, circinnate when young, provided with large, viscid, stalked glands; stipules present (and then often split) or absent. Inflorescence cymose, bracteate, often circinnate, few to many-flowered. Flowers bisexual, regular, (4–)5-merous; sepals connate at base, imbricate; petals free, thin, white, pink or purple; stamens 5, free, alternating with the petals; ovary superior, 1-celled, styles 3 or 5, simple or divided towards the tip. Fruit a loculicidal, 3–5-valved capsule, many-seeded. Seeds small, albuminous, with straight embryo and short cotyledons.

Small insects are attracted and trapped by the glistening drops of fluid produced by the glands (tentacles) of the leaf blades. These glands bend over to entrap the insect and secrete a digestive ferment which acts upon the proteins. In this way, the plant has a supply of organic substances containing nitrogen compounds while growing under circumstances where these compounds are in short supply.

Ecology *Drosera* distinctly prefers acid, oligotrophic, often sandy or peaty soils. In Malesia, some species are apparently bound to a seasonal climate (e.g. *D. indica*, *D. peltata*), whereas others are restricted to a per-humid climate (e.g. *D. burmannii*).

Management Propagation is usually easy by seed or leaf cuttings; occasionally, root cuttings and secondary tubers have been used. However, sterilization of the vegetative explants often poses a problem. For some species, the most successful means of reproduction is by using small spherical or flat structures at the base of the leaves. In-vitro multiplication is comparatively easy and effective; roots, stem internodes, axillary rosettes, flower buds and flower stalks have all been successfully used as explant sources. A modified Murashige and Skoog medium is usually used. The low concentration of plumbagin in the culture would appear to preclude in-vitro production of *Drosera* as a commercial source of naphthoquinone.

Genetic resources Although all *Drosera* species treated here have a large area of distribution, they occur only locally in South-East Asia. However, they do not seem to be immediately endangered.

Prospects *Drosera* includes important medicinal plants in several parts of the world, and deserves more attention in South-East Asia, where medicinal applications seem to be limited. Results obtained from tests suggest that extracts from *Drosera* species like *D. peltata* could be used in the treatment of oral infectious diseases such as dental caries and periodontitis, in addition to the better-known uses such as the treatment of spasmodic cough and skin complaints such as corns.

Literature 64, 118, 184.

Selection of species

Drosera burmannii Vahl

Symb. Bot. 3: 50 (1794).

Vernacular names *Indonesia*: punggu api (Belitung), serenta bumi (Karimata, western Kalimantan). Laos: mok bo? cay. Thailand: chok bo wai (north-eastern). Vietnam: c[owx] tr[os]i g[af], b[ef]o d[aas]t, c[aar]m dia la.

Distribution India, Sri Lanka, Indo-China, southern China, southern Japan, Thailand, throughout Malesia except Sumatra and Java, and north-eastern Australia.

Uses In Vietnam, *D. burmannii* is considered antispasmodic and used to treat whooping-cough. In China, it is used against malaria.

Observations A small stemless herb; leaves in a dense rosette, close to the soil, obovate to orbicular, 0.5–1 cm long, often reddish, stipules present, 3–6-partite; inflorescences 1–3, up to 30 cm long; flowers with white petals 4–5 mm long and 5 styles; fruit 1–2 mm long, 5-valved. *D. burmannii* occurs on sandy or peaty soils up to 1400 m altitude.

Selected sources 247, 249, 250, 671, 782.

Drosera indica L.

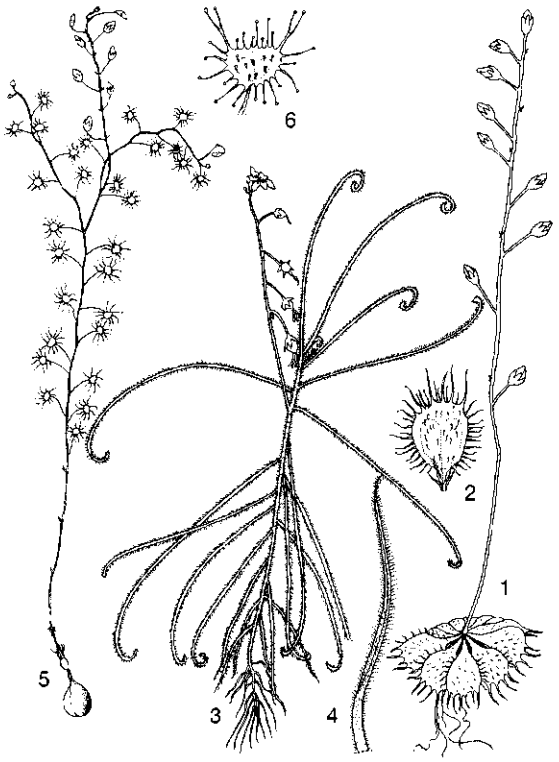
Sp. pl. 1: 282 (1753).

Vernacular names Philippines: bintipalo (Tagalog). Thailand: ya nam khang (north-eastern). Vietnam: c[or] tr[or]i g[af], m[oof] c[oo]i, g[oj]ng v[os].

Distribution Tropical Africa, southern India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, southern Japan, Thailand, throughout Malesia except the Moluccas, and tropical Australia.

Uses In Vietnam, a maceration in alcohol of *D. indica* is applied to calluses and corns. It is commonly used in Indian medicine as a powerful rubefacient.

Observations A small herb with glandular stem up to 30 cm long; leaves arranged spirally, linear, up to 12 cm long, with circinnate apex, pale green, distinct petiole absent, stipules absent; inflorescence lateral from the upper part of the stem, up to 20 cm long; flowers with pink to purple petals 7–10 mm long and 3 bifid styles; fruit c.



Drosera burmannii Vahl – 1, plant habit; 2, leaf with stipules. Drosera indica L. – 3, plant habit; 4, part of leaf. Drosera peltata J.E. Smith ex Willd. – 5, plant habit; 6, leaf.

3 mm long, 3-valved. *D. indica* occurs in periodically wet grassland, fallow rice fields, and muddy soils, up to 1200 m altitude.

Selected sources 247, 249, 250, 671, 782.

Drosera peltata J.E. Smith ex Willd.

Sp. pl. 1: 1546 (1798).

Vernacular names Philippines: bain, sanabugan (Igorot), gumgumayeng (Bontok). Vietnam: g[oj]ng v[os] l[as] b[as]n nguy[eej]t.

Distribution India, Sri Lanka, Indo-China, China, Japan, Thailand, eastern Java, the Lesser Sunda Islands, the Philippines, southern Sulawesi, New Guinea, Australia and Tasmania.

Uses In the Philippines, dried and powdered leaves are applied to aching teeth. In India, *D. peltata* is used to treat phthisis, and the leaves, bruised and sometimes mixed with salt, as a blister. In traditional medicine in China, it is applied to treat stomach-ache, dysentery and bruises, whereas the roots are used against arthritis. In India, the plant is used to dye silk brown.

Observations A small herb with a subterranean tuber and glabrous stem up to 35 cm long; leaves arranged spirally, triangular, 3–6 mm in diameter, with distinct petiole up to 15 mm long peltately attached to the blade, stipules absent; inflorescence lateral from the upper part of the stem, up to 7 cm long; flowers with white petals 5–6 mm long and 3 styles having several branches towards the apex; fruit c. 3 mm long, 3-valved. *D. peltata* occurs in grassland, open forest and roadsides, often on wet sandy-peaty soils.

Selected sources 211, 247, 249, 250, 760, 782.

Titi Juhaeti

Drymaria cordata (L.) Willd. ex Schultes

Roemer & Schultes, Syst. veg. 5: 406 (1819).

CARYOPHYLLACEAE

$2n = 24, 36$

Vernacular names Chickweed (En). Indonesia: jukut ibun (Sundanese), angleng (Javanese), si rempas bide (Batak). Papua New Guinea: lukumuaia (Fore, Eastern Highlands), iyalo (Fane, Central Province). Philippines: bakalanga (Bukidnon). Thailand: yaa klet hoi (Chiang Mai). Vietnam: d[ow]n x[uw][ow]ng, t[uf] t[if].

Origin and geographic distribution *D. cordata* is pantropical and occurs throughout tropical Asia, but was originally introduced from tropical America.

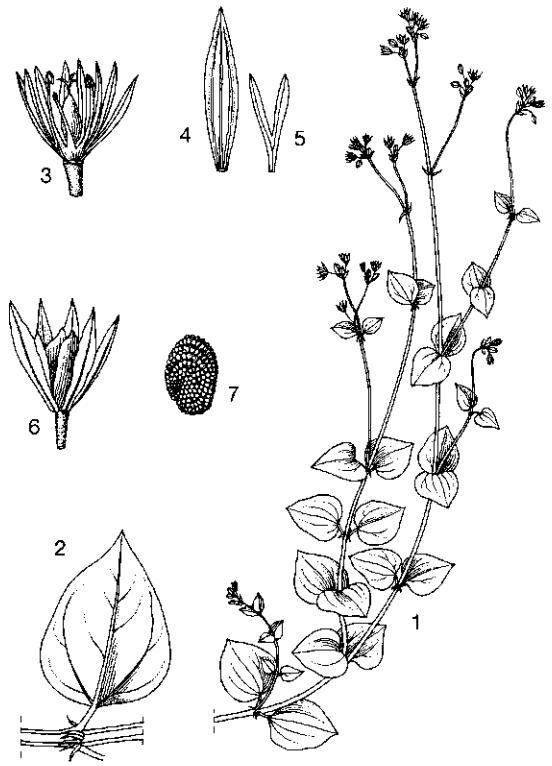
Uses There are some records on medicinal uses in South-East Asia. In Papua New Guinea, chopped leaves baked in bamboo are prescribed to treat swollen limbs, possibly caused by malaria. In Indonesia, the sap is used as a laxative and to treat fever, whereas a poultice of leaves rubbed with lime is applied to boils.

D. cordata is used in many countries in Africa for respiratory chest-ailments: to treat colds and bronchitis, often as an inhalation. It is also used to treat eye-troubles. The sap has an aromatic pungency and is laxative and antifebrile. Vesicant properties have also been found, and the plant is applied externally to oedemas of the feet, leprosy, injuries, yaws, sores and tumours. However, prolonged treatment may cause burning. In India, the entire plant is used as febrifuge, antivenin and to treat inflammation.

In India, *D. cordata* has been found effective as a ground cover to prevent erosion on steep slopes. It is also a useful fodder, although it has been associated with poisoning of cattle.

Properties In a test with guinea-pigs, a methanolic extract of *D. cordata* caused a decrease of contractions induced by acetylcholine in isolated rings trachea. In a cough model induced by sulphur dioxide gas in mice, the methanol extract exhibited significant antitussive activity in a dose-dependent manner, comparable to codeine phosphate, a prototype antitussive drug. A methanol extract showed significant anti-inflammatory activity against carrageenin, histamine, serotonin and dextran-induced rat hind paw oedemas. Methanol extracts also showed significant antibacterial activities against *Bacillus pumilis*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.
Poisoning of cattle fed with *Drymaria* has been observed, particularly with *D. arenarioides* Schultes in Mexico. The toxic activity has been attributed to saponins. In Sumatra, *D. cordata* has also been mentioned in connection with poisoning of cattle. However, saponins have not been demonstrated, or have only been found in very low concentration in *D. cordata*. In fact, very little chemical research has been done for this species; only the isolation of the alkaloid 4-methoxy-canthin-6-one has been mentioned in the literature.

Botany An annual herb; stems prostrate or ascending, up to 100(–150) cm long, striate, internodes longer than the leaves, rooting at nodes, glabrous to glandular. Leaves opposite, deltoid-ovate to suborbicular or cordate, 0.5–2.5 cm × 0.3–2 cm, subtruncate to obtuse at base, often apiculate at apex, 3–7-veined; petiole 2–8 mm long; stipules lacerate with filiform segments. Inflorescence a terminal cyme, 3–many-flowered, peduncle up to 12 cm long; bracts lanceolate, 2–5 mm long. Flowers bisexual, regular, 5-merous, greenish or yellowish-green; pedicel up to 8 mm long; sepals free, 2–4.5 mm long, inflexed, strongly carinate, 3-veined; petals free, 1.5–3 mm long, bifid up to the middle or more, base clawed; stamens 2–3(–5), filaments connate at base; ovary superior, 1-celled, style short, 2–3-fid. Fruit an oblong capsule 1.5–2.5 mm long, 2–3-valved, 1–2-seeded. Seeds orbicular or reniform, 1.5–2 mm in diameter, densely tuberculate.
D. cordata can be found flowering and fruiting throughout the year. The fruits with the persistent calyx adhere easily to the fur of animals, and are thus dispersed.
Drymaria comprises about 50 species, all except 2 exclusively American. Two subspecies have been distinguished within *D. cordata*. In South-East Asia, subsp. *diandra* (Blume) J.A. Duke is found,



Drymaria cordata Willd. ex Schultes – 1, flowering stem; 2, leaf and stipules; 3, flower with sepals removed; 4, sepal; 5, petal; 6, dehisced fruit enclosed by sepals; 7, seed.

which occurs in tropical Asia, Australia and Africa but not in America. It differs from subsp. *cordata* by the flowers being broadest above the middle (at or below the middle in subsp. *cordata*), inflexed sepals and slightly broader seeds, and is sometimes considered as a distinct species (*D. diandra* Blume). However, intermediates between the 2 subspecies do occur, especially in Africa. Other *Drymaria* species to be found in South-East Asia includes *D. villosa* Cham. & Schlechtendal, which is often associated with *D. cordata*.

Ecology *D. cordata* is a common weed of gardens, plantations (e.g. tea, coffee, sugar cane, cinchona, upland rice), ditches, roadsides and riversides, usually in shady locations, in Java up to 1700 m altitude, in New Guinea up to 2700 m. It occurs locally abundantly, but is uncommon in some regions, e.g. in Peninsular Malaysia and Singapore.

Management *D. cordata* can be a noxious weed, particularly in upland rice, because it may form a dense cover. Herbicides such as paraquat

and 2,4-D amine are often used as a foliar spray to control *D. cordata* as a weed.

Genetic resources *D. cordata* is still expanding its area of distribution, and efforts are directed more towards its eradication as a weed than towards protection.

Prospects Several pharmacological properties deserve more attention, particularly the anti-inflammatory, antitussive and antibacterial properties. These make *D. cordata* a promising medicinal plant, which is easy to cultivate if necessary.

Literature 250, 334, 347, 652, 653, 651.

Other selected sources 120, 121, 225, 380, 453, 782.

Juliana Jonathan

Dunbaria incana (Zoll. & Moritzi) Maesen

Wageningen Agric. Univ. Pap. 98(1): 61 (1998).
LEGUMINOSAE
$2n$ = unknown

Synonyms *Dunbaria nivea* Miq. (1855), *Dunbaria scortechinii* Prain (1897), *Dunbaria harmandii* Gagnep. (1915).

Vernacular names Malaysia: tampong urat, patong urat. Thailand: yaan thua raet (peninsular). Vietnam: d[aa]y bu, d[aa]y d[aaj]u hoang, d[aa]y m[os]c.

Origin and geographic distribution *D. incana* is found in Indo-China, southern China (Hainan), Thailand, Peninsular Malaysia, Sumatra and Java.

Uses In Peninsular Malaysia (Perak), the leaves are used for poulticing wounds, ulcers and itch, and also to treat fever. In southern China the whole plant of *D. punctata* (Wight & Arnott) Benth. is applied to snakebites. *D. bella* Prain is mentioned as being used medicinally in Laos.

Botany A perennial climber up to 8 m long; stems up to 5 mm in diameter, ridged and velvety when young. Leaves alternate, pinnately 3-foliolate; petiole 2–8.5 cm long, grooved above; stipules caducous; leaflets rhomboid-ovate, terminal leaflet 4–12 cm × 3–9 cm, base broad to narrowly cuneate, apex cuspidate-acuminate; petiolules 1–3 mm long; stipels minute, hair-like. Inflorescence an axillary raceme, 14–25(–30) cm long, bracts ovate to narrowly elliptical, 3–9 mm × 1–3 mm, 10–20-flowered. Flowers 1–2 per node, bisexual; calyx tube 5 mm long, 5-toothed, yellowish-green to reddish, short pubescent, glandular; corolla papilionaceous, standard rotundate, twisted, 12–17 mm × 14–18 mm, base clawed and with 2 auricles, apex emarginate, dorsally maroon, ventrally yellowish, wings obovate, 12–13 mm × 5 mm, clawed, keel with large, coiled beak, c. 10 mm in diameter, clawed; stamens 10, 9 connate and 1 free; ovary superior, sessile, 1-celled, style filiform, curved. Fruit a linear to slightly falcate pod (4–)5.5–6.5 cm × 0.7–0.8 cm, dark brown with short grey hairs and orange glands, 7–8(–10)-seeded. Seeds reniform, c. 4 mm × 5 mm × 3 mm.

Flowers and fruits of *D. incana* can be found throughout the year. *Dunbaria* comprises 20 species and is found from India to southern China, Korea and southern Japan, throughout South-East Asia and in northern Australia. It belongs to the subtribe *Cajaninae* of the tribe *Phaseoleae*, and is related to *Cajanus*, of which the cultivated pigeonpea (*Cajanus cajan* (L.) Millsp.) is best known.

Ecology *D. incana* is found in forest borders, thickets, riverine forest, bamboo forest, on waste ground, in tidal areas and on limestone hills, from sea-level up to 400(–1000) m altitude.

Genetic resources *D. incana* is widely distributed and common in disturbed habitats, and is not at risk of genetic erosion.

Prospects The prospects for *D. incana* as a medicinal plant are unclear because information on the phytochemistry and pharmacological properties is lacking.

Literature 121, 949.

Other selected sources 62, 250, 731.

L.J.G. van der Maesen

Ehretia philippinensis A.DC.

Prodr. 9: 504 (1845).
BORAGINACEAE
$2n$ = unknown

Vernacular names Philippines: alibungog (Cebu Bisaya), bayukon (Tagalog), talibobong (Bikol).

Origin and geographic distribution *E. philippinensis* is restricted to the Philippines (Luzon, Mindanao and Palawan).

Uses The stem bark of *E. philippinensis*, scraped into a pulp, and the fresh leaves are commonly used as a medicine. Usually they are applied as a poultice to painful swellings or infected wounds, acting as an emollient or as an anti-inflammatory. A decoction of the stem bark or the roots is widely taken against diarrhoea or dysentery accompanied by tenesmus. It is also used as a mouthwash to treat toothache.

E. resinosa Hance (synonym: *E. navesii* S. Vidal)

from Taiwan and the Philippines is used in the Philippines as a febrifuge. A preparation containing an extract of *E. resinosa* has been patented for skin care; it is credited with anti-inflammatory, wound healing and skin improvement effects.
The leaves of *E. acuminata* R.Br. (synonym *E. ovalifolia* Hassk.), occurring from China to Australia, are pounded and applied to swellings. The fruit is edible.
The wood of *Ehretia* is only used on a local scale, as it is not very strong, and the leaves are used for fodder.

Properties In tests with mice, a crude stem bark extract of *E. philippinensis* was found to be moderately toxic when administered intraperitoneally and slightly toxic when administered orally. A decrease in motor activity and slight analgesia were observed, but no further significant physiological changes. The butanol and ethylacetate fractions of the methanol extract of stem bark showed antihistamine release activity against compound 48/80, a potent histamine liberator. Rosmarinic acid was isolated and identified as the active constituent. Five cyanoglucosides were also isolated: ehretiosides A1, A2, A3 and B, and simmondsin. A stem bark extract was also tested for anti-inflammatory activity using different animal models. The extract was found to be equally potent as an aspirin reference.
From the stem bark of *E. acuminata* two 2-methoxyhydroquinone glucosides, a sesquilignan and a neolignan were isolated, as well as four lignans.

Botany A small tree up to 5 m tall; branches crooked, young branches brown to greenish-brown, glabrous. Leaves alternate, simple, broadly lanceolate to oblong-lanceolate, 4–15 cm × 1.5–7.5 cm, base attenuate, obliquely truncate, apex acute or acuminate, margins entire, glabrous to subglabrous; petiole 1–3 cm long; stipules absent. Inflorescence axillary or on short lateral branches, corymbose, many-flowered. Flowers bisexual, regular, 5-merous, fragrant; pedicel short; calyx broadly cup-shaped, 1.3–1.5 mm × 1.3–2 mm, usually glabrous, lobes triangular; corolla 3.5–4(–5) mm long and c. 5 mm in diameter, white, tube cylindrical-campanulate, lobes more or less reflexed, broadly rounded, up to 2.5 mm long; stamens inserted on corolla, long exserted; ovary superior, 2-celled with 2 ovules in each cell, style 4.5–6 mm long, forked for 0.8 mm, stigmas capitate. Fruit a subglobose drupe 3–4 mm in diameter, orange or reddish, with 2 separate 2-seeded pyrenes.

Ehretia comprises about 50 species and occurs in the tropics and subtropics of Africa, Asia, Australia and America (3 species). In Malesia, 12 species are found. *Ehretia* is sometimes placed in the small family *Ehretiaceae*.

Ecology *E. philippinensis* occurs in forests along rivers and in secondary growth, at low and medium altitudes.

Genetic resources and breeding Although *E. philippinensis* only occurs in the Philippines it is rather common there, and there are no records of overexploitation.

Prospects *E. philippinensis* has compounds with interesting biological activities, which merit further research. The wound-healing and anti-inflammatory properties are of special interest and comparable to those of *Carmona retusa* (Vahl) Masam., which is an important medicinal plant in the Philippines. Perhaps *E. philippinensis* can be developed as a supplement to this species.

Literature 247, 760, 858.
Other selected sources 227, 1037, 1042.

G.H. Schmelzer

Elatostema J.R. Forster & J.G. Forster

Charact. gen. pl. ed. 2: 105 (1776).
URTICACEAE
x = unknown; *E. repens*: $2n = 26$, *E. sessile*: $n = 13$, $2n = 32, 52$

Origin and geographic distribution *Elatostema* comprises at least 200 species, and is distributed in tropical and subtropical Asia, Australia and Africa. Asia is by far richest in species; only about 5 species occur in Africa, and 2 in Australia.

Uses *Elatostema* is most commonly used as a poultice to treat abdominal disorders, swellings, boils and dislocated bones, as has been recorded in Peninsular Malaysia for *E. repens* and *E. sessile*. There are other reports on medicinal applications of *Elatostema* in South-East Asia, but without reliable identification to the species. In Peninsular Malaysia, leaves are reputedly used to make a poultice for application to the head of women in labour. In the Moluccas, the leaves are applied to the forehead to treat headache, pounded leaves are used as an embrocation in children suffering from severe cough, and the plants are applied in a cooling wash for the head, sometimes also to promote hair growth. In Papua New Guinea, leaves are used internally to arrest diarrhoea. Some species with more fleshy leaves are sometimes

cooked and eaten as a vegetable, e.g. in the Philippines.

Botany Monoecious or dioecious herbs or undershrubs. Leaves alternate, distichous, sometimes with a small leaf subopposite a normal one, simple, usually oblique, often 3-veined from the base, sometimes pinnately veined, sessile or subsessile; stipules intrapetiolar. Inflorescence an axillary cyme or discoid head, usually involucrate, sessile or peduncled. Flowers unisexual, crowded on receptacle, minute, with 3–5 tepals; male flowers with tepals often horned below apex, 3–5 stamens and rudimentary pistil; female flowers often with minute tepals, a superior, 1-celled ovary and rudimentary stamens. Fruit a minute achene enclosed by the tepals, usually warted or with longitudinal ribs.

The delimitation of *Elatostema* is not yet very clear. *Pellionia* is often included in *Elatostema* (usually as one of 4 subgenera), but sometimes also kept separate because of its cymose inflorescences. If the latter conception, which has been gaining importance in recent years, is followed, *E. repens* belongs to *Pellionia*.

Ecology In general, *Elatostema* is characteristic for wetter locations in forest in the lowland to lower mountainous regions. It often occurs along streams, on rocks or on the forest floor. Locally, it can be very abundant, or even dominate the understorey of the forest.

Management *E. repens* and probably also other *Elatostema* species, can be easily propagated by cuttings. For *E. repens*, this is commonly practised to obtain pot plants.

Genetic resources It is not possible to judge at present the threat of genetic erosion for *Elatostema*. More information is needed on the delimitation and distribution of the South-East Asian species. The habitat preference (along streams in lowland forest) should be taken into account, as this type of habitat is under pressure.

Prospects *Elatostema* is poorly known in all respects, including botany, chemistry and properties. A sound taxonomic study, also covering related genera, is needed to interpret the literature properly and as a start for research on phytochemistry and pharmacological properties. For some time to come, the importance of *Elatostema* as a medicinal plant will remain unclear.

Literature 79, 117, 121, 334, 347, 407, 731.

Selection of species

Elatostema repens (Lour.) Hallier f.

Ann. Jard. Bot. Buitenzorg 13: 316 (1896).

Synonyms *Polychroa repens* Lour. (1790), *Pellionia daveauana* N.Br. (1880), *Pellionia repens* (Lour.) Merr. (1928).

Vernacular names Malaysia: sisek naga bukit, sisek tenggiling, sisek keli (Peninsular). Vietnam: tai d[as], sam d[as].

Distribution Burma (Myanmar), Indo-China, Thailand and Peninsular Malaysia. *E. repens* is cultivated in Java.

Uses In Peninsular Malaysia, the plant is applied as a poultice to swellings, boils, dislocated bones and abdominal disorders. A decoction is drunk to treat rheumatism. *E. repens* is cultivated as an ornamental, also as a pot plant; often forms with violet-tinged or silver-white marked leaves are grown.

Observations A herb with creeping and ascending branches up to 60 cm long; leaves rounded in lower part of stem, obliquely lanceolate in upper part of stem, 3–9 cm × 2–4 cm, dentate; flowers arranged in cymes, male cymes with 5–10 cm long peduncle, female ones sessile. *E. repens* is locally common on river banks in the forest; it also occurs on limestone rocks.

Selected sources 62, 121, 789.

Elatostema sessile J.R. Forster & J.G. Forster

Charact. gen. pl. ed. 2: 106 (1776).

Vernacular names Malaysia: sisek tenggiling, cheng man (Peninsular).

Distribution Nepal, Bhutan, India, Burma (Myanmar), southern China, Peninsular Malaysia.

Uses In Peninsular Malaysia, pounded leaves are used as a poultice to treat severe abdominal disorders.

Observations A small herb of c. 30 cm tall, with simple stem; leaves obliquely oblanceolate, 10–20 cm × 3.5 cm, long-acuminate, coarsely serrate; flowers arranged in sessile or shortly peduncled heads. *E. sessile* occurs on rocks in streams in hill forest, and is locally abundant.

Selected sources 121, 789.

Nanda Utami

Ellipanthus tomentosus Kurz

Journ. As. Soc. Beng. 41, 2: 305 (1872).
CONNARACEAE
$2n$ = unknown

Synonyms *Ellipanthus griffithii* Hook.f. (1876), *Ellipanthus luzoniensis* S. Vidal (1886), *Ellipanthus gibbosus* King (1897).

Vernacular names Indonesia: woyo (Sulawesi). Malaysia: kerantai merah (Peninsular), kelin (Sarawak). Philippines: alomangoi, atarukan (Tagalog), saling-uak (Panay Bisaya). Cambodia: sramar sbat. Laos: hăm fan. Thailand: kham rok (Chon Buri), karong daeng (eastern), chang nao (Ratchaburi, Nakhon Ratchasima). Vietnam: m[oof]ng g[af], d[aaf]u g[af], l[oos]p b[oos]p.

Origin and geographic distribution *E. tomentosus* occurs in eastern India, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines and Sulawesi; it is probably extinct in Singapore.

Uses In Thailand, the branches and stems of *E. tomentosus* are used as an appetizer, to combat flatulence and to treat abdominal spasm and, in combination with other plants, asthma. A decoction of the bark and wood is administered to treat malfunction of the kidneys.
The wood is hard and durable and may be used for local construction work such as bridges and house posts.

Botany A shrub or small to medium-sized tree up to 25(–30) m tall, with bole up to 60 cm in diameter; young branchlets fulvous-tomentose. Leaves alternate, unifoliolate (seemingly simple, but petiole with articulation below apex), elliptical to lanceolate, sometimes obovate, 7–22(–33) cm × 3–9 cm, acute, rounded or subcordate at base, sometimes slightly peltate, acuminate at apex, entire, glabrous to tomentose beneath, pinnately veined with looped secondary veins; petiole 0.5–3.5 cm long; stipules absent. Inflorescence axillary or ramiflorous, paniculate or glomerulate, up to 2.5 cm long, densely pilose. Flowers bisexual (sometimes unisexual?), (4–)5(–6)-merous, sweet-scented; pedicel articulated below the calyx; sepals valvate in bud, 1.5–2 mm long; petals free, 2–4.5 mm long, pilose, whitish; stamens usually 5 fertile and 5 rudimentary, connate at base; ovary superior, oblique, pilose, style slender, stigma usually 2-lobed. Fruit a reddish-brown follicle 2–4 cm long, more or less stipitate, densely tomentose, opening along the ventral suture, 1-seeded. Seed ovoid or ellipsoid, 1–2 cm long, testa shining black, basal part with orange or red sarcotesta; endosperm thin, cotyledons thick.
The sweet-scented flowers are probably pollinated by insects. The seeds, conspicuous by their contrasting black and orange-red colours, are probably dispersed by birds.
Ellipanthus comprises 6 species, apparently all closely related, and is distributed in eastern Africa, Madagascar and tropical Asia. It is classified in the tribe *Connareae* together with *Connarus* and some other 1-carpellate genera. In Malesia the genus is confined to the western part (not in the Lesser Sunda Islands, the Moluccas and New Guinea), where 2 species occur. *E. beccarii* Pierre is restricted to Borneo; it differs from *E. tomentosus* in the usually 4-merous and unisexual flowers. *E. tomentosus* is a variable species in which 2 subspecies are distinguished, one of these with 2 varieties. Subsp. *tomentosus* comprises the whole area of distribution of the species except Java, subsp. *kingii* (Boerl. & Koord.) Leenh. is a rare endemic of Java.

Ecology *E. tomentosus* is locally frequent (e.g. in Peninsular Malaysia) in primary lowland mixed dipterocarp forest and peat swamp forest, up to 700 m altitude, in Java up to 1500 m.

Genetic resources Although *E. tomentosus* has a large area of distribution, it might become liable to genetic erosion because of its preference for primary lowland rain forest, a type of habitat under much pressure. It still appears to be locally common (e.g. in Peninsular Malaysia), but in other areas is uncommon (e.g. in Borneo) or even rare (e.g. in Java).

Prospects Research is needed to confirm the claimed pharmacological properties of *E. tomentosus*. The prospects as a medicinal plant seem very limited because of its habit and habitat preference.

Literature 173, 247.

Other selected sources 62, 113, 121, 249, 250, 540, 877, 990.

R.H.M.J. Lemmens

Emilia prenanthoidea DC.

Prodr. 6: 303 (1837).
COMPOSITAE
$2n$ = unknown

Synonyms *Emilia angustifolia* DC. (1837), *Emilia papuana* Mattfeld (1940).

Vernacular names Papua New Guinea: tiligibe (Lalibu, Southern Highlands), kalanevuda

(Kami, Eastern Highlands). Vietnam: chua l[ef] n[us]i, rau m[uw][ow]ng.

Origin and geographic distribution *E. prenanthoidea* occurs from India eastwards to southern China, throughout continental South-East Asia and Malesia.

Uses In Papua New Guinea the leaves of *E. prenanthoidea* are mixed with wild ginger rhizomes and squeezed periodically onto a tooth cavity to relieve toothache. The juice from squeezed leaves is used to cover sores, or heated leaves are placed over the sores. Mixed with the leaves of *Grevillea papuana* Diels, the leaves are likewise applied to ulcers.

E. sonchifolia (L.) DC., well known as a vegetable throughout South-East Asia, has many medicinal applications. It is administered internally against fever, cough and diarrhoea, and externally as a poultice for sores and swellings, and to treat dim eyes and sore ears. *E. coccinea* (Sims) G. Don, occasionally cultivated as an ornamental in South-East Asia, is widely used in African folk medicine, in much the same way as *E. sonchifolia* in South-East Asia.

Properties There is no information on the phytochemistry or pharmacological properties of *E. prenanthoidea*. However, the aerial parts of *E. sonchifolia* contain pyrrolyzidine alkaloids and flavonoids. An aqueous extract of the aerial parts has shown antimicrobial activity. A methanolic extract of *E. sonchifolia* showed in-vitro cytotoxicity to Daltons lymphoma, Ehrlich ascites carcinoma and mouse lung fibroblast (L-929) cells, but not to normal human lymphocytes. Oral administration of the extract at 100 mg/kg to mice reduced the development of both solid and ascites tumours and increased the lifespan of tumour-bearing mice. The extract inhibited DNA synthesis as judged from a reduction in tritiated thymidine incorporation into Dalton's lymphoma cells in vitro. Studies indicated potent antioxidant and anti-inflammatory activities of the fresh leaf juice and methanolic extract.

Botany An annual herb, erect or at base prostrate, up to 150 cm tall; stem slender, ribbed, branched, glabrous. Leaves alternate, spatulate to lanceolate or linear-lanceolate, upper leaves sagittate-lanceolate, 1.5–17 cm × 0.2–3 cm, base with more or less rounded auricles, apex acuminate, acute or obtuse, entire or sometimes slightly repand-dentate, sessile. Inflorescence a terminal, subcylindrical head 8–17 mm × 4–5 mm, 2–3 together or rarely solitary, 20–45-flowered; peduncle filiform, 3–33 cm long; involucral bracts 6–8, lanceolate, obtuse or subacute. Flowers bisexual, regular, 5-merous; corolla tubular, 9–14 mm long, with spreading lobes, red, pink, purple, light mauve or white; stamens with cohering anthers forming a tube; ovary inferior, 1-celled, style with 2 spreading branches. Fruit an achene, linear-oblong to barrel-shaped, 3–4 mm long, ribbed, glabrous, with numerous white pappus hairs c. 7 mm long at apex.

E. prenanthoidea can be found flowering throughout the year. Dispersal of the fruits is by wind, carrying them over great distances.

Emilia consists of about 30 species indigenous in the Old World tropics and naturalized in the Americas. It is closely related to *Senecio*, the main difference being that in *Senecio* the involucre usually has a few bracts that are much shorter than the other ones (in *Emilia* all bracts are of equal length).Vegetatively it resembles species of *Sonchus*, but it can easily be distinguished by its solid stems which do not contain milky sap.

Ecology *E. prenanthoidea* occurs in both dry and wet habitats, as a weed along roadsides, on river banks, in grasslands, in fields (e.g. tea and rubber plantations) and relatively open dry forest. It prefers sunny or slightly shaded localities at 200–2700 m altitude. It is locally abundant, but in general occurs scattered.

Genetic resources *E. prenanthoidea* is a widespread weedy species, which is not threatened by genetic erosion.

Prospects Since research showed interesting pharmacological properties of *E. sonchifolia*, further research of *E. prenanthoidea* is desirable. However, attention should be paid to the presence of pyrrolyzidine alkaloids because of their toxic nature.

Literature 347, 358, 502, 851, 853.

Other selected sources 62, 679, 850.

Yuyu Suryasari Poerba

Enicostema axillare (Lamk) A. Raynal

Adansonia, ser. 2, 9: 75 (1969).

GENTIANACEAE

$2n = 38$

Synonyms *Enicostema littorale* Blume (1826), *Enicostema hyssopifolium* (Willd.) I. Verd. (1961), *Enicostema verticillatum* auct. non (L.) Gilg.

Vernacular names Indonesia: rebha bisah (Madurese).

Origin and geographic distribution *E. axillare* occurs in a large part of the Old World trop-

ics: southern and eastern Africa, India, Sri Lanka, Indo-China and the drier parts of Malesia. The Malesian populations have been distinguished as subsp. *littorale* (Blume) A. Raynal, and occur in Java, Madura, the Kangean Islands and the Lesser Sunda Islands (Lombok, Sumbawa, Sumba and Timor).

Uses In the Kangean Islands (Indonesia), a decoction of the whole plant is commonly used to treat fever. In India, *E. axillare* (subsp. *axillare*) is a well-known medicinal plant, especially renowned for its diuretic and anti-diabetic properties, but also used as a tonic and anthelmintic, and to treat malaria. The plant juice is used as an antivenin.

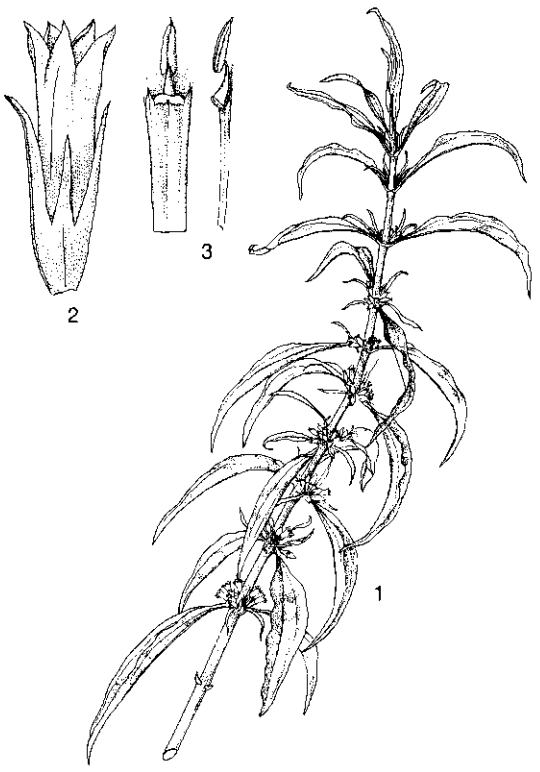
Properties As is the case with many *Gentianaceae*, *E. axillare* plants taste bitter due to the presence of secoiridoids. Whole plants from India (subsp. *axillare*) gathered at different growth stages yielded the flavonoids apigenin, genkwanin, isovitexin, swertisin, 5-O-glucosylswertisin, 5-O-glucosylisoswertisin and saponarin. The flavonoid composition and quantities differed with plant age. The secoiridoid (or gentiana) alkaloids gentianin (not to be confused with the coumaric acid ester of delphinidin-3-O-glucoside, which is known under the same name) and enicoflavin have also been isolated, as well as the pure secoiridoid swertiamarin.

An alcoholic extract of Indian *E. axillare* showed in-vitro and in-vivo antimalarial activity against *Plasmodium berghei*. The water extract of whole plants showed hypoglycaemic activity when administered intragastrically to rabbits at a dose of 600 mg/kg.

Botany An erect herb up to 80 cm tall, often woody at base, glabrous; stem below each leaf with 2 decurrent ridges. Leaves opposite, pairwise connected by a narrow ridge, simple and entire, the lower ones oblong-lanceolate, the higher ones narrowly lanceolate to linear, 4–16 cm × 0.5–4.5 cm, acutely acuminate, 3–5-veined; stipules absent. Inflorescence an axillary, head-like cyme, subsessile, 5–15-flowered. Flowers bisexual, regular, 5-merous; calyx 4–6 mm long, with lobes about as long as tube; corolla tube 6–7 mm long, greenish, lobes 2–3 mm long, contorted in bud, whitish turning yellowish; stamens inserted below the middle of the corolla tube, filaments with a small basal scale; ovary superior, 2-celled, style short with capitate stigma. Fruit an ellipsoid capsule 5–7 mm long, septicidally 2-valved, many-seeded.

In Java *E. axillare* flowers throughout the year.

Enicostema comprises 3 species: one indigenous in the West Indies and Central America, one endemic in north-western Madagascar, and the widespread and variable *E. axillare* with 3 subspecies. The Malesian subsp. *littorale* can be distinguished from subsp. *axillare* (Africa, India, Sri Lanka, Indo-China) and subsp. *latilobium* (N.E.Br.) A. Raynal (eastern Africa) by its triangular to lanceolate, acute calyx lobes with narrow scarious margins, its long-acuminate leaves and comparatively large fruit.



Enicostema axillare (Lamk) A. Raynal – 1, flowering stem; 2, flower; 3, stamens, front and side view.

Ecology In Indonesia, *E. axillare* occurs in the lowland, in grassland, fallow land and open teak forest, often near the coast, on periodically dry, heavy soils, and exceptionally on dry lava rocks in the mountains up to 900 m altitude.

Management In India, it has been shown that vegetative growth of *E. axillare* (subsp. *axillare*) was enhanced in the shade compared with plants grown in full sun, but reproductive growth (flower number) was reduced by shade. The plants are able to reproduce both sexually and asexually by root suckers. Adventitious shoot bud regeneration was achieved from leaf explants of Indian plants cultured on Murashige and Skoog medium. Shoots

were multiplied on medium containing 6-benzyladenine. In-vitro organogenesis has also been studied, and complete plantlets have been developed from callus.

Genetic resources *E. axillare* has an extremely wide distribution and occurs in anthropogenic habitats, even locally becoming a weed. Although the area of distribution of subsp. *littorale* is limited, its adaptation to open, dry habitats guarantees its survival in the long run.

Prospects *E. axillare* is a promising medicinal plant. Interesting compounds have been isolated, e.g. flavonoids for which anti-inflammatory activity and antispasmodic effects have been reported. Scientific research on the antimalarial activity should receive more attention because *E. axillare* is used to treat malaria in regions as far apart as India and the Kangean Islands of Indonesia. Moreover, it can be cultivated and propagated comparatively easily.

Literature 62, 277, 334, 630, 773.

Other selected sources 331, 843, 898, 959.

R.H.M.J. Lemmens

Epiphyllum oxypetalum (DC.) Haw.

Phil. Mag. 6: 109 (1829).

CACTACEAE

$2n$ = unknown

Synonyms *Phyllocactus acuminatus* (K. Schumann) K. Schumann (1897).

Vernacular names Indonesia: hong te.

Origin and geographic distribution *E. oxypetalum* is native to tropical America (Mexico, Guatemala, Venezuela and Brazil), but is widely cultivated in tropical countries, e.g. in gardens in Java.

Uses In Indonesia, a decoction of the fresh or dried flowers (often flower buds) and sometimes fresh stems is used externally to treat inflammations, wounds and boils, and internally to treat cough, phlegm, tuberculosis, pharyngitis, uterine bleeding and gastritis.

In Central America, a decoction of *Epiphyllum* flowers is also used to treat cough, and as an expectorant and tonic.

E. oxypetalum is planted as an ornamental for its flowers, and sometimes also as hedge plant.

Properties The sweet-tasting flowers reputedly have anti-inflammatory and haemostatic activities, whereas anti-inflammatory activity has also been reported for the slightly acid stems. The acidity of the stem is possibly due to the presence of citric acid, which has been demonstrated in many other *Cactaceae*.

Botany An erect shrub up to 3 m tall, widely and irregularly branched, spineless; stem terete or compressed-ensiform at base, strongly flattened and leaf-like towards apex; branches drooping and conspicuously articulate, internodes coarsely undulate-crenate, bearing a small areole in incisions. Leaves absent. Flowers solitary on upper areoles, bisexual, on stout, 0.5–2 cm long pedicels, 30–35 cm long; perianth gamophyllous, falling off shortly after anthesis, with long, red-scaly tube and much shorter, regular limb, outer tepals reddish, inner tepals white; stamens numerous, free, inserted on or near apex of perianth tube; ovary inferior, obtusely ribbed, style white, with 18–20 branches. Fruit a globose to ellipsoid berry, unilaterally dehiscent, many-seeded. Seeds shining black.

The plants bear a few flowers at long intervals. In Java, the flowers open in the late evening and close definitely in the late night or early morning. They are pollinated by hawkmoths and birds, at least in its natural area of distribution. Fruits do not develop in Java.

Epiphyllum oxypetalum (DC.) Haw. – branch with flower.

Epiphyllum consists of about 15 species and occurs mainly in Central America, with a few species extending to the West Indies and South America. It belongs to the tribe *Hylocereeae* of the subfamily *Cactoideae*, together with 5 other genera from tropical America. *E. hookeri* Haw. is also cultivated as an ornamental in Java, but it is not known whether it has the same uses.

Ecology In its native area of distribution, *E. oxyphyllum* is an epiphyte, growing on trees together with e.g. *Bromeliaceae* and *Orchidaceae* species. Acid soils with a pH of less than 6 are preferred for cultivation. Within the genus, *E. oxyphyllum* is the easiest species to cultivate. It grows and flowers extremely well in moist conditions.

Management *E. oxypetalum* can be propagated by stem cuttings.

Genetic resources *E. oxypetalum* does not seem to be easily liable to genetic erosion as it is widely cultivated in the tropics. However, the genetic variability in Malesia is probably very limited as the plants are propagated vegetatively. *Epiphyllum* species have been crossed with species from related genera such as *Disocactus* and *Selenicereus*. Such hybrids are widely cultivated as ornamentals.

Prospects Although no research has been done on the phytochemistry and pharmacological properties, *E. oxyphyllum* seems to be an interesting medicinal plant as it is used for similar complaints in different parts of the world. Research is therefore needed to confirm the attributed medicinal activities.

Literature 62, 991.

Other selected sources 334, 366, 646.

R.H.M.J. Lemmens

Epipremnum pinnatum (L.) Engl.

Pflanzenr. 37(IV.23B): 60 (1908).

ARACEAE

$2n = 60$

Synonyms *Scindapsus pinnatus* (L.) Schott (1832), *Rhaphidophora pinnata* (L.) Schott (1860), *Rhaphidophora merrillii* Engl. (1905).

Vernacular names Indonesia: lolo munding (Sundanese), jalu mampang (Javanese), samblung (Balinese). Philippines: tabatib (Tagalog), takotin (Bisaya), amlong (Bikol, Bisaya). Thailand: ngot, ngot khao (Surin), naang rong (Trat). Vietnam: r[as]y leo l[as] x[er], r[as]y ng[os]t.

Origin and geographic distribution *E. pinnatum* is very widely distributed, from Bangladesh, the Andaman Islands, Burma (Myanmar), Vietnam and probably also Laos, southern China, southern Japan, through Thailand and the whole of Malesia, to Queensland (Australia) and many islands in the Pacific.

Uses *E. pinnatum* is used medicinally in different parts of its large area of distribution. The leaves are regularly sold in markets in Singapore for use in herbal tea, which is reputedly effective against rheumatism and cancer, and acts as a general tonic. In the Philippines, the sap is applied to snake bites, and the inflorescence is used as an emmenagogue. In Indonesia, the inner part of the stem is applied as embrocation to treat sprains. In New Britain, the leaves are used externally to treat abscesses and swellings. In Vietnam, whole plants are used in traditional medicine, to treat fractures, bruises, cough, paralysis, rheumatism, conjunctivitis, mastitis, ecchymosis and furuncles, and as an antidote.

Baskets have been made in the Philippines from the inner parts of the aerial roots. In Tonga, the aerial roots of *E. pinnatum* are collected, baked on stones in an oven, and immersed in salt water for a long period to preserve them and to make it easier to remove the bark. The weavers split these prepared roots horizontally, and make traditional baskets from them, together with the leaf midribs of coconut.

E. pinnatum is often cultivated as an ornamental, with or without variegated leaves. In Bali, the leaves and young shoots are fed to cattle; in horses, they act as vermifuge.

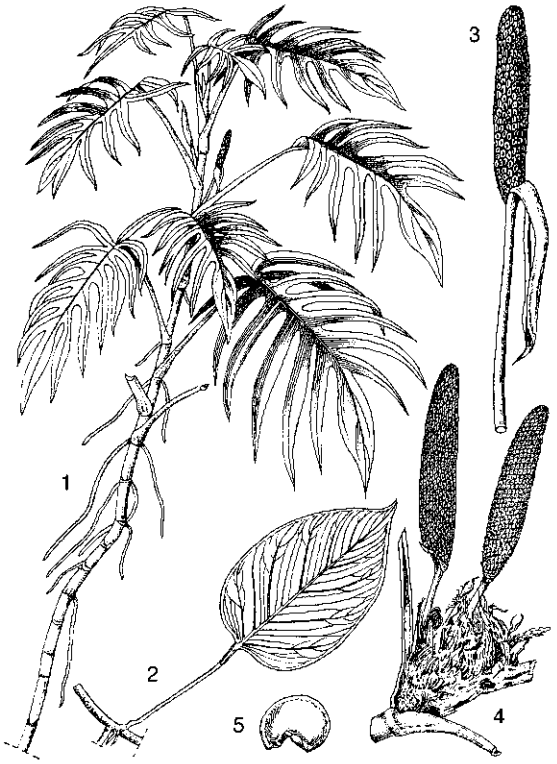
E. giganteum (Roxb.) Schott is reputedly poisonous, and the poison has been used criminally and as dart poison in mixtures.

Properties Leaf extracts of *E. pinnatum* showed cytotoxic activity against cancer cells in vitro, and the hot-water-soluble fraction of the extract produced immunostimulation in laboratory animals. Polyhydroxy-alkaloids are present in the leaves.

Botany A large climber up to 15 m long; stem up to 4 cm in diameter, lustrous green with irregular longitudinal whitish crests, becoming pale brown, with numerous clasping roots and few feeding roots. Leaves alternate, ovate to oblong-elliptical in outline, usually regularly pinnatifid, 10–93 cm × 5–60 cm, rounded to slightly cordate at base, acute to acuminate at apex, sometimes minutely perforate; petiole 20–60 cm long, canaliculate, with petiolar sheath later falling off to leave a brownish scar, basically and apically distinctly

geniculate; stipules absent. Inflorescence a cylindrical, whitish, yellowish or greenish spadix up to 25 cm long enveloped by a boat-shaped greenish spathe withering after anthesis and caducous; peduncle stout, up to 21.5 cm long. Flowers bisexual, without perianth; stamens 4; ovary superior, with trapezoid stylar region and linear stigma. Fruit a greenish berry, densely packed in a cylindrical infructescence oblique at base, with few seeds embedded in sticky orange-red pulp. Seeds curved, c. 4.5 mm × 3.5 mm, testa bony and ornamented, brownish.

Epipremnum comprises approximately 15 species of slender to very large root-climbing lianas, and is distributed from India, Bangladesh, Burma (Myanmar), Indo-China, southern China and southern Japan, through Thailand and the whole of Malesia, to northern Australia (Queensland) and the islands of the Pacific (to the Cook Islands). It is classified in the tribe *Monstereae*; other Asiatic genera of this tribe are *Amydrium*, *Rhaphidophora* and *Scindapsus*. *E. pinnatum* is the only widespread species; the other *Epipremnum* species have a restricted natural range. *E. pinnatum* cv. Aureum (synonym: *Epipremnum aureum* (Linden & André) G.S. Bunting) is often cultivated, usually with variegated leaves. Probably, this cultivar originates from the Solomon Islands.



Epipremnum pinnatum (L.) Engl. – 1, plant habit; 2, leaf of juvenile shoot; 3, inflorescence; 4, stem part with infructescences; 5, seed.

Ecology *E. pinnatum* occurs in primary and secondary rain forests and monsoon forest, up to 1600 m altitude. It is sometimes a weed in rubber plantations, and grows occasionally on rocks and in coastal forest.

Management *E. pinnatum* cultivated for ornamental purposes is propagated by stem cuttings. In-vitro propagation is successfully practised using shoot tips and axillary buds cultured on Murashige and Skoog medium supplemented with kinetin and adenine sulphate. Root rot caused by *Pythium splendens* is common in cultivated plants.

Genetic resources *E. pinnatum* is very widely distributed and occurs in very divergent habitats. It is consequently not liable to genetic erosion. There are no known germplasm collections of *E. pinnatum*.

Prospects It is surprising that a plant species like *E. pinnatum* that is so widely used in traditional medicine throughout its extremely large area of distribution has been so poorly investigated with regard to its phytochemistry and pharmacological properties. The reputed beneficial activities seem to justify more research.

Literature 104, 153, 333.

Other selected sources 121, 334, 347, 611, 740, 760, 971.

Nguyen Van Dzu

Epirixanthes elongata Blume

Catalogus: 82 (1823).

POLYGALACEAE

$2n = 44$

Synonyms *Salomonia aphylla* Griffith (1844), *Salomonia elongata* (Blume) Kurz ex Koord. (1912), *Epirixanthes aphylla* (Griffith) Merr. (1918).

Vernacular names Malaysia: chenduan, chimbuai (Peninsular). Vietnam: th[uw][owj]ng c[aw]n hoa.

Origin and geographic distribution *E. elongata* occurs in eastern India, southern Burma (Myanmar), Vietnam, southern China, Taiwan, Thailand (recently found in Lampang Province), Peninsular Malaysia, Sumatra, western Java,

Borneo and the Moluccas (Ambon, Seram).

Uses In Peninsular Malaysia *E. elongata* is used as a contraceptive and abortifacient by women, and during childbirth. An infusion of the dried plant is drunk. Plants are sometimes burned and the ash mixed with oil is smeared on the forehead or breast for its magic power. It is much valued as a love potion. Dayaks in Sarawak believe that it causes sterility in men and chickens.

Botany A small, erect herb, violet, reddish or dark cream and lacking chlorophyll, up to 25 cm tall, with densely branched root system; stem slender, up to 2 mm in diameter, simple or branched in upper half, minutely hairy or papillose. Leaves arranged spirally, small, bract-like, 2–3.5 mm long, ciliate-pilose, 1-veined, sessile. Inflorescence a terminal spike up to 6 cm long, with ovate, cuspidate, caducous bracts. Flowers bisexual, 2–2.5 mm long, yellowish-white; sepals 5, free, subequal, ciliolate-papillose, persistent; petals 3, unequal, asymmetrical, halfway adnate to the staminal tube, the 2 upper ones halfway connate to the lower one, free part of lower petal boat-shaped; stamens (4–)5, anthers sessile or stipitate; ovary superior, orbicular, 2-celled, style longer than ovary, erect, apically with slightly 2-lobed stigma. Fruit broadly ellipsoid or reniform, up to 1 mm long, indehiscent, with fleshy pericarp, enclosed by the sepals, 2-seeded. Seeds ellipsoid, glabrous, embryo translucent, endosperm nearly absent in ripe seeds.

Epirixanthes comprises 5 species and is distributed from eastern India, Burma (Myanmar), Indo-China and southern China, throughout the Malesian region to the Solomon Islands. It is related to *Salomonia*, which differs in its green leaves (chlorophyll present), S-curved style and dehiscent fruit.

Ecology *E. elongata* is saprophytic and grows among leaf litter in primary lowland rain forest. It is nowhere common and only rarely locally abundant. It prefers intense shade and does not tolerate drying of the forest floor.

Genetic resources Although widespread, *E. elongata* is restricted to humid rain forest, which is under growing pressure. It appears to be in need of conservation measures.

Prospects The use of *E. elongata* is more for psychological, i.e. magic, effects (as a love potion, and after childbirth to protect against evil spirits) than of genuine pharmacological value. Its rather rare appearance together with the poor possibilities for cultivation mean that it has no prospects as a medicinal plant.

Literature 121.
Other selected sources 247.

R. Kiew

Eranthemum viscidum Blume

Bijdr. fl. Ned. Ind.: 793 (1826).
ACANTHACEAE
$2n$ = unknown

Vernacular names Indonesia: jarong bubukuan (Sundanese).

Origin and geographic distribution *E. viscidum* seems to be restricted to Java, where it occurs throughout the island, but there are also some reports from the Lesser Sunda Islands, perhaps referring to cultivated plants.

Uses In Java, the juice from young leaves and stem tops is used externally to treat eye infections.

The tuberous root of *E. roseum* (Vahl) R.Br. boiled in milk is a popular remedy for leucorrhoea in India. *E. whartonianum* Hemsl., the roots of which are used to treat indigestion in Bougainville (Papua New Guinea), probably belongs to the genus *Pseuderanthemum*.

E. pulchellum Andrews (synonym: *E. nervosum* (Vahl) R.Br. ex Roemer & Schultes) is a commonly cultivated ornamental shrub.

Properties There is no information on the properties of *E. viscidum*, but the iridoid glucoside eranthemoside and 0.3% of the quaternary amino acid betain have been isolated from flowering *E. pulchellum*, as well as polyphenols and their related monomers such as sinapic acid.

Botany An erect herb up to 100 cm tall, often branched from the very base; nodes thickened. Leaves opposite, simple and entire, ovate-lanceolate to lanceolate, 2.5–20 cm × 1–6 cm, base decurrent, acuminate at apex, with linear cystoliths, short-hairy on the larger veins beneath, otherwise glabrous; petiole 0.5–5 cm long, petioles of the opposite leaves connected by a transverse ridge; stipules absent. Inflorescence a terminal and axillary, erect, dense spike-like raceme 3–15 cm long, with large (up to 3 cm) usually green, short-hairy and glandular bracts. Flowers bisexual, with 2 bracteoles; calyx surpassing the bracteoles, 5-fid, with narrow, acute and equal segments; corolla gamopetalous, with thin tube up to 3 cm long and 5 lobes contorted in bud, c. 2.5 cm across, violet blue; stamens 2, inserted near the top of the corolla tube, 2 minute staminodes present; ovary superior, 2-celled, style with 2 unequal stigmas. Fruit

a clavate capsule c. 1.5 cm long, acute, up to 4-seeded. Seeds compressed and partly surrounded by the hardened funicle, covered all over with mucigenous hairs.
E. viscidum flowers in Java from June to December.
Eranthemum consists of approximately 30 species and originates from tropical Asia. In Malesia, 2 species are indigenous, *E. sumatranum* Bremek. being endemic to Sumatra. Some species are attractive ornamentals grown for their foliage, bluish flowers and overlapping bracts, which are often conspicuously feathered with green. Several species of the related genus *Pseuderanthemum* also have ornamental value.

Ecology *E. viscidum* occurs in shaded, not too dry localities up to 800 m altitude, often in brushwood and hedges.

Management *Eranthemum* species cultivated as ornamentals are propagated by softwood cuttings.

Genetic resources Although *E. viscidum* seems to be endemic to Java, there are no indications that it is threatened.

Prospects Too little is known about *E. viscidum* to indicate its medicinal value, but in the light of the medicinal properties of many *Acanthaceae* species research seems worthwhile.

Literature 110, 334.

Other selected sources 62, 181, 331, 426, 731.

R.H.M.J. Lemmens

Eria pannea Lindley

Bot. Reg. 28: 64, misc. 79 (1842).
ORCHIDACEAE
$2n = 38$

Synonyms *Eria teretifolia* Griffith (1848).

Vernacular names Malaysia: kura kubong, gading gajah (Peninsular). Vietnam: n[ir] lan r[as]ch, n[ir] lan t[ar] t[ow]i.

Origin and geographic distribution *E. pannea* is distributed from eastern India, Bhutan and Burma (Myanmar), through Indo-China, southern China and Thailand, to Peninsular Malaysia, Singapore, Sumatra, the Riau Archipelago, Bangka and Borneo.

Uses There is only one record of medicinal uses from Peninsular Malaysia, stating that boiled plants of *E. pannea* are used to prepare a medicinal bath to treat ague. In Vietnam *E. pannea* is applied externally to treat fractures, bruises and skin complaints, and occasionally it is used in a bath to treat malarial fever.
Several *Eria* species are cultivated by orchid amateurs, e.g. *E. javanica* (Sw.) Blume.

Properties There is no information on the phytochemistry of *E. pannea*, but some other *Eria* species have been investigated. The glycoside pectolinarigenin 7-glucoside was isolated from *E. javanica*. Nudol (2,7-dihydroxy-3,4-dimethoxyphenanthrene), erianthridin, sitosterol and erianol (a steroidal compound) have been isolated from *E. spicata* (D. Don) Hand.-Mazz. Nudol has also been found in some other *Eria* species. Flavanthridin, flavanthrinin and the dimeric 9,10-dihydrophenanthrene derivative flavanthrin were isolated from *E. flava* Griffith, and the phenanthrene derivatives confusarin and confusaridin from *E. amica* Reichenb.f. Protoalkaloids have been isolated from *E. jarensis* Ames.

Botany A small perennial epiphytic herb with long, creeping rhizome and raising stems of several internodes with few leaves or with 1-leaved pseudobulb. Leaves alternate, simple, terete, 7.5–17.5 cm long, fleshy; petiole and stipules absent, but tubular sheath present at base of leaf. Inflorescence lateral, up to 5 cm long, woolly, usually 1–3-flowered; bracts ovate. Flowers bisexual, zygomorphic, pale yellow; sepals 3, triangular, 1–1.5 cm long, woolly outside; petals 3, oblong-lanceolate, shorter than sepals, hairy, lip (labellum) oblong, entire, dull red to purplish with thickened, yellowish basal and apical central part; column slender, greenish; anther with 8 pollinia. Fruit a fusiform capsule with numerous seeds. Seeds minute.
Eria comprises approximately 500 species and is distributed from India to the Polynesian Islands. It is one of the most polymorphic of all orchid genera, especially with respect to vegetative characters. It is close to another large genus, *Dendrobium*, from which it differs by having 8 pollinia and a woolly indumentum. Many sections have been distinguished; *E. pannea* belongs to section *Strongylaria*.

Ecology *E. pannea* is an epiphyte on trees, but can also be found on rocks, from the lowland up to 2000 m altitude. It is locally common, e.g. in northern Thailand.

Management Like other *Eria* species, *E. pannea* can undoubtedly be propagated by division.

Genetic resources *E. pannea* is widely distributed and at least locally common. Therefore, it does not seem to be endangered.

Prospects Research on phytochemistry and

pharmacological activity should be done before a possible recommendation of *E. pannea* as a useful medicinal plant can take place.

Literature 121, 830, 971.

Other selected sources 588, 589, 590, 591, 832, 993.

Dzuong Duc Huyen

Erismanthus obliquus Wallich ex Müll. Arg.

DC., Prodr. 15, 2: 1138 (1866).

EUPHORBIACEAE

$2n$ = unknown

Vernacular names Malaysia: kasip keledut, rukam ayer, bekoi (Peninsular). Thailand: aet (Yala).

Origin and geographic distribution *E. obliquus* occurs in peninsular Thailand, Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia, a paste made from *E. obliquus* leaves is applied externally as an anodyne.

Botany A monoecious, small to medium-sized tree up to 17 m tall, with fluted bole up to 20 cm in diameter. Leaves distichously opposite, simple, elliptical, (7–)10–23 cm × 2.5–8 cm, obliquely cordate at base, acuminate to caudate at apex, slightly serrate at margin with a gland on each tooth, punctate, pinnately veined, glabrous; petiole 1–4 mm long; stipules interpetiolar, up to 13 mm long. Inflorescence a unisexual, axillary raceme, many-flowered male and 1-flowered female in same axil of one leaf of a pair, alternating per node. Flowers unisexual, regular, 5-merous, long-pedicelled, with imbricate sepals basally united; male flowers c. 2 mm in diameter, green to pale yellow-brown, with petals slightly shorter than sepals, 15 stamens on a short torus and a pistillode up to 5 mm long; female flowers c. 20 mm in diameter, green to orange-pink, petals lacking, with superior, ovoid, 3-celled ovary, a single style and 3 stigmas each split into 2 lobes. Fruit a subglobose, 3-lobed capsule 1–1.5 cm in diameter, sericeous, pale yellow, opening septicidally and loculicidally into 6 valves, 1–3-seeded. Seeds globose, 4–6 mm in diameter, glossy brown with pale brown short stripes.

Erismanthus belongs to the tribe *Erismantheae* together with *Moultonianthus* and *Syndyophyllum*. It comprises only 2 species, with *E. sinensis* Oliv. restricted to Indo-China, southern China (Hainan) and northern and central Thailand. The wood of this species is of good quality and used for handles of axes and knives.

Ecology *E. obliquus* occurs in the undergrowth of rain forest, often along rivers and on limestone soils, up to 600 m altitude.

Genetic resources Although *E. obliquus* can be locally common, it is in general relatively rare and restricted to lowland rain forest. It might therefore be liable to genetic erosion.

Prospects The uses of *E. obliquus* are seemingly marginal and a development of the medicinal applications is not expected.

Literature 121, 955.

Other selected sources 990.

P.C. van Welzen

Erycibe Roxb.

Pl. Coromandel 2: 31 (1802).

CONVOLVULACEAE

x = unknown

Origin and geographic distribution *Erycibe* comprises approximately 70 species and occurs from India and Sri Lanka, through Burma (Myanmar), Indo-China, southern China, southern Japan, Thailand and Malesia, to Australia (northern Queensland). It is probably introduced in New Caledonia. It occurs throughout Malesia, where about 50 species can be found. For Indo-China (Laos, Cambodia and Vietnam), 9 species have been reported.

Uses In Peninsular Malaysia, a decoction of the roots is used during or after childbirth, and a poultice of the leaves to treat sores, itch or headache. In Taiwan, a stem extract of *E. henryi* Prain (synonym: *E. obtusifolia* auct. non Benth.) is used to relieve rheumatoid arthritis. A stem extract of *E. obtusifolia* Benth. is applied medicinally in China; a compound has been isolated that is used to treat glaucoma.

The branches or stems sometimes serve as binding material.

Properties Tests with mice showed that a high dose of a stem extract of the Taiwanese *E. henryi* may be responsible for a little antioxidant activity in both liver and kidney. Mice died immediately following intraperitoneal injection of extract at a dose of 10 mg/kg, but survived after oral administration even at 30 mg/kg.

The tropane alkaloid baogongteng A has been isolated from the Chinese *E. obtusifolia* and *E. hainanensis* Merr.; this compound has cholinergic and myotic activities, and is used for treating

glaucoma in China. *E. obtusifolia* possesses anti-inflammatory activity, which is due to the presence of scopoletin.

Botany Lianas, woody creepers or scandent shrubs; older branches with orbicular or broadly elliptical lenticels, or with longitudinal cork-ridges. Leaves arranged spirally, simple and entire, usually acuminate at apex; petiole short, channelled above; stipules absent. Inflorescence a terminal or axillary panicle, bracts usually minute, caducous. Flowers bisexual, regular, 5-merous, fragrant; sepals free, unequal; corolla deeply lobed, each lobe bifid; stamens inserted slightly above base of corolla; ovary superior, 1-celled, style absent, stigma usually conical and ridged. Fruit a berry, usually ellipsoid, 1-seeded. Seed with plain or strongly folded cotyledons.

In Borneo, it has been demonstrated that *Erycibe* (*E. maingayi* C.B. Clarke) seeds are distributed by sun bears that eat the fruits. Probably other animals (e.g. birds and monkeys) also serve as seed dispersers.

Erycibe is placed in the tribe *Erycibeae*, together with the American genera *Dicranostyles*, *Lysiostyles* and *Maripa*, and sometimes also *Humbertia* from Madagascar. This tribe is considered as primitive within the *Convolvulaceae*.

Ecology *Erycibe* occurs in lowland forest, primary as well as secondary, or scrub vegetation, up to 1300 m altitude.

Genetic resources *Erycibe* is restricted to a habitat under pressure. Many species have been found only locally, or are known from very few collections, and are therefore likely to be threatened with extinction.

Prospects Nothing is known about the phytochemistry and pharmacological properties of Malesian *Erycibe*. However, interesting compounds such as tropane alkaloids have been demonstrated in Chinese *Erycibe*. It might be worth investigating the Malesian species for related compounds. It is unknown whether a scientific basis exists for the few medicinal applications in Malesia. It has even been suggested that the uses related with childbirth are connected with the similarity of the bifid corolla lobes to the uterus of animals.

Literature 212, 375, 376, 1015.

Selection of species

Erycibe aenea Prain

Journ. As. Soc. Beng. 58, 2: 85 (1894).

Vernacular names Malaysia: langsat hutan (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses A decoction of the roots is used as a restorative during the first 3 days after childbirth in Peninsular Malaysia.

Observations A liana up to 50 m long, with stem up to 10 cm in diameter, older branches with few to many orbicular lenticels; leaves elliptical-oblong or oblong, 6–15 cm × 2.5–7 cm, with distinctly sunken venation beneath; inflorescence axillary, 1–4 cm long, (1–)2–5(–10)-flowered; flowers with corolla 7–8.5 mm long, yellow; fruit ellipsoid or obpyriform, c. 2.5 cm long, scurfy. *E. aenea* occurs in lowland forest up to 750 m altitude.

Selected sources 121, 247.

Erycibe malaccensis C.B. Clarke

Hook.f., Fl. Brit. India 4: 182 (1883).

Synonyms *Erycibe dubia* Elmer (1909).

Vernacular names Indonesia: kakuwasa, capungongo (Sulawesi). Malaysia: akar perut kijang jantan, akar sekijang, akar serawan jantan (Peninsular). Philippines: balisaog, malutai (Tagalog), saladai (Bisaya).

Distribution Peninsular Malaysia, the Philippines and Sulawesi.

Uses A poultice of the leaves is applied to sores and to the head to treat headache in Peninsular Malaysia.

Observations A liana or woody creeper up to 30 m long, or a scandent shrub up to 3 m tall, older branches with distinct longitudinal cork-ridges; leaves ovate to elliptical or oblong, 5–16 cm × 2.5–6.5 cm, with prominent venation beneath; inflorescence axillary or pseudoterminal, 1.5–10(–16) cm long, 3–15(–20)-flowered; flowers with corolla 7–11 mm long, white; fruit ellipsoid, c. 1.5 cm long, smooth, red. *E. malaccensis* occurs in lowland forest up to 500 m altitude.

Selected sources 121, 247.

Erycibe rheedii Blume

Bijdr. fl. Ned. Ind. 16: 1047 (1826).

Synonyms *Erycibe angulata* Prain (1894).

Vernacular names Indonesia: olor bahai (Simeuluë), panawar ganggang (Palembang, Sumatra). Malaysia: tampang ari, tampang ular ari, rumput ular ari (Peninsular).

Distribution Peninsular Malaysia, Sumatra, western Java and northern Borneo.

Uses In Peninsular Malaysia, the roots, after boiling in oil, are applied to the abdomen of women in labour to expedite delivery.

Observations A liana or woody creeper up to 20 m long, sometimes a scandent shrub, older branches with few orbicular lenticels; leaves elliptical-oblong to oblong or obovate-oblong, (7.5–)12–24(–30) cm × (3.5–)5.5–10(–14) cm, with slightly prominent venation beneath; inflorescence axillary or terminal, 1–23 cm long, 5–200-flowered; flowers with corolla 7–9 mm long, white or cream-coloured; fruit ellipsoid, c. 2 cm long, glabrous or with some stellate hairs near apex, dirty yellowish-brown or bluish. *E. rheedii* occurs in scrub vegetation, forest edges and swampy forest up to 250 m altitude.

Selected sources 121, 247.

R.H.M.J. Lemmens

Euchresta Benn.

Pl. jav. rar.: 148, t. 31 (1838).

LEGUMINOSAE

$x = 9$; *E. formosana*, *E. horsfieldii*: $2n = 18$

Origin and geographic distribution *Euchresta* comprises 5 species and is found from the Himalayas eastward to Japan and southward to western Malesia. Two species occur in South-East Asia.

Uses In South-East Asian traditional medicine *Euchresta* seeds are considered a useful antidote and they are used as a tonic. They are also credited with an aphrodisiac action and applied externally as well as internally. However, they are so poisonous that great caution is required when they are taken internally. The roots are also used to treat snakebites. A decoction of the leaves is used during childbirth to ease labour.

Properties Numerous prenylated flavonoids have been isolated from the roots and stems of *Euchresta*, together with isoflavones, pterocarpans, coumaronochromones and flavanones. Flavonoid glycosides are abundantly present in the leaves, most commonly with apigenin as the aglycone. The seeds contain alkaloids such as cytisine (at a concentration of 1.5%), matrine and matrine-N-oxide. The toxic complications of cytisine are related to an initial vasoconstriction, that is however accompanied by an increase of blood pressure. Symptoms of cytisine poisoning of the better known *Laburnum anagyroides* Medic. (synonym *Cytisus laburnum* L.) seeds are mostly limited to hypersalivation, burns in the mouth and throat, and vomiting, which prevents a massive absorption of the alkaloids. In cases of severe intoxication, the following symptoms of stimulation of the central nervous system by cytisine are observed: excitation, convulsion, and respiratory arrest. Matrine is known to exhibit anti-inflammatory, antiulcer and analgesic properties, and it showed significant inhibition of ocular inflammation induced by lens proteins. An ethanolic extract of *E. formosana* roots exhibited hypothermic activity in rats.

Botany Erect shrubs up to 2 m tall. Leaves arranged spirally, imparipinnate, long-petioled; stipules small; leaflets opposite, entire, without stipels. Inflorescence a terminal or leaf-opposed raceme, erect, with small bracts. Flowers bisexual, pedicellate; calyx campanulate, oblique, shortly 5-lobed; corolla papilionaceous, much longer than calyx, standard narrow, emarginate, clawed, wings oblong, auriculate, keel obtuse, its petals scarcely adhering and auriculate; stamens 10, 9 connate but easily separable, 1 free; ovary superior, long-stalked, 1-celled, style filiform, curved, stigma capitate. Fruit an oblong to ovoid or ellipsoid, drupe-like pod, stalked, thick and leathery, 1-seeded, indehiscent. Seed large, without caruncle and albumen.

Euchresta can be found flowering and fruiting throughout the year. It is usually classified in a separate tribe *Euchresteae*. However, its phytochemistry is remarkably similar to that of *Sophora*.

Ecology *Euchresta* occurs in closed to open, secondary forest, brushwood and savanna, in the Malesian region in mountains above 1400 m altitude.

Genetic resources The natural distribution of *Euchresta* within South-East Asia is rather limited and fragmented. An increased exploitation may therefore potentially threaten its genetic diversity, although it is also present in disturbed habitats.

Prospects Traditional uses of *Euchresta* seeds can be largely ascribed to the activities of cytisine. Future prospects seem rather limited because of the toxic effects of cytisine. However, the pharmacological properties of other alkaloids such as matrine might be of interest (e.g. as lead compounds) in the development of new pharmaceuticals. The potential of other constituents needs to be determined by further research.

Literature 118, 334, 605, 606, 760.

Selection of species

Euchresta formosana (Hayata) Ohwi

Journ. Jap. Bot. 12: 659 (1936).

Synonyms *Euchresta horsfieldii* auct. non (Lesch.) Benn.

Vernacular names Philippines: laguan (Tagalog), katanda, makhilab (Bukidnon).

Distribution The Philippines, Taiwan and southern Japan (the Ryukyu Islands).

Uses In the Philippines the roots are chewed to treat snakebites.

Observations An erect shrub up to 2 m tall, with glabrous branchlets; leaflets (3-)5–9, elliptical to lanceolate, 8–15 cm × 2.5–4.5 cm; flowers with white to purplish corolla, c. 1.5 cm long; fruit ellipsoid, c. 2 cm long, bluish-black. *E. formosana* occurs in evergreen forest in the mountains, up to 2000 m altitude.

Selected sources 380, 760.

Euchresta horsfieldii (Lesch.) Benn.

Pl. jav. rar.: 148, t. 31 (1838).

Vernacular names Indonesia: palakiya, pranajiwa (Javanese). Vietnam: s[ow]n d[aaj]u c[aw]n.

Distribution Eastern India, Burma (Myanmar), Indo-China, southern China, Thailand, northern Peninsular Malaysia, Sumatra, Java and Bali.

Uses In Java the seeds are a renowned traditional medicine, administered for diseases of the chest. Because of their emetic action they are considered a useful antidote in all cases in which poison has been swallowed, and they are taken as a tonic. Credited with an aphrodisiac action, they are applied externally and internally. The pounded seeds mixed with lemon juice are applied externally to snakebites. In Thailand and Vietnam a decoction of the leaves is used during childbirth to ease labour.

Observations An erect shrub up to 2 m tall, with brown-hairy branchlets, roots tuberous; leaflets(3–)5–7(–9), elliptical-ovate to oblong, 6–20 cm × 3–8.5 cm; flowers with white to yellowish corolla, 1.5–2 cm long; fruit oblong to ovoid or ellipsoid, 1–2 cm long, shining bluish-black. *E. horsfieldii* occurs in mainland South-East Asia in secondary forest, brushwood and savanna up to 1800 m altitude, in Java in closed forest at 1400–2000 m altitude.

Selected sources 35, 62, 121, 250, 292, 334, 731.

J.L.C.H. van Valkenburg

Euodia hortensis J.R. Forster & J.G. Forster

Charact. gen. pl.: 7 (1775).

RUTACEAE

$2n$ = unknown

Synonyms *Euodia longifolia* A. Rich. (1834), *Euodia schullei* Warb. var. *simplicifolia* Guill. (1931).

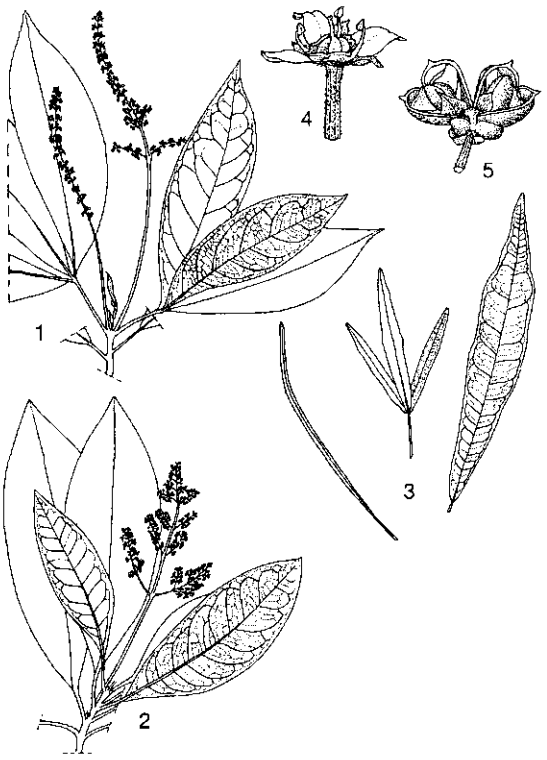
Vernacular names Papua New Guinea: sup (Kanganaman, Sepik).

Origin and geographic distribution The area of distribution of *E. hortensis* ranges from New Guinea eastward to Samoa, Tonga and Niue, but it is probably not native east of the New Hebrides. It has been introduced as an ornamental in gardens and parks in Java.

Uses In the Sepik region, Papua New Guinea, leaf scrapings of *E. hortensis* are added to water and the solution is drunk to give some relief to a cold. In the Solomon Islands crushed leaves are used as a poultice to treat boils. Roots and leaves are chewed together with *Areca catechu* L. nut and lime as a remedy for malaria. In islands of the Pacific the bark or an infusion of the leaves is used to reduce a fever, and leaves are chewed to treat toothache, and used to prepare a remedial bath. A leaf decoction is reputed to cure stomachache, fever and menstrual pains. A decoction of the bark, apparently being more potent, is taken to treat stomach ulcers, as an emmenagogue, and to relieve pain during childbirth. The fragrant leaves and inflorescenses are worn as personal decoration, especially on social occasions. The small wood, although of small dimension, is used for house construction or bow-making. *E. hortensis* is commonly planted as an ornamental.

Properties Prenylated acetophenones and furano monoterpenes (evodene) have been isolated from *E. hortensis* leaves, and an essential oil containing caryophyllene, α-copaene and ar-curcumene has been isolated from the flowers.

Botany A shrub or tree up to 15 m tall; young branchlets strigillose to glabrous, terminal bud densely appressed pubescent. Leaves opposite, 1- or 3-foliolate, pellucid-dotted; petiole 0.5–6.5 cm long; stipules absent; leaflets elliptical to obovate or linear, 4–36 cm × 0.3–8 cm, base obtuse to attenuate, apex obtuse to acuminate, entire to lobed or undulate, glabrous; petiolule 0–1 cm long. Inflorescence axillary, thyrsiform or racemose, 2–30 cm long, glabrous to puberulent. Flowers bisexual, 4-merous; sepals connate at base, ovate or ovate-triangular, 1–2 mm long; petals ovate to elliptical,



Euodia hortensis J.R. Forster & J.G. Forster – 1, flowering twig with 3-foliolate leaves; 2, flowering twig with 1-foliolate leaves; 3, leaf variability of putative cultigens; 4, flower, floral parts partially removed; 5, fruit.

1.5–2 mm long, persistent in fruit, white or cream; stamens with glabrous filaments; disk cupular; ovary superior, 4-carpellate, carpels connate at base. Fruit consisting of 1–4 1-seeded follicles 4–5 mm long, glabrous. Seeds (2.5–)3–4.5 mm long, minutely granulose, brown or reddish-brown, dull to lustrous.

Euodia consists of 7 species and ranges from New Guinea and north-eastern Australia east to Samoa, Tonga and Niue. Except for the New Caledonian endemic *E. tietaensis* (Guill.) T.G. Hartley, the species are very closely related.

Euodia and *Melicope* are very closely related genera and much confusion exists with respect to the proper identity of the hundreds of names in use. The most important differences between the two genera are the dull and roughened seeds that are discharged upon dehiscence of *Euodia* fruits versus the shiny and smooth seeds remaining attached in the dehisced *Melicope* fruits.

E. hortensis has a long history of cultivation resulting in much variation in leaf shape. The putative cultigens of *E. hortensis* are vegetatively remarkably similar to those of *Melicope denhamii* (Seem.) T.G. Hartley and as a result the two species have been confused.

Ecology *E. hortensis* is found in both primary and secondary forest, coastal and inland, in thickets, open localities and disturbed areas, from sea-level up to 600 m altitude.

Genetic resources *E. hortensis* is a relatively widespread species, well adapted to disturbance, and it is frequently cultivated in gardens, villages and cemeteries. It does not seem to be in danger of genetic erosion.

Prospects There is no information on pharmacological properties of *E. hortensis*. Research is needed to support its traditional medicinal uses.

Literature 121, 320, 347.

Other selected sources 116, 731.

Juliasri Djamal

Fagerlindia fasciculata (Roxb.) Tirveng.

Nordic Journ. Bot. 3(4): 458 (1983).

RUBIACEAE

$n = 11$

Synonyms *Gardenia fasciculata* Roxb. ex Sprengel (1827), *Randia fasciculata* (Roxb.) DC. (1830), *Oxyceros fasciculata* (Roxb.) Yamazaki (1970).

Vernacular names Malaysia: akar duri, akar kuku lang (Peninsular).

Origin and geographic distribution *F. fasciculata* is distributed from the Himalayas of Nepal, Bhutan and northern India, through eastern India, Indo-China and Thailand, to Peninsular Malaysia.

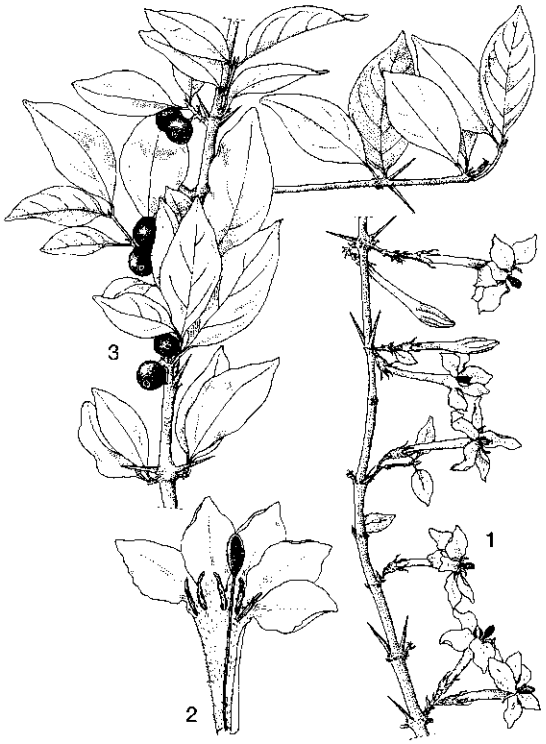
Uses In Peninsular Malaysia, leaves are pounded with *Prismatomeris* leaves to obtain a poultice to treat sores. In India, the fruits are used in cases of sunstroke.

Botany A shrub or small tree up to 6 m tall. Leaves opposite, simple and entire, elliptical to ovate, 3–12 cm × 1.5–5 cm, hairy on the veins below, with 4–9 pairs of secondary veins; petiole 3–10 mm long; stipules interpetiolar, narrowly triangular, cuspidate; leaf axils with 2 buds each, the upper ones developing into spines c. 1 cm long. Inflorescence terminal, fasciculate, or flowers solitary. Flowers bisexual, regular, 5-merous; calyx with short tube and narrow lobes, persistent; corolla salver-shaped with tube (1.5–)2.5–4.5 cm

long and lobes (0.6–)1.5–3 cm long, contorted in bud, tube inside hairy; stamens inserted near the apex of the corolla tube, filaments very short, anthers large, exserted from the corolla throat; ovary inferior, 2-celled, style long, with 2 large stigmas. Fruit a globose berry, 1–1.5 cm in diameter, hairy, crowned by the calyx cup, many-seeded. Seeds shaped like the segments of an orange, 5–7 mm long.

The main vertical orthotropic axis is monopodial and bears horizontal plagiotropic shoots. The growth of a plagiotropic axis is terminated by the production of a terminal inflorescence, and further growth is sympodial. Branches produced during sympodial branching may bear spines representing reduced shoots. There is a second serial bud situated below the spines. This may develop into a short shoot bearing an inflorescence or it may develop into a vegetative shoot.

The anthers surround the stigma in bud, and pollen is released already in flower buds. When the flowers open the pollen is presented on the stigma, which then opens to expose the receptive inner surface.



Fagerlindia fasciculata (Roxb.) Tirveng. – 1, flowering branch; 2, corolla opened, showing stamens, style and stigmas; 3, fruiting branch.

Fagerlindia most resembles *Catunaregam* and *Oxyceros*, which are also spiny shrubs. It is best characterized by the 2 buds in the leaf axils and the salver-shaped corolla.

Fagerlindia comprises about 9 species, and occurs from the Himalayas to southern China and Malesia, where 3 species have been found: *F. fasciculata* in Peninsular Malaysia, and 2 other species in the Philippines.

Ecology In Peninsular Malaysia, *F. fasciculata* occurs in lowland and hill forest.

Genetic resources *F. fasciculata* does not seem likely to be endangered. It occurs throughout Peninsular Malaysia, in different forest types.

Prospects Very little is known of *F. fasciculata* in all respects. Research is needed to confirm the beneficial effect on sores; perhaps there are active compounds comparable to those found in related genera such as *Catunaregam*.

Literature 121, 790, 990.

Other selected sources 931.

R.H.M.J. Lemmens

Fimbristylis Vahl

Enum. pl. 2: 285 (1805).

CYPERACEAE

$x = 5$; *F. falcata*: $2n = 22, 44$, *F. miliacea*: $2n = 10, 20$

Origin and geographic distribution *Fimbristylis* comprises about 200 species and has a pantropical distribution, with some species extending to the warmer parts of the temperate regions. About 80 species have been found in the Malesian region.

Uses *Fimbristylis* is occasionally used in traditional medicine, in South-East Asia mainly for poulticing to treat fever. In Peninsular Malaysia *F. dura* (Zoll. & Moritzi) Merr. is used as a tonic after childbirth. In Brunei *F. pauciflora* R.Br. is rubbed on the body to induce labour. *F. dichotoma* (L.) Vahl is used as a diuretic in China.

Some *Fimbristylis* species, especially *F. umbellaris* (Lamk) Vahl (synonym: *F. globulosa* (Retz.) Kunth), are used for matting, others as green manure in rice fields, e.g. *F. dichotoma*, *F. pauciflora* and *F. schoenoides* (Retz.) Vahl, or as forage, e.g. *F. dichotoma* and *F. miliacea*.

Properties Rhizome sections of *F. falcata* significantly reduced radial growth of *Fusarium oxysporum*; the antifungal activity was found to be due to the presence of a volatile compound. Quinones such as cyperaquinone have been isolat-

ed from *F. dichotoma* rhizomes; these compounds are also found in *Cyperus* species. Flavonoids such as aureusidin, delphinidin, luteolin and tricin have been isolated from leaves and inflorescences of *F. dichotoma*.

Botany Annual or perennial herbs, usually with short rhizome and tufted stems; stems usually erect, subterete to more or less angular, solid. Leaves in a rosette, often also a few in lower part of stems and then often reduced to bladeless or short-bladed sheaths, simple, linear, sessile, with closed sheaths at base. Inflorescence terminal, simple or more or less compound, consisting of spikelets, sometimes capitate or consisting of a single spikelet; bracts foliaceous, but often much reduced; spikelets few to many-flowered, axis usually persistent after falling of glumes and fruits. Flowers simple and naked, each subtended by a bract (glume), bisexual, with 1–3 free stamens and a superior, 1-celled ovary having a style articulated at base and ending into 2–3 stigmas. Fruit a trigonous or lenticular nut, orbicular to oblong-linear, smooth to tuberculate, reticulate or ribbed. Seed with thin testa, embryo small, surrounded by abundant endosperm.

Fimbristylis is often classified in the tribe *Fimbristylideae*, together with *Eleocharis*, which resembles *Fimbristylis* species with a single spikelet but differs in the presence of flower bristles, and *Bulbostylis*, which differs in its persistent style base. It has also been included in the tribe *Cypereae*, comprising, among others, *Bulbostylis*, *Cyperus*, *Eleocharis* and *Scirpus*. *Cyperus* also differs in its persistent style base.

The names *F. littoralis*, *F. miliacea* and *F. quinquangularis* are used for 2 closely related, widespread species, and this makes it difficult to interpret the literature. Here *F. littoralis* is considered synonymous with *F. miliacea*, and *F. quinquangularis* (Vahl) Kunth representing another species differing in 5-angled stems and leaves not laterally flattened. Probably both species are used indiscriminately.

Ecology Most *Fimbristylis* species prefer wet localities such as swamps, rice fields, margins of lakes and river banks, usually in the lowland, rarely above 1500 m altitude. Some occur in forest, savannas or along the seashore. A few species (e.g. *F. miliacea*) are troublesome weeds in rice fields, germinating very quickly and recovering rapidly after ploughing.

Genetic resources In comparison with other *Cyperaceae* genera such as *Cyperus*, many *Fimbristylis* species have limited areas of distribution, although several are widely distributed, which is the case for both species treated here. However, *F. falcata* is rare in the Malesian region, whereas *F. miliacea* is a very common weed.

Prospects Nothing is known about the pharmacological properties of *Fimbristylis*. Possibly these are comparable to those of *Cyperus*, which is used in traditional medicine for similar purposes, e.g. for poulticing in cases of fever, and for which febrifuge properties have been demonstrated. Research has mainly focused on the control of weedy species such as *F. miliacea*.

Literature 247, 331, 362, 760.

Selection of species

Fimbristylis falcata (Vahl) Kunth

Enum. pl. 2: 239 (1837).

Synonyms *Fimbristylis junciformis* (Nees) Kunth (1837).

Vernacular names Philippines: malasibuias (Tagalog). Thailand: yaa dok khaao (Loei). Vietnam: c[os]i qu[aw]n l[uw][owx]i li[eef]m.

Distribution Nepal, India, Sri Lanka, Indo-China, Thailand, the Philippines, New Guinea and New Britain.

Uses In India the rhizomes are used to treat dysentery and ringworm.

Observations A perennial herb with woody, shortly creeping rhizome and solitary or somewhat tufted, angular stems up to 55 cm tall; leaves flat; inflorescence loose, consisting of spikelets in clusters of (1–)2–5, spikelets ovoid, 3–4 mm × 1.5 mm; flowers with 3 stamens; fruit obovoid, c. 1 mm long. *F. falcata* occurs in grassland, up to 1800 m altitude.

Selected sources 247, 760, 782, 865.

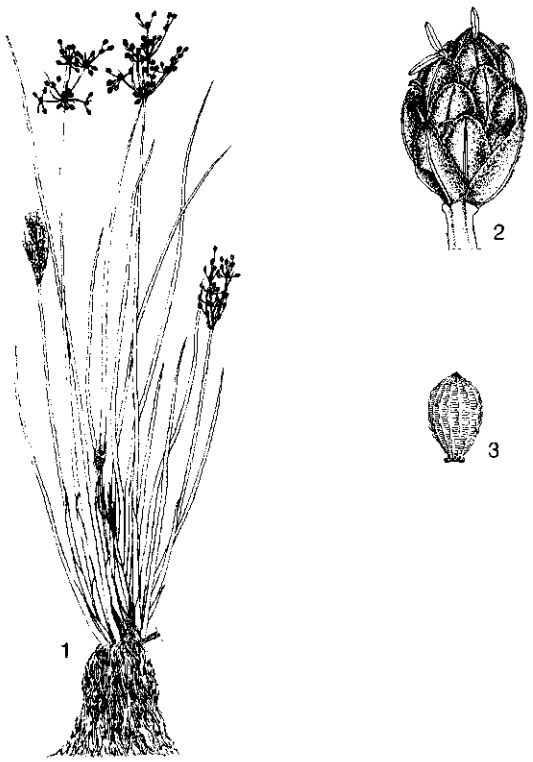
Fimbristylis miliacea (L.) Vahl

Enum. pl. 2: 287 (1805).

Synonyms *Fimbristylis littoralis* Gaudich. (1826).

Vernacular names Indonesia: babawangan (Sundanese), adas-adasan (Javanese), porih pae (Sumbawa). Malaysia: rumput tahi kerbau, rumput kurau, rumput keladi (Peninsular). Philippines: agor (Tagalog), sirau-sirau (Iloko), sirisibuyas (Bikol). Burma (Myanmar): mônhnyin. Cambodia: kak phnèk kdam, smao. Thailand: yaa rat khiat (Chia Nat), yaa nuat plaa duk (Surat Thani, Bangkok, Trang). Vietnam: c[or] t[of] te, c[os]i qu[aw]n t[of] te.

Distribution *F. miliacea* is pantropical, extend-



Fimbristylis miliacea (L.) Vahl – 1, plant habit; 2, spikelet; 3, fruit.

ing into some temperate regions, e.g. China and Japan; it occurs throughout the Malesian region, possibly except Borneo.

Uses In Peninsular Malaysia the leaves are sometimes applied as a poultice to treat fever. *F. miliacea* is browsed by cattle. It serves as a green manure in rice fields, but is considered one of the most noxious weeds in rice in Asia.

Observations An annual or short-perennial herb with fibrous roots and densely tufted, acutely 4-angled stems up to 40(–90) cm tall; leaves laterally compressed; inflorescence loose, consisting of numerous solitary, ovoid spikelets 1.5–5 mm × 1–1.5 mm; flowers usually with 1 stamen; fruit broadly ellipsoid to subglobose, up to 0.5 mm long. *F. miliacea* occurs scattered in open or slightly shaded wet localities such as swampy grassland, rice fields and teak forest, up to 1000 m altitude. It may be a troublesome weed in rice fields.

Selected sources 121, 247, 334, 362, 760, 782, 879.

R.H.M.J. Lemmens

Fissistigma Griffith

Not. pl. asiat. 4: 706 (1854).

ANNONACEAE

x = unknown; *F. manubriatum*: $2n = 16$

Origin and geographic distribution *Fissistigma* comprises approximately 60 species, and occurs from eastern India and southern China, throughout tropical Asia including the whole of Malesia, to north-eastern Australia.

Uses Decoctions of roots, leaves and sometimes flowers of *Fissistigma* are used in traditional medicine in Peninsular Malaysia. They are applied after childbirth and to treat stomach-ache and fever. A poultice of the leaves is occasionally used externally against sores.

Several *Fissistigma* species are used in traditional medicine in southern China and Taiwan, e.g. to treat sciatica, rheumatoid arthritis, inflammation and neoplasm. Examples are *F. balansae* (Aug. DC.) Merr., *F. glaucescens* (Hance) Merr., *F. oldhamii* (Hemsl.) Merr., *F. polyanthum* (Hook.f. & Thomson) Merr. and *F. shangtzeense* Tsiang & P.T. Li.

Properties The chalcones pedicin, fissistin and isofissistin have been isolated from an ethylacetate extract of *F. lanuginosum*. The first of these compounds inhibits tubulin assembly into microtubules and thus shows antimitotic activity; the latter 2 compounds showed cytotoxicity against KB cell lines. A bioactive fraction (brine shrimp bioassay) has been purified from the stem of *F. latifolium* in Malaysia; the flavonoids tectochrysin and 6,7-O,O-dimethylbacalein and the aristolactam alkaloid goniopedaline have been isolated from the fraction.

Crude extracts of the Chinese *F. balansae* and *F. oldhamii* showed significant activity in an antiplatelet aggregation assay. A number of aristolactams and 2 dioxoaporphines were isolated as active compounds. The mechanism of the antiplatelet aggregation effect of these compounds appears to be different from that of aspirin, and the effect may be due to the inhibition of thromboxane A_2 formation.

A number of alkaloids have been found in the Chinese *F. balansae*, *F. glaucescens* and *F. oldhamii*. Of these, atherosperminine (as perchlorate) and atherosperminium I, isolated from *F. glaucescens*, showed strong inhibition of platelet aggregation, whereas the first of these compounds also showed a vasodilating action on thoracic aorta preparations of rats. Atherosperminine also exerts a non-specific relaxant effect on the trachealis muscle.

Liriodenine, isolated from *F. glaucescens*, was shown to be a selective muscarinic receptor antagonist in isolated trachea, ileum and cardiac tissues of guinea-pigs and rats; therefore, it was concluded that it has therapeutic potential for the treatment of cardiac arrhythmias. The selective α-1D-adrenoceptor antagonist in vascular smooth muscle (–)-discretamine has also been isolated from *F. glaucescens*. The total alkaloid fraction of *F. oldhamii* increased the coronary blood flow in tests on isolated hearts. The hydro-oxadiazine-type alkaloid fissoldhimine and a morphinandienone alkaloid were isolated from *F. oldhamii*. Antitumour and antiviral activities have been attributed to the Chinese *F. polyanthum*.

From the pleasantly smelling flowers of the Chinese *F. shangtzeense* an essential oil has been isolated with linalool and α-terpineol as the major components; this might be a valuable source of raw material for perfumery.

Botany Lianas, with simple hairs. Leaves alternate, distichous, simple and entire; stipules absent. Inflorescence a terminal leaf-opposed few-flowered fascicle. Flowers bisexual, regular; sepals 3, valvate, more or less connate at base; petals 6, in 2 whorls, inner ones slightly shorter than outer ones, valvate, free, triquetrous, concave at base; stamens numerous, spirally arranged, connective with a tongue-shaped apex; carpels numerous, free, usually pubescent. Fruit consisting of numerous free stipitate, indehiscent monocarps, many-seeded. Seeds in 2 rows, smooth and shining.

Some species which are included in *Fissistigma* in older literature have been transferred to other genera: *F. mabiforme* (Griffith) Merr. is now *Mitrella kentii* (Blume) Miq., and *F. cylindricum* (Maingay ex Hook.f. & Thomson) Merr. is now *Pyramidanthe prismatica* (Hook.f. & Thomson) J. Sinclair.

Ecology In Malesia, *Fissistigma* occurs particularly in lowland forest, also in secondary forest and forest edges, but its ecological requirements are very poorly known.

Genetic resources Several *Fissistigma* species are, at least locally, common (e.g. *F. fulgens* and *F. latifolium*), but for other ones very few collections are available. Moreover, the exact areas of distribution are still unclear.

Prospects *Fissistigma* does not seem to be much used in traditional medicine in Malesia, Thailand or Indo-China. The few reports available on phytochemistry and pharmacological properties, however, show interesting results. Moreover, the better investigated Chinese species are accredited medicinal plants. More research of the South-East Asiatic species seems worthwhile.

A taxonomic revision of the complete genus is still lacking. It is badly needed for correct identification and to understand the distribution of the various species.

Literature 121, 140, 150, 159, 493, 557, 756, 860, 1010, 1011.

Selection of species

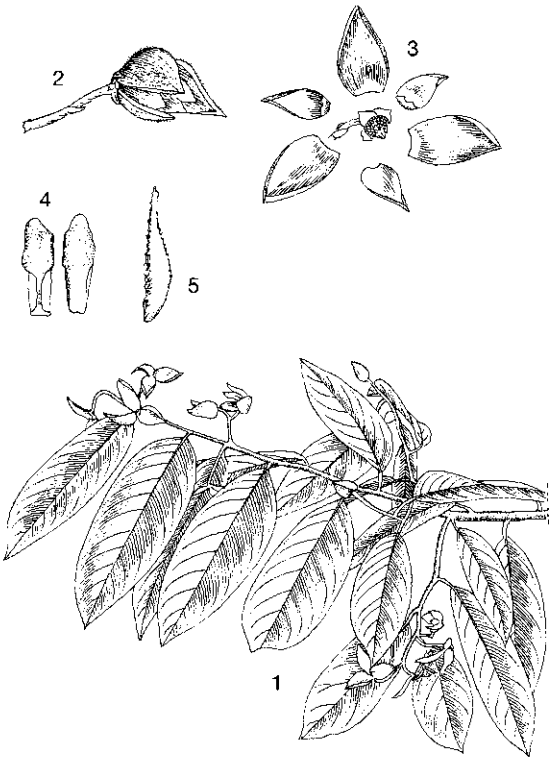
Fissistigma fulgens (Hook.f. & Thomson) Merr.

Philipp. Journ. Sci. 15: 130 (1919).

Synonyms *Melodorum fulgens* Hook.f. & Thomson (1855).

Vernacular names Malaysia: akar larak, akar salah hutan, akar sengolok (Peninsular).

Distribution Southern Peninsular Malaysia, Singapore, Sumatra, Borneo and the Philippines.



Fissistigma fulgens (Hook.f. & Thomson) Merr. – 1, flowering branch; 2, flower; 3, flower with petals detached; 4, stamens, front and back view; 5, pistil.

Uses In Peninsular Malaysia, a decoction of the leaves is used after childbirth, and a leaf poultice to treat sore legs.

Observations A large liana; leaves oblong-lanceolate, 7.5–15 cm × 3–5 cm, shortly appressed golden pubescent and with indistinct tertiary venation below; outer petals 1–1.5 cm long, orange; monocarp globose to oblong, 3–4 cm long, with c. 2 cm long stalk, tawny tomentose. *F. fulgens* is locally common, e.g. in southern Peninsular Malaysia; it often occurs in forest edges.

Selected sources 121, 860.

Fissistigma kingii (Boerl.) Burkill

Kew Bull.: 317 (1935).

Synonyms *Melodorum kingii* Boerl. (1899).

Vernacular names Malaysia: pokok achar, akar larak merah (Peninsular).

Distribution Peninsular Malaysia, Bangka and Borneo.

Uses In Peninsular Malaysia, a decoction of the flowers is used to treat stomach-ache.

Observations A large liana; leaves elliptical, 7–12 cm × 3.5–5.5 cm, dark chocolate-brown tomentose with distinct tertiary venation below; outer petals 1.5–2 cm long; monocarp globose, 2.5–3 cm in diameter, with 3–3.5 cm long stalk, rough or slightly verrucose. *F. kingii* occurs in lowland forest, but is apparently uncommon.

Selected sources 121, 860.

Fissistigma lanuginosum (Hook.f. & Thomson) Merr.

Philipp. Journ. Sci. 15: 132 (1919).

Synonyms *Melodorum lanuginosum* Hook.f. & Thomson (1855).

Vernacular names Malaysia: larak api, selusoh semang (Peninsular).

Distribution Indo-China, Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia, a decoction of the root is used after childbirth and to treat stomach-ache.

Observations A large liana; leaves oblong or obovate-oblong, 9–21 cm × 4–8 cm, rufous-lanate tomentose with distinct tertiary venation below; outer petals 3–3.5 cm long, pinkish; monocarp subglobose, c. 2 cm in diameter, with stalk up to 0.5 cm long. *F. lanuginosum* occurs in open forest and in forest edges, and is locally common in Peninsular Malaysia.

Selected sources 34, 121, 860.

Fissistigma latifolium (Dunal) Merr.

Philipp. Journ. Sci. 15: 132 (1919).

Synonyms *Melodorum latifolium* (Dunal) Hook.f. & Thomson (1855).

Vernacular names Malaysia: akar pisang-pisang beledu (Peninsular), akar raral (Sarawak). Philippines: alakai (Tagalog), auaan (Bagobo). Thailand: nom wua (Nakhon Si Thammarat).

Distribution Indo-China, Thailand, Peninsular Malaysia, Singapore, Java, Borneo and the Philippines; possibly also Sumatra.

Uses In Peninsular Malaysia, the juice is used medicinally, but it is not indicated for which purpose. A tonic drink is made from the boiled roots by the Iban people in Borneo.

Observations A large liana up to 20 m long; leaves oblong, obovate or oblong-lanceolate, 8–35 cm × 3.5–15 cm, rusty brown tomentose with distinct tertiary venation below; outer petals 1–3 cm long, orange; monocarp oblong or subglobose, 2–5 cm long, with stalk up to 4 cm long. *F. latifolium* is locally very common, e.g. in lowland forest in Peninsular Malaysia; in Java it occurs in forest up to 1200 m altitude.

Selected sources 62, 121, 681, 860.

Fissistigma manubriatum (Hook.f. & Thomson) Merr.

Philipp. Journ. Sci. 15: 134 (1919).

Synonyms *Melodorum manubriatum* Hook.f. & Thomson (1855).

Vernacular names Malaysia: akar kenchong, akar jangkang, akar sembelit (Peninsular).

Distribution Peninsular Malaysia, Singapore, Bangka and Borneo.

Uses In Peninsular Malaysia, a decoction of the root is used to treat stomach-ache and fever.

Observations A large liana up to 30 m long; leaves oblong-lanceolate, 5–13.5 cm × 2–4.5 cm, thickly and shiningly appressed tomentose with indistinct tertiary venation below; outer petals 2–2.3 cm long, reddish when young, greyish when older; monocarp ovoid-globose, 2.5–3 cm long, with stalk 1.5–7.5 cm long. *F. manubriatum* occurs in lowland forest, and is locally common, e.g. in Peninsular Malaysia.

Selected sources 121, 860.

R.H.M.J. Lemmens

Floscopa scandens Lour.

Fl. cochinch. 1: 193 (1790).
COMMELINACEAE
$2n = 12, 22, 24, 54$

Vernacular names Malaysia: hawar-hawar, rumput tapak itek, rumput johong beraleh (Peninsular). Philippines: pugad-labuyo, aligbangon (Tagalog), sambilau (Samar-Leyte Bisaya). Thailand: phak bieo (Chiang Rai), phak plaap (central), yaa plong khon (Nakhon Ratchasima). Vietnam: c[or] d[aaf]u r[if]u hoa ch[uf]y, d[aaf]u r[if]u leo.

Origin and geographic distribution *F. scandens* is widely distributed from Nepal, India and Sri Lanka, through Burma (Myanmar), Indo-China, southern China, Thailand and throughout the Malesian region, to northern Australia.

Uses In Peninsular Malaysia the juice of *F. scandens* is squeezed into the eyes to treat sore eyes and ophthalmia. A decoction of whole plants is used internally after childbirth, and the plant is also used externally on broken bones. In India, the juice is also applied to sore eyes.

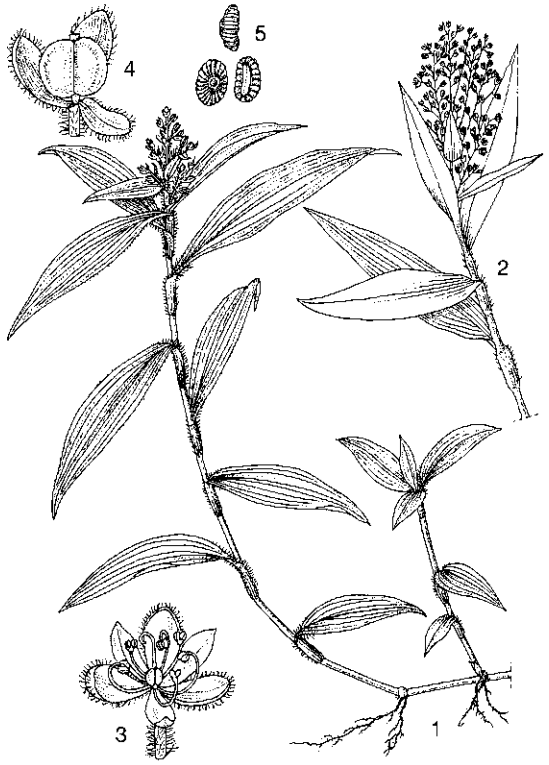
Botany A perennial herb up to 100 cm tall, erect from a creeping base. Leaves arranged spirally, simple and entire, lanceolate, 3–10 cm × 1–3.5 cm, acute, pubescent, with parallel veins, with distinct, pubescent leaf-sheaths at base. Inflorescence a terminal, sometimes axillary cyme 2–10 cm long, dense and many-flowered, with racemiform branches, densely patently glandular-hairy. Flowers bisexual, slightly zygomorphic, 3-merous, small; pedicel 1.5–3 mm long; sepals ovate to oblong, 2.5–3.5 mm long, free, greenish to violet, long glandular-hairy outside; petals slightly longer than sepals, posterior ones oblong, anterior one narrower and lanceolate, free, glabrous, violet; stamens 6, all fertile, slightly unequal; ovary superior, 2-celled, stipitate, style 1, sometimes 2. Fruit an ellipsoid capsule c. 3 mm long, enclosed by the calyx, loculicidally opening with 2 valves, 2-seeded. Seeds oblong-ellipsoid, c. 2 mm long, ribbed.

Floscopa comprises about 20 species and is pantropical. Africa is richest in species. Only the polymorphic *F. scandens* occurs in the Asiatic region.

Ecology *F. scandens* occurs along watersides, in swampy, sunny or shaded localities, up to 1500 m altitude.

Genetic resources *F. scandens* is widespread and common in many regions, and consequently not in danger of genetic erosion.

Prospects As long as data on phytochemistry and pharmacological activity are lacking, the value of *F. scandens* as a medicinal plant cannot be determined. The usage for eye diseases deserves particular attention in research.



Floscopa scandens Lour. – 1, plant habit; 2, top of flowering stem; 3, flower; 4, fruit; 5, seeds in different views.

Literature 62, 121.

Other selected sources 760.

Umi Kalsom Yusuf

Friesodielsia v. Steenis

Bull. Bot. Gard. Buitenzorg III, 17: 458 (1948).
ANNONACEAE
$x = 8$

Origin and geographic distribution *Friesodielsia* comprises approximately 50 species and occurs in tropical Africa and Asia. The number of species and the exact distribution in South-East Asia are not known, but about 12 species have been recorded for Peninsular Malaysia, 2 for Java and about 13 for the Philippines. Sumatra and Borneo are also rich in species.

Uses *Friesodielsia* is occasionally used in tradi-

tional medicine: a decoction of roots and/or stems after childbirth, as a sedative, uterine tonic and emmenagogue. The fruits of *F. biglandulosa* (Blume) v. Steenis are edible.

Properties There is very little information on the properties of Asiatic *Friesodielsia* species, but there is some more information on West African species. The hexahydroxanthenic derivatives oxymitrone and 9α-O-methyloxymitrone have been isolated from the stem bark of *F. kingii* (J. Sinclair) v. Steenis from Peninsular Malaysia, together with the flavanone demethoxymatteucinol. Also isoquinoline alkaloids, mainly of the aporphine and protoberberine type, have been isolated. From a petroleum extract of the stem bark of the West African *F. enghiana* (Diels) Verdc. 2 bisabolene sesquiterpenes and 9 flavonoids were isolated, and from a petroleum extract of twigs of *F. velutina* (Sprague & Hutch.) v. Steenis (also from West Africa) 12 alkaloids, some flavonoids and phenylpropanoids. Amongst the alkaloids from the latter species were lysicamine, which was active against *Bacillus subtilis*, *Botrytis cinerea* and *Saprolegnia asterophora*, and atherosperminine, which was also active against these organisms and *Rhizoctonia solani*. Furthermore, atherosperminine, which is also known to occur in other *Annonaceae* such as *Fissistigma*, has several additional pharmacologically interesting properties, e.g. inhibition of platelet aggregation and vasorelaxing activity.

Botany Lianas or scandent shrubs with simple hairs. Leaves alternate, distichous, simple and entire; stipules absent. Flowers solitary, leaf-opposed or supra-axillary, bisexual, regular; sepals 3, valvate, more or less connate at base; petals 6, in 2 whorls, inner ones much shorter than outer ones, valvate, cohering; stamens numerous, spirally arranged, connective with a truncate dilated apex; carpels numerous, oblong to cylindrical, pubescent. Fruit consisting of numerous free stipitate, indehiscent monocarps, 1(–2)-seeded.

In older literature, the species are treated under the name *Oxymitra*. However, an older genus name *Oxymitra* exists for a group of *Hepaticae* (liverworts). *Friesodielsia* has been subdivided into 3 subgenera: subgenus *Friesodielsia* (Africa and Asia), subgenus *Amblymitra* (Africa) and subgenus *Oxymitropsis* (Africa). Probably, these subgenera merit genus status, and perhaps even the African and Asiatic species from the subgenus *Friesodielsia* can be distinguished on genus level: African species with 1–5-articled fruits, flowers comparatively wider, outer petals slightly longer than inner ones; Asiatic species with 1(–2)-articled fruits, flowers comparatively longer, outer petals much longer than inner ones.

Ecology Most *Friesodielsia* species occur in lowland forest, also at the edges of the forest. However, very little is known about the ecological requirements.

Genetic resources Very little is known about the distribution patterns of the species. However, several species apparently have limited areas of distribution and might become easily endangered because of habitat destruction.

Prospects *Friesodielsia* is badly in need of a taxonomic revision. Once its species are better known botanically, research on phytochemistry and pharmacological activity can be linked with specific species, and this might give interesting results, as has been the case in other *Annonaceae* genera.

Literature 3, 246, 784.

Selection of species

Friesodielsia bakeri (Merr.) v. Steenis

Blumea 12(2): 358 (1964).

Synonyms *Oxymitra bakeri* Merr. (1915).

Vernacular names Philippines: lagdangangbibit (Tagalog), uisiuis (Negrito).

Distribution The Philippines (Luzon).

Uses A decoction of the roots and stems is used as a uterine tonic and emmenagogue.

Observations A scandent shrub; leaves narrowly lanceolate, 15–28 cm × 1.5–5 cm, petiole 2–3 mm long; flowers with outer petals 12–13.5 cm long and inner petals 2–2.5 cm long; monocarp ellipsoid, c. 8 mm long, smooth. *F. bakeri* occurs in damp lowland forest.

Selected sources 619, 760.

Friesodielsia latifolia (Hook.f. & Thomson) v. Steenis

Blumea 12(2): 360 (1964).

Synonyms *Oxymitra latifolia* Hook.f. & Thomson (1855).

Vernacular names Malaysia: lengkian, larak kuching (Peninsular).

Distribution Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia, a decoction of the root is used after childbirth and as a sedative.

Observations A liana up to 20 m long; leaves oblong-ovate to obovate, 17–28 cm × 6–12 cm, petiole 12–15 mm long; flowers with outer petals 2.5–4 cm long and inner petals 2–2.5 cm long; monocarp

oblong-ovoid, c. 15 mm long, slightly pubescent and granular. *F. latifolia* occurs in lowland forest and is locally not uncommon, but it seldom flowers.

Selected sources 121, 860.

R.H.M.J. Lemmens

Galbulimima belgraveana (F. v. Mueller) Sprague

Journ. Bot., London 60: 138 (1922).

HIMANTANDRACEAE

$2n = 24$

Synonyms *Himantandra belgraveana* (F. v. Mueller) F. v. Mueller ex Diels (1912).

Vernacular names White magnolia (En). Papua New Guinea: agara (Fore, Eastern Highlands), waga (Aseki, Morobe), alusa (Oksapmin, West Sepik).

Origin and geographic distribution *G. belgraveana* occurs from the Moluccas and New Guinea to the Solomon Islands and northern Australia (Queensland).

Uses In Papua New Guinea the bark of *G. belgraveana* is used as an analgesic. It is chewed and the resulting sap mixed with salt is swallowed as a cure for abdominal and other body pains. The bark mixed with wild ginger (*Zingiber* sp.) is used to treat fever. A mixture of *G. belgraveana* bark, tobacco leaves and *Zingiber officinale* Roscoe rhizome is applied to get rid of head lice. *G. belgraveana* is better known for its psychoactive effects. The bark, sometimes together with leaves of a *Homalomena* species, is chewed, or a decoction drunk, to induce visions and a dream-like state, which are associated with tremor and miosis, lasting for about one hour followed by a sense of calmness, euphoria and then drowsiness. Bark and leaves of *G. belgraveana*, masticated and rubbed on the legs, are supposed to make men fierce.

The timber is suitable for light construction, moulding and interior work.

Properties *G. belgraveana* bark has a resinous smell and a bitter taste. It contains lignans, sesquiterpenes and alkaloids. Research has focused on the alkaloids; significant variation in alkaloid content and composition of the bark has been observed and numerous alkaloids have been isolated. (+)-Himbacine, a piperidine alkaloid with a tetracyclic lactone structure, present in *G. belgraveana*, showed strong spasmolytic activity on isolated guinea-pig ileum. It induced a specific atropine-like blockade of acetylcholine receptors and additionally a non-specific papaverine-like spasmolytic action against histamine and barium chloride. Other studies revealed its cardioselective antimuscarinic activity, and (+)-himbacine is therefore widely used as a pharmacological tool involving heterogeneity of muscarinic receptors (as a selective M_2 subtype antagonist). It showed antihypertensive activity. Animal-model tests revealed (+)-himbacine to be effective in preventing the development of myopia in chicken eyes.

Botany An evergreen, aromatic, small to fairly large tree up to 40 m tall; bole up to 100 cm in diameter, sometimes with buttresses up to 3 m high and 1 m wide; bark surface fissured and ridged, or pustular, with a resinous smell. Leaves alternate, simple, elliptical to ovate, (5–)6–16 cm × (2–)3–8 cm, entire, scaly below; petiole 1–2.5 cm long; stipules absent. Flowers on short axillary shoots, usually solitary, shoots with 2(–3) bracts, bisexual; calyx calyptrate with the upper part deciduous; corolla calyptrate; sporophylls (stamens) numerous, arranged spirally along the elongated receptacle, narrowly lanceolate, those towards the apex

Galbulimima belgraveana (F. v. Mueller) Sprague – 1, twig with flowerbuds; 2, flowering twig; 3, fruit.

and base sterile; carpels many, initially free, later connate, style plumose. Fruit a fleshy syncarp, subglobose, 1.5–3 cm in diameter, pink or red, with cartilaginous endocarp.

Galbulimima is the only genus of *Himantandraceae*, a primitive family closely related to *Annonaceae* and *Eupomatiaceae*. The only Malesian species is *G. belgraveana*. *G. baccata* F.M. Bailey, closely related to, and sometimes considered conspecific with *G. belgraveana*, occurs in Queensland (Australia).

Ecology *G. belgraveana* is widespread and locally common in primary rain forest on hill slopes and ridges up to 2700 m altitude, but mostly found at 1000–2000 m in montane forest in association with *Nothofagus* or other *Fagaceae*.

Genetic resources There is little risk of genetic erosion of *G. belgraveana* at present, since it is widespread and locally common.

Prospects (+)-Himbacine is considered a useful pharmacological tool for the further understanding of the muscarinic receptor, and therefore of interest in the design of new drugs. It may have clinical potential in sinus bradycardia, where atropine (exhibiting side-effects due to its non-selective nature) is being currently used. (+)-Himbacine is also a lead compound in the search for drugs to treat Alzheimer's disease and to reduce intraocular pressure. The hallucinogenic activity of *G. belgraveana* bark deserves more attention.

Literature 180, 280, 348, 883, 928, 1004.

Other selected sources 279, 347, 595, 909, 954.

B. Thomas

Galearia Zoll. & Moritzi

Moritzi, Syst. Verz.: 19 (1846).

PANDACEAE

x = unknown

Origin and geographic distribution *Galearia* comprises 6 species and occurs in tropical Asia from Burma (Myanmar), Indo-China and Thailand to the whole Malesian region (except the Lesser Sunda Islands and the Moluccas) and the Solomon Islands.

Uses A few medicinal applications of *Galearia* have been recorded for South-East Asia: the treatment of stomach-ache with leaves and bark in combination with other plants, and of gonorrhoea with the roots. The wood is sometimes used for implements, and *Galearia* is occasionally planted in hedges.

Properties The presence of alkaloids has been recorded for *G. filiformis* bark. The bark of *G. filiformis* showed antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli* and *Saccharomyces cerevisiae*.

Botany Dioecious shrubs or small to medium-sized trees. Leaves alternate, distichous, on short shoots, with buds only in the axils of leafy shoots, simple, slightly oblique at base, entire or crenulate towards the apex, shortly petiolate; stipules arising at different levels, mostly elongate and narrow, caducous. Inflorescence a terminal or sometimes cauliflorous spike with flowers in cymose fascicles or solitary. Flowers small, unisexual, regular, 5-merous; calyx often cup-shaped, toothed; petals larger than calyx, valvate, often hooded; male flowers with 10(–15) stamens, usually in 2 whorls and unequal but sometimes in 1 whorl and equal, and a usually hairy pistillode; female flowers with superior, 2–5-celled ovary and sessile, variously lobed stigmas. Fruit a transversely elongate or subglobose drupe, with few, often sculptured stones. Seeds transversely oblong or broadly cuneate, compressed.

Galearia is often included in the family *Euphorbiaceae*, but it is nowadays fairly generally accepted that it constitutes, together with *Centroplacus*, *Microdesmis* and *Panda*, a separate family *Pandaceae*.

Ecology Usually *Galearia* occurs in lowland rain forest, often in primary forest, but *G. filiformis* and *G. fulva* can also be found in secondary forest and sometimes even brushwood.

Genetic resources *Galearia* is not much collected for medicinal or other purposes and does not seem at risk of genetic erosion, but the habitat preference of several species, i.e. lowland primary forest, may bring them into danger as a result of the ongoing forest logging.

Prospects The applications of *Galearia* in local medicine seem to be very limited, and there is no reason to expect an increase.

Literature 121, 252, 296.

Selection of species

Galearia filiformis (Blume) Boerl.

Handl. fl. Ned. Ind. 3: 282 (1900).

Vernacular names Indonesia: ki tako (Sundanese), balung kayu (Javanese), kayu tulang (Sumatra), sipupaipai (Siberut).

Distribution Sumatra and Java.

Uses In Sumatra (Siberut) the bark and leaves

are used in a mixture with other medicinal plants to treat stomach-ache. In Java *G. filiformis* is planted in hedges, and the wood is used to prepare implements such as rice-pounders.

Observations A tall shrub or small tree up to 12 m tall, with bole up to 20 cm in diameter; leaves oblong-lanceolate to subovate, 6.5–24 cm × 2–11 cm, without distinct scalariform tertiary veins; male flowers with deeply concave petals and crowded stamens having short, thick filaments. *G. filiformis* occurs in mixed forest and brushwood up to 700 m altitude.

Selected sources 58, 62, 252, 296, 334.

Galearia fulva (Tul.) Miq.

Fl. Ned. Ind. 1(2): 430 (1859).

Synonyms *Galearia affinis* (R.Br.) Miq. (1859), *Galearia philippinensis* Merr. (1915), *Galearia ridleyi* Gage (1922).

Vernacular names Malaysia: ekur tupai, akar penurun lotong, akar penurun tupai (Peninsular). Thailand: mieo (Trang), lin khwaai (Songkhla), taek naa (Surat Thani). Vietnam: c[as]nh b[ooj]ng.

Distribution Burma (Myanmar), Cambodia, Vietnam, Thailand, Peninsular Malaysia, Singapore, Sumatra, Borneo and the Philippines.

Uses In Peninsular Malaysia, a decoction of the roots is used to treat gonorrhoea.

Observations A shrub or small tree, often straggling, up to 8 m tall; leaves elliptical to elliptical-obovate, 9–23 cm × 3–11 cm, with distinct scalariform tertiary veins; male flowers with slightly concave petals and separated stamens having narrowly elongate filaments. *G. fulva* is variable and occurs in primary and secondary lowland forest, up to 750(–1200) m altitude.

Selected sources 121, 252, 990.

Fitmawati

Gardenia pseudopsidium (Blanco) Fern.-Vill.

Nov. app.: 109 (1880).

RUBIACEAE

$2n$ = unknown

Vernacular names Philippines: malabayabas, sulipa (Tagalog), kalanigi (Panay Bisaya).

Origin and geographic distribution *G. pseudopsidium* occurs in many parts of the Philippines.

Uses The fruits of *G. pseudopsidium* are used to treat smallpox.

G. jasminoides Ellis is much more commonly used in traditional medicine: the roots to treat headache, dyspepsia, nervous disorders and fever, bark to treat dysentery, leaves in febrifugous poultices and to treat sore eyes, flowers as emollient, and fruits to treat jaundice, dysentery, and diseases of kidneys and lungs. However, its main uses are as a dye, the fruits being used to colour food and occasionally textiles yellow, and as an ornamental.

In Thailand seeds of *G. sootepensis* Hutch. are boiled with water and the solution is used as a shampoo to kill lice.

Several *Gardenia* species are used in traditional medicine in Africa, e.g. to treat fever, smallpox, leprosy, sleeping sickness, ophthalmia, after childbirth and as an aphrodisiac.

Several species are beautiful ornamentals, which flower profusely. *Gardenia* wood is sometimes used for turnery, carving and implements. The fruits of some species are edible.

Properties There is no information on phytochemistry or pharmacological properties of *G. pseudopsidium*. However, much research has been done on the pharmacology of *G. jasminoides*. The iridoid glycoside geniposide is one of the constituents of its fruits; in mice it showed an antithrombotic effect in vivo due to the suppression of platelet aggregation, and has the ability to inhibit P4503A monooxygenase and increase glutathione content in rat liver, supporting its use in traditional Chinese medicine for the treatment of hepatic and inflammatory diseases. It also showed anti-inflammatory effects when used for treating soft tissue injuries in animals. Geniposide orally administered to rats is transformed in the intestine to genipin, which acts as a genuine choleretic. However, at a high oral dose of 2000 mg/kg geniposide showed hepatotoxic activity in rats. Another iridoid glycoside, deacetylasperulosidic acid methyl ester, also isolated from *G. jasminoides* fruits, lowered the blood glucose level in normal mice.

Crocetin is a major component of *G. jasminoides* fruits. This carotenoid pigment is the basis for the dye prepared from the fruits. In tests with mice, it suppressed 12-O-tetradecanoylphorbol-13-acetate-promoted skin carcinogenesis, possibly via its antioxidant activity. Crocetin also showed inhibitory effect on benzo(a)pyrene-induced genotoxicity and neoplastic transformation in C3H10T1/2 cells, and it protected against oxidative damage in rat primary hepatocytes.

Gardenic acid and gardenodic acid isolated from *G. jasminoides* fruits may be used as early pregnancy-terminating agents. The lipoxygenase in-

hibitor 3-caffeoyl-4-sinapoylquinic acid was isolated from the fruit.

Botany A small tree. Leaves opposite, simple and entire, crowded at the ends of branchlets, obovate-oblong, 11–22 cm × 4–10 cm, cuneate at base, acuminate at apex, shortly petioled; stipules entire and connate. Flowers solitary in leaf axils, bisexual, usually 5-merous, fragrant; calyx with 5-ridged tube and 10 linear segments alternating longer and shorter; corolla with long tube 5–6 cm long and large lobes, white but turning yellow; stamens inserted just below the corolla throat, alternating with corolla lobes, anthers sessile; ovary inferior, 1-celled, style clavate. Fruit an ovoid to subglobose berry 5–7 cm long, with obscure longitudinal ridges, crowned by the calyx segments, many-seeded.
Gardenia comprises about 120 species and occurs in Africa, tropical and subtropical Asia, northern Australia and islands of the Pacific. About 10 species occur within the Malesian region. There is no taxonomic study of the genus for South-East Asia, and the status of *G. pseudopsidium* is unclear. It is considered to be closely allied to *G. carinata* Wallich ex Roxb. from Thailand and Peninsular Malaysia, and should be compared with this and other species.

Ecology *G. pseudopsidium* occurs in lowland primary forest.

Genetic resources *G. pseudopsidium* is restricted to a type of habitat, i.e. lowland primary forest, which is under much pressure in the Philippines. It may be liable to genetic erosion.

Prospects It is still unclear whether *Gardenia* species such as *G. pseudopsidium* have similar activities as *G. jasminoides*, but more research may be worthwhile. *G. jasminoides* exhibits very interesting pharmacological properties, and it certainly has promising prospects as a medicinal plant of wider use in South-East Asia.

Literature 117, 621, 760.

Other selected sources 27, 120, 173, 200, 377, 447, 542, 632, 725, 883, 905, 1027.

R.H.M.J. Lemmens

Gentiana quadrifaria Blume

Bijdr. fl. Ned. Ind.: 847 (1826).
GENTIANACEAE
$2n$ = unknown

Synonyms *Gentiana laxicaulis* Zoll. (1845).

Vernacular names Indonesia: jukut cengcang (Sundanese), angkeb, sirawan bumi (Javanese).

Origin and geographic distribution *G. quadrifaria* occurs in Java, where it can be found in the mountains throughout the island. It has also been reported from Sri Lanka, India and Vietnam, but it is possible that it has been confused with related species (or subspecies).

Uses In Indonesia, *G. quadrifaria* is used to treat dysentery.
Gentiana species are used as medicinal plants in various parts of the world. The root of *G. lutea* L. was already used in the treatment of gastro-intestinal tract diseases in Europe thousands of years ago, but it is nowadays better known for its root extracts used in the production of liquors. *G. scabra* Bunge is an important medicinal plant in China and Korea, used e.g. for the treatment of peripheral circulatory disorders, diabetic complications and in mixtures with other medicinal plants to treat various viral diseases. Roots of *G. scabra* are imported in Vietnam, and prescribed there against e.g. chills, fever, jaundice, sore throat, ophthalmia and haematuria. *G. loureiroi* (G. Don) Griseb. is used in traditional medicine in Vietnam to treat pimples, dysentery and inflammation of the liver.

Properties *G. quadrifaria* tastes very bitter. Bitter-tasting secoiridoids are commonly present in *Gentiana*, e.g. gentiopicroside, amarogentin and esters of sweroside and swertiamarin. These are usually considered the active principles, and are probably also present in *G. quadrifaria*. Xanthones (e.g. gentisin, isogentisin and gentiin) are also commonly present throughout the genus. A methanol extract of *G. scabra* showed a potent antagonistic activity against anti-platelet activating factor in tests with mice; 2-hydroxy-3-methoxybenzoic acid glucose ester was isolated as the active compound. *G. scabra* also showed inhibitory effect of aldose reductase from rat lens. Butanol and chloroform root extracts showed antihepatotoxic activity against carbon tetrachloride at a dose of 670 mg/kg. A water extract of the root of the Chinese *G. macrophylla* Pallas showed activity on the central nervous system. Gentiopicroside, a main bitter secoiridoid constituent isolated from its roots, suppressed chemically and immunologically induced hepatic injuries in mice. In China, systemic lupus erythematosus was successfully treated with *G. macrophylla* complex tablets and a minimal dose of prednisone, and showed very significant statistical difference with a control group treated with prednisone alone. Flavones with antiplatelet and vasorelaxing properties have been isolated from *G. arisanensis* Hayata from Taiwan. Compounds with antifungal and an-

tioxidant activities have also been isolated from Chinese *Gentiana* species.

Botany A small annual herb up to 20 cm tall, usually branching from the base, with a long taproot. Leaves opposite, simple and entire, ovate to elliptical or obovate, 2–10 mm × 1–6 mm, with a recurved mucro at apex, very shortly ciliate at base, often reddish tinged; petiole short and broad, pairwise connate; stipules absent. Flowers terminal, solitary, sessile or shortly pedicelled, (4–)5-merous; calyx 6–8 mm long, divided to about halfway, segments very acute, keeled; corolla tubular-campanulate, 8–10 mm long, lobes caudately acuminate, alternating with induplicate, entire membranes, dark blue, rarely violet; stamens inserted below the middle of the corolla tube, included; ovary 1-celled, style short, with 2 stigmas. Fruit a capsule borne on a rather long, thick stalk, 2-valvate at top, straw-coloured, many-seeded, usually enclosed by withered corolla. Seeds c. 1 mm long.

The plants remain small and compact in sunny localities, but in shaded localities they grow to a much greater height and are far less compact. *G. quadrifaria* can be found flowering in Java throughout the year. The flowers expand only in very bright weather, last 3 days, and are reportedly protandrous and self-pollinated.

Gentiana quadrifaria Blume – 1, habit of plant from exposed locality; 2, habit of plant from shaded locality.

Gentiana comprises approximately 360 species and occurs in Europe, northern Africa (Morocco), America, Asia and eastern Australia. China is richest, with about 250 species. South-East Asia is poor in species: about 10 in Indo-China, Thailand and Malesia each, 2 of which in Java and about 4 in the Philippines.

Ecology *G. quadrifaria* occurs on grassland, roadsides and open locations in the forest, often in very sterile and exposed places, at altitudes of 1600–3300 m. It is locally common, and has reportedly increased in number because of the deforestation in the mountains of Java. Many *Gentiana* species are confined to higher altitudes, and are characteristic for mountain vegetations above the treeline, where they are often very conspicuous because of their brightly coloured flowers.

Management Plant regeneration and multiplication by tissue culture have been practised successfully for *G. scabra* in Korea and *G. lutea* in Europe. Regenerated plants synthesized biologically active secoiridoids and hence may be of pharmaceutical and economic significance.

Genetic resources The exact distribution of *G. quadrifaria* is still unknown and should be investigated; the reputed populations in India, Sri Lanka and Vietnam should be compared with those of Java. In Java, it does not seem to be endangered.

Prospects *G. quadrifaria* might be a promising medicinal plant in Indonesia. Probably it contains secoiridoids such as gentiopicroside, which have beneficial effects e.g. on the gastro-intestinal tract. If research shows promising results, propagation and cultivation methods should be developed, or methods for sustainable harvesting from the wild, which might be easy for a species with such a short life cycle.

Literature 62, 334, 952.

Other selected sources 64, 382, 500, 558, 671, 1045, 1047.

R.H.M.J. Lemmens

Geophila repens (L.) I.M. Johnst.

Sargentia 8: 281 (1949).

RUBIACEAE

$2n = 44$

Synonyms *Geophila reniformis* D. Don (1825), *Geophila herbacea* (Jacq.) O. Kuntze (1891), *Carinta repens* (L.) L.B. Sm. & Downs (1956).

Vernacular names Malaysia: pegaga ular, pegaga tikus, pantat berok (Peninsular). Thailand: mali din (Trat), uttaphit nam (peninsular).

Origin and geographic distribution *G. repens* occurs throughout the tropics of Africa, Madagascar, South and Central America, Asia and Micronesia. It is found in the whole of South-East Asia.

Uses In Peninsular Malaysia, the plant is used externally for poulticing sore legs, and internally to treat diarrhoea. In Thailand, a decoction of the whole plant is considered diuretic and febrifugal. In Africa, leaves are eaten as a vegetable by barren women suffering from abdominal troubles and anaemia, and by convalescents to restore vigour and fecundity; it is also used in a bath to cure infants with fever, and to treat inflamed eyes. In Paraguay *G. repens* is used in traditional medicine for the treatment of skin diseases.

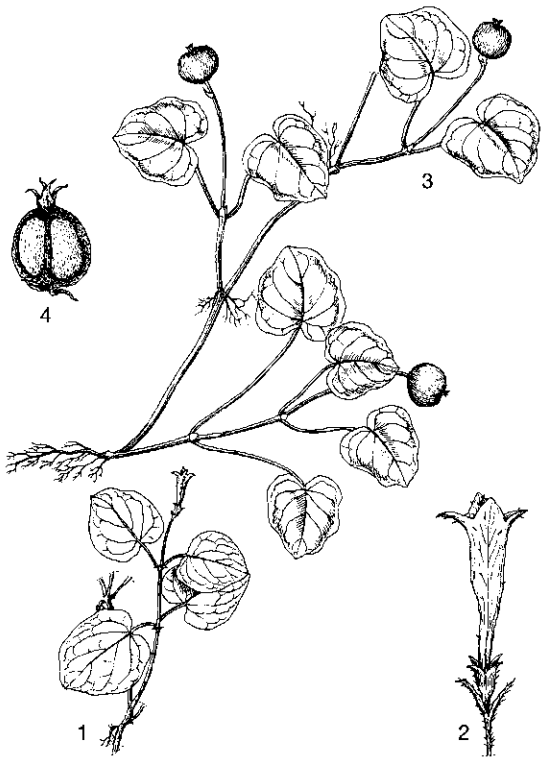
Other *Geophila* species are also used medicinally in Africa, externally to treat wounds, arthritis, headache, toothache and sore eyes, and internally to treat stomach-ache, earache, tachycardia, female sterility and diarrhoea.

Properties A dichloromethane extract of *G. repens* from Paraguay showed in-vitro antifungal activity in an agar disk diffusion assay. There is no information on the phytochemistry of *G. repens*. Alkaloids, however, are present in the African *G. obvallata* (Schumach.) Didr.

Botany A small creeping perennial herb, with papillose stems up to 50 cm long, profusely rooting. Leaves opposite, cordate-orbicular or cordate-reniform, 2–4.5 cm × 1.5–4.5 cm, usually glabrous, palmately 7–9-veined, markedly pale below; petiole 1–9 cm long, densely papillose; stipules interpetiolar, transversely elliptical. Inflorescence a terminal few-flowered umbel (flowers often solitary); peduncle up to 4 cm long, papillose-pubescent. Flowers bisexual, (4–)5(–7)-merous; calyx deeply divided, lobes 3–4 mm long; corolla tubular-infundibuliform, with tube 8–11 mm long and lobes 5–8 mm long, white, soon caducous; stamens inserted in corolla tube, filaments minute; ovary inferior, 2-celled, crowned by a thick disk, style 2-branched. Fruit a globose or broadly ellipsoid drupe c. 8 mm in diameter, red, sometimes orange when ripe; pyrenes 2, plano-convex.

Geophila comprises about 20 species, 10 of which are neotropical and 7 African. In tropical Asia 3–4 species occur. The genus belongs to the large tribe *Psychotrieae*, together with e.g. *Psychotria*.

G. repens is a variable species and it has been proposed that it be divided into 2 subspecies, one in Africa and Asia and the other in America, mainly based on the shape of the pyrenes (straight in Africa and Asia, and twisted in America). Recent evidence from morphological and palynological studies points to a specific status for the American populations.



Geophila repens (L.) I.M. Johnst. – 1, habit of flowering plant; 2, flower; 3, habit of fruiting plant; 4, dried fruit.

Ecology *G. repens* occurs in lowland forest, in not too dry localities, usually below 1000 m, but sometimes up to 1600 m altitude (e.g. in Java).

Genetic resources *G. repens* has an extremely large area of distribution and is not in danger of genetic erosion.

Prospects The fact that *G. repens* is used in traditional medicine in remote regions of the world, often for similar complaints, warrants research on phytochemistry and pharmacological properties, which has not been done up to now. A taxonomic study of *Geophila* worldwide is also desirable, in particular of the *G. repens* complex.

Literature 121, 173, 748.

Other selected sources 62, 120, 544, 750.

R.H.M.J. Lemmens

Geunsia pentandra (Roxb.) Merr.

Philipp. Journ. Sci., Bot. 11: 309 (1916).
VERBENACEAE
$2n$ = unknown

Synonyms *Callicarpa pentandra* Roxb. (1820), *Geunsia farinosa* Blume (1826).

Vernacular names Malaysia: tampang besi, ambong (Peninsular), tambong (Sabah). Philippines: layaupan (Bagobo).

Origin and geographic distribution *G. pentandra* is widely distributed in India, Peninsular Malaysia, Singapore, Sumatra, Java, Borneo, the Philippines, Sulawesi, the Moluccas, New Guinea and the Solomon Islands.

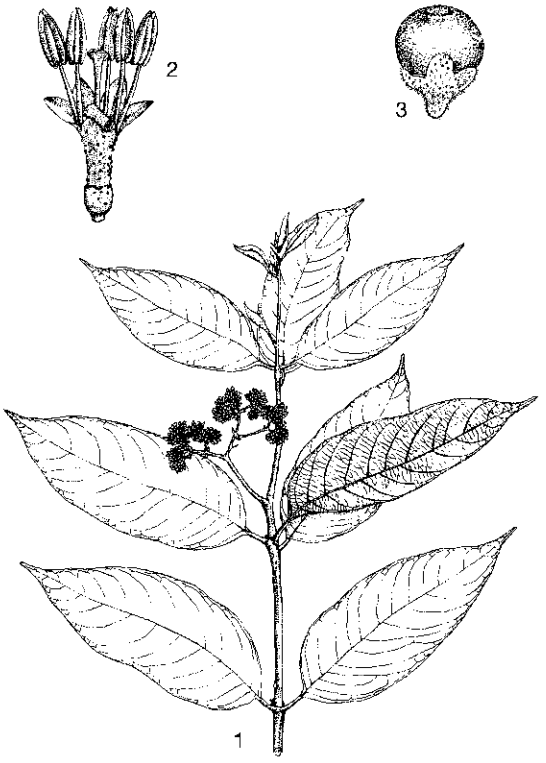
Uses In Peninsular Malaysia, *G. pentandra* is used to treat vertigo. In Sumatra ground root bark has been applied against swellings. In Borneo (Kalimantan) *G. pentandra* is used to treat toothache. The white and lightweight wood is sometimes used, e.g. for rafters.

Properties There is no information on the pharmacological properties of *G. pentandra*. Methyl salicylate, carosolic acid, ursolic acid, diterpenes, pentandralactone and pentandranoic acids A–C have been isolated from *G. pentandra*.

Botany An erect shrub to small or medium-sized tree up to 25 m tall, with bole up to 50 cm in diameter, buttressed; twigs with stellate-mealy indumentum. Leaves partly opposite, partly solitary, simple, ovate to oblong-ovate or oblong-elliptical, 9–30 cm × 3–12 cm, cuneate to rounded at base, acuminate to caudate at apex, margin entire, leathery, stellate-hairy and gland-dotted below, prominently pinnately veined; petiole 1–5 cm long; stipules absent. Inflorescence an axillary cyme on a 2–10 cm long peduncle, whitish to brownish stellate-tomentose, many-flowered. Flowers bisexual, regular, usually 5-merous, very shortly pedicelled; calyx shortly campanulate, c. 2 mm long; corolla with c. 5 mm long tube and c. 2 mm long lobes, white to greenish, pink or purple; stamens inserted on the base of the corolla tube, exserted; ovary superior, usually imperfectly 5-celled, style exserted, stigma broad. Fruit a depressed-globose drupe 4–6 mm in diameter, red to black when mature, usually breaking up into 10 1-celled pyrenes.

G. pentandra is a fast-growing tree that may be common in logged-over forest, e.g. in Borneo, where it has a life cycle of about 15 years with a maximum bole diameter of 50 cm.

Geunsia comprises about 20 species and is restricted to tropical Asia. It is related to *Callicarpa* and sometimes even included in this latter genus, which differs in its usually 4-merous flowers. *Geunsia* is still poorly known botanically, and it is unclear whether *G. pentandra* and *G. farinosa* represent different species or should be considered synonymous as accepted here. When they differ specifically, it is not always clear to which species the information on medicinal uses refers.



Geunsia pentandra (Roxb.) Merr. – 1, flowering branch; 2, flower; 3, fruit.

Ecology *G. pentandra* occurs in mixed forest, primary as well as secondary forest, often in edges and along roads, also in brushwood up to 2000 m altitude. It is locally common.

Genetic resources *G. pentandra* is widely distributed, often occurs in secondary forest, and is not in danger of genetic erosion.

Prospects Applications of *G. pentandra* in traditional medicine are known for several regions in Malesia: Peninsular Malaysia, Sumatra and Borneo. It would therefore seem worthwhile studying the phytochemistry and pharmacological properties, also in the light of the close affinity to *Callicarpa* species, which are well known as medicinal plants in South-East Asia and have several interesting pharmacological properties.

Literature 121, 642.
Other selected sources 62, 331, 460, 789, 990, 1014.

R.H.M.J. Lemmens

Globba L.

Mant. pl. 2: 170 (1771).
ZINGIBERACEAE
$x = 8$; *G. atrosanguinea*: $2n = 48$, *G. patens*: $2n = 32, 48$, *G. pendula*: $2n = 32, 48$, *G. variabilis*: $2n = 32, 48$

Origin and geographic distribution *Globba* comprises about 100 species. The region from the eastern Himalayas through Burma (Myanmar) to Indo-China and Thailand is richest in species. Many species are local endemics, but some are widespread, e.g. *G. pendula*. *G. marantina* L. is widely cultivated as a spice.

Uses The rhizome and sometimes the leaves of several *Globba* species are used in traditional medicine in South-East Asia, often as a protective medicine after childbirth and externally to treat sores and rheumatism.
In the Nicobar and Andaman Islands, *G. pauciflora* Baker is used to treat asthma.
The somewhat spicy bulbils of *G. marantina* are eaten; they stimulate the appetite. Several *Globba* species have ornamental value, having inflorescences with dark red bracts contrasting with yellow-orange flowers.

Properties There is only very little information on the phytochemistry and pharmacological activities of *Globba*. Flavonoids such as cyanidin, quercetin and rutin have been isolated from *G. patens* leaves. An ethanol-water (1:1) extract of dried rhizomes was screened for antihistamine, antipyretic, antispasmodic and hypotensive activities, but all tests gave a negative result.

Botany Small to medium-sized herbs with short, creeping rhizome and tuberous roots. Leaves distichously alternate, simple and entire, usually lanceolate to elliptical, cuneate at base, acuminate at apex, subsessile, with ligule at base. Inflorescence a terminal panicle consisting of cincinni subtended by bracts; peduncle with sterile bracts, these often with axillary bulbils. Flowers bisexual, zygomorphic, 3-merous, each flower subtended by a bracteole; calyx turbinate to campanulate, lobed to dentate; corolla with long, slender tube, lobes unequal, one larger than the other 2 and hooded (labellum); functional stamen 1, long-exserted, arched, filament connate to the labellum at base, anther often with lateral appendages, staminodes 2, petaloid; ovary inferior, 1-celled, style long-exserted, arched, placed in a furrow of the filament, stigma appearing on top of the anther. Fruit a usually globose capsule, dehiscent by 3 valves, many-seeded. Seeds with lacerate aril. Seedling with hypogeal germination.
Globba belongs to the tribe *Globbeae*, together with 3 small Asiatic genera, all characterized by the long-exserted, arched stamen and style and 1-celled ovary with parietal placentation.

Ecology *Globba* is most commonly found in shaded, humid localities in lowland rain forest, often along streams. Some species are less discriminating, e.g. *G. pendula* which can be found in secondary forest or sometimes even grassland, and *G. marantina* which favours open, dry habitats.

Management *Globba* can be propagated by division, or by removing bulbils produced in the lower bract axils of the inflorescence. *G. winitii* C.H. Wright, cultivated as an ornamental on a large scale in Thailand, is propagated by in-vitro tissue culture. Cut flowers are sometimes collected from *Globba* populations in the wild, e.g. in Thailand.

Genetic resources The many *Globba* species that are local endemics are liable to genetic erosion, also because they often prefer lowland rain forest, a type of habitat under much pressure in mainland South-East Asia, which is the centre of diversity.

Prospects There is no information on the phytochemistry or pharmacological properties of *Globba*. Research is desirable to judge its prospects as a medicinal plant of more wider use, because many other *Zingiberaceae* are important in traditional medicine. It is expected that its value as an ornamental will further increase.

Literature 121, 334, 550.

Selection of species

Globba atrosanguinea Teijsm. & Binnend.

Natuur. Tijdschr. Ned. Ind. 27: 22 (1864).

Vernacular names Indonesia: susu perada (Palembang, Sumatra), tubo bala (Kenyah Dayak, Kalimantan).

Distribution Sumatra and Borneo.

Uses In Sumatra a leaf decoction is applied externally to treat fever; it is considered cooling and stimulating. In Borneo the rhizome is wrapped in leaves, baked in coals, and applied as a poultice to sores caused by insects. *G. atrosanguinea* is culti-

vated as an ornamental, being quite spectacular with its brilliant red bracts and yellow-orange flowers.

Observations A herb up to 65 cm tall; leaves acute to acuminate at apex, usually reddish below; inflorescence almost erect, rather compact, with many short cincinni, bracts broad and brilliant red; flowers yellow to orange, sessile, staminodes shorter than lateral corolla lobes, anther with 4 appendages. *G. atrosanguinea* is locally common in lowland forest up to 1000 m altitude, often on wet localities.

Selected sources 334, 534, 551, 875.

Globba patens Miq.

Fl. Ned. Ind. Suppl.: 613 (1861).

Synonyms *Globba aurantiaca* auct. non Miq.

Vernacular names Malaysia: puar gembur, tepus hutan bukit, meroyan berok (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia a draught or lotion of a decoction of the rhizome or whole plant is used as a protective medicine after childbirth.

Observations A herb up to 50 cm tall; leafy shoot with up to 5 leaves; leaves with abruptly acuminate apex, usually hairy below; inflorescence almost erect, compact, with numerous, very short cincinni; flowers orange, pedicel 4–7 mm long, staminodes shorter than to as long as lateral corolla lobes, anther with 4 appendages. *G. patens* is locally common in lowland and lower montane forest up to 1200 m altitude.

Selected sources 121, 550, 551, 789, 994.

Globba pendula Roxb.

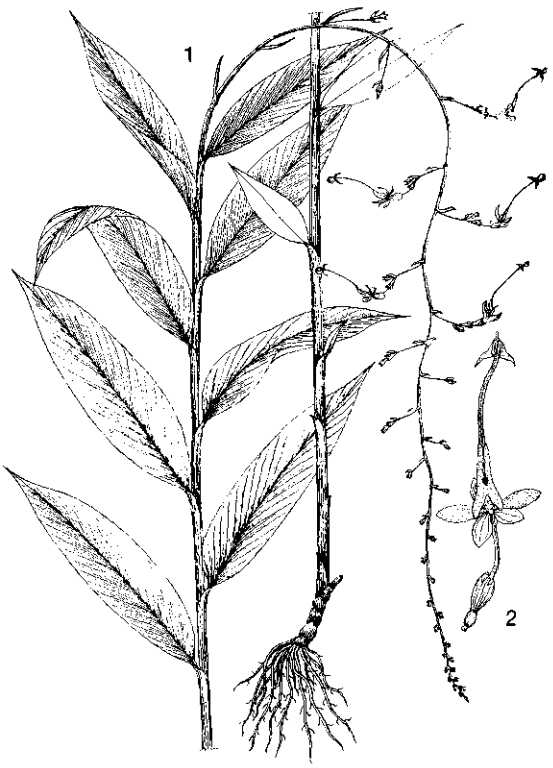
Asiat. Res. 11: 359 (1810); Pl. Coromandel 3: t. 228 (1815).

Synonyms *Globba panicoides* Miq. (1861), *Globba uliginosa* Miq. (1861), *Globba wallichii* Baker (1890).

Vernacular names Indonesia: pedas kancil (Palembang, Sumatra), jae kera (Bangka). Malaysia: meroyan tinggal, halia hutan, puar birah (Peninsular). Vietnam: ng[ar]i m[oj]i.

Distribution Bangladesh, southern Burma (Myanmar), Vietnam, peninsular Thailand, Peninsular Malaysia, Sumatra, Bangka, western Java and Borneo.

Uses In Sumatra the rhizome rubbed in water is administered to women during labour and to treat abdominal complaints. In Bangka the rhizome is used as an anthelmintic. In Peninsular Malaysia a poultice of the boiled rhizome or whole plant is applied as a protective medicine after childbirth and to treat rheumatism, and a decoction of the rhizome to treat gonorrhoea.



Globba pendula Roxb. – 1, habit of flowering plant; 2, flower.

Observations A herb up to 100 cm tall; leafy shoot with up to 13 leaves; leaves with acuminate-caudate apex, with stiff, curved hairs on lateral veins above; inflorescence much elongated, nodding, with rather long cincinni; flowers orange, subsessile, staminodes longer than lateral corolla lobes, anther with 2 appendages. *G. pendula* is locally common in primary as well as secondary, lowland and lower montane forest up to 1200 m altitude.

Selected sources 62, 121, 334, 550, 551, 789, 875.

Globba variabilis Ridley

Trans. Linn. Soc. 3: 378 (1893).

Synonyms *Globba malaccensis* Ridley (1899), *Globba perakensis* Ridley (1899).

Vernacular names Malaysia: puar hudang, puar halia, menderong gajah (Peninsular). Thailand: ta-pu ti-ku, put khon, put nuu (Pattani).

Distribution Peninsular Thailand, Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia a lotion of a decoction of the whole plant is used as a protective medicine after childbirth, and bruised leaves are applied to sores.

Observations A herb up to 70 cm tall; leafy shoot with 3–6 leaves; leaves shortly acuminate at apex, usually glabrous; inflorescence erect, compact, with several short cincinni, bracts reddish; flowers yellow to orange, sessile, staminodes about as long as lateral corolla lobes, anther with 2–4 appendages. *G. variabilis* occurs scattered in lowland forest, often on moist locations along streams and near waterfalls.

Selected sources 121, 550, 551, 789.

R.H.M.J. Lemmens

Glochidion J.R. Forster & J.G. Forster

Charact. gen. pl.: pl. 113, t. 57 (1775).

EUPHORBIACEAE

$x = 13$

Origin and geographic distribution *Glochidion* comprises about 280 species, most of which occur in the Old World tropics from India, Sri Lanka and Burma (Myanmar), through Indo-China, southern China, Thailand and throughout the Malesian region, to northern Australia and Polynesia. A few species are found in tropical America and Madagascar. Malesia harbours over 100 species.

Uses In the Malesian region, some *Glochidion* species are used in traditional medicine. The most common uses are of the bark and leaf decoctions in the treatment of alimentary disorders such as stomach-ache, dysentery and diarrhoea, and of bites and stings of animals, and skin problems.

Several non-Malesian *Glochidion* species are used in traditional medicine in tropical Asia. In Vietnam, the leaves of *G. velutinum* Wight are used to treat oedema, kidney troubles and snakebites, and the roots to treat dysentery, fever and cough. The roots and leaves of *G. eriocarpum* Champ. are used against dysentery, rheumatism, itch and eczema. A decoction of the leaves of the latter has been used as a diuretic with good results in nephrotic syndrome and congestive heart failure. In Thailand, the pounded bark of *G. lanceolarium* (Roxb.) Voight mixed in a small amount of water is applied topically as antipruritic. Pounded bark and seeds of *G. calocarpum* Kurz are used internally in the Nicobar Islands for treating any kind of alimentary disorder, e.g. diarrhoea, dysentery and amoebiasis, and externally to treat skin diseases; a leaf decoction is taken orally against fever. In India, several *Glochidion* species are also used in traditional medicine, e.g. *G. multiloculare* (Roxb. ex Willd.) Müll. Arg., which is applied in the treatment of dysentery, stomach disorders and piles.

The wood of several *Glochidion* species is used to build native and temporary houses. It is mainly used for poles and rafters, and for tool handles, sometimes also for light framing, flooring, moulding, interior trim and utility furniture. It is also considered a good fuelwood, and the boles have been used in mushroom cultivation. The bark has been used to tan fishing nets, and also for fishing net floats. Young shoots are sometimes eaten as a vegetable.

Properties A number of triterpenoids have been isolated from *Glochidion*. Apparently, triterpenoids of the lupeol type, including glochidone, glochidonol and glochidiol, are characteristic for the genus. Some of these, such as the triterpene glycoside glochidioside, have been associated with anticancer activity. Three hydrolyzable tannins, glochiins M-1, M-2 and C-1, have been isolated from dried leaves of *G. rubrum*.

In tests in China, extracts of *G. eriocarpum* showed considerable in-vitro activity against gram-positive and gram-negative bacteria. However, the bark of *G. glomerulatum* gave negative results in a test on antimicrobial activity.

Botany Monoecious shrubs or small trees, occasionally medium-sized and up to 30 m tall; bole up to 50(–70) cm in diameter, usually without buttresses. Leaves alternate, distichous, simple and entire, often asymmetrical at base, shortly petiolate; stipules usually persistent. Inflorescence an axillary small cluster below the leaves. Flowers unisexual, with 4–6-lobed perianth (petals absent), disk absent; male flowers with 3–8 stamens, filaments united into a column; female flowers with a superior, 3–9-celled ovary, styles connate, rarely free, entire. Fruit a woody capsule, lobed or ribbed, splitting from the base upward, with persistent sepals and style, several-seeded. Seeds with red or orange sarcotesta. Seedling with epigeal germination; cotyledons emergent, leafy; hypocotyl elongated; leaves alternate or arranged spirally, conduplicate.

Pollination of the flowers is by insects; seed dispersal presumably by birds.

Glochidion is closely related to and sometimes confused with *Phyllanthus*. Unlike the latter it has no disk glands, but it does have fused styles and colourful seeds.

Ecology *Glochidion* is a very common and characteristic element of secondary forest and colonizes cleared land, but also occurs scattered in primary rain forest. It can be found in well-drained as well as swampy locations, from lowland up to 2750 m altitude; most species show a comparatively wide altitudinal range.

Management *Glochidion* can be propagated by seeds and cuttings. Seeds of *G. obscurum* still in their sarcotesta show about 60% germination in 12–49 days.

Seed viability of the Indian *G. multiloculare*, however, is low, and it is propagated as a medicinal plant in vitro from shoot tips and leaf and stem explants. Young plants were successfully transplanted to soil under glasshouse conditions.

Genetic resources There are no records of *Glochidion* in germplasm banks. As most species occur commonly, they are unlikely to be endangered.

Prospects The wide use of *Glochidion* in traditional medicine in many regions in South-East Asia justifies more research on pharmacological properties and chemical composition. Particularly the common applications such as the treatment of dysentery, coughs and skin complaints deserve more attention.

Literature 134, 173, 331, 671, 731, 883, 1029.

Selection of species

Glochidion glomerulatum (Miq.) Boerl.

Handl. fl. Ned. Ind. 3: 276 (1900).

Synonyms *Glochidion wallichianum* Müll. Arg. (1863).

Vernacular names Indonesia: samak pulut (Sumatra). Malaysia: ubah puteh, hujan panas puteh, pokok manchong (Peninsular). Thailand: rot nam (Surat Thani), manpuu (Trang). Vietnam: s[os]c ch[uj]m, b[oj]t [ees]ch l[uf]n.

Distribution Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Bangka, Java and Borneo.

Uses In Sumatra, scrapings of the bark are mixed with water and the solution is drunk to treat dysentery.

Observations A shrub or small to medium-sized tree up to 20(–27) m tall, bole up to 45 cm in diameter, with or without buttresses; leaves obliquely ovate, 6–15 cm × 3.5–8 cm, glabrous, petiole 3–5 mm long; inflorescence sessile; male flowers with 3 stamens, female flowers with usually 3-celled ovary; fruit usually strongly 6-lobed, depressed, c. 5 mm in diameter, minutely pubescent, sessile. *G. glomerulatum* occurs in primary as well as secondary forest up to 1500 m altitude, also in swamp forest and forest fringes. It is locally common, e.g. in Peninsular Malaysia.

Selected sources 19, 20, 22, 62, 121, 295, 296, 990.

Glochidion littorale Blume

Bijdr. fl. Ned. Ind.: 585 (1826).

Vernacular names Indonesia: ketumbel (Jakarta), dempul (Javanese), ketumbang (Bangka). Malaysia: hujan panas, daun sau sik (Peninsular). Philippines: kayong (Bisaya), nigad (Sulu), tabango (Tagbanua). Vietnam: tr[aa]m b[ooj]t, b[oj]t [ees]ch bi[eer]n.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, Flores and the Philippines.

Uses In Peninsular Malaysia, a decoction of the leaves mixed with *Guioa* roots is used to treat stomach-ache. In Java, the leaves have been applied against dysentery, tonsillitis and after childbirth. In Borneo, a preparation of the plant is used for bathing after childbirth. The fruit is edible. The wood is used for fuel.

Observations A shrub up to 6 m tall; leaves ovate to suborbicular, 3.5–8.5 cm × 2.5–6.5 cm, rounded at apex, leathery, glabrous, petiole 3–5 mm long; inflorescence sessile; male flowers with 6 stamens, female flowers with 10–14-celled ovary; fruit subglobose, marked with numerous fine ribs, c. 15 mm in diameter, usually glabrous, reddish, shortly stalked. *G. littorale* occurs in brushwood and open forest near the coast, up to 100 m altitude. However, it has also been found in mountains up to 1800 m altitude, e.g. in Borneo.

Selected sources 19, 20, 22, 23, 24, 62, 121, 334, 990.

Glochidion molle Blume

Bijdr. fl. Ned. Ind.: 586 (1826).

Vernacular names Indonesia: ki huut (Sundanese), dempul lelet (Javanese), impoh (Makassar). Philippines: bugna, ubal (Sulu), piaas (Tagbanua).

Distribution Java, Borneo (once collected), the Philippines, Sulawesi, the Moluccas and the Tanimbar Islands.

Uses In Java, the leaves are used externally to treat dysentery, and the juice to treat bites of snakes and other animals, and scorpion stings.

The bark is used to make rough rope. The sap is used for dyeing clothes in Borneo.

Observations A shrub or small tree up to 10 m tall, bole often gnarled, up to 30 cm in diameter; leaves oblong to lanceolate-oblong, 2–7.5(–9) cm × 1–4 cm, subcordate at base, with patent, long, soft hairs, petiole 1–2 mm long; inflorescence sessile; male flowers with 3 stamens, female flowers with 3-celled ovary; fruit depressed, 6-lobed, c. 9 mm in diameter, patently hairy, pale green with a red flush. *G. molle* occurs in forest and brushwood, sometimes also on river banks, up to 800 m altitude.

Selected sources 20, 23, 24, 62, 121, 334.

Glochidion obscurum (Roxb. ex Willd.) Blume

Bijdr. fl. Ned. Ind.: 585 (1826).

Synonyms *Glochidion glaucum* Blume (1825).

Vernacular names Indonesia: ki pare lalaki (Sundanese), uris-urisan, cabuk (Javanese). Malaysia: cheremai antan, dulang-dulang, ubah paya (Peninsular). Thailand: khram, ma rua, ruat (peninsular). Vietnam: b[oj]t [ees]ch g[aa]n m[owf], s[os]c che.

Distribution Burma (Myanmar), Indo-China, southern China, southern Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, Sumbawa; possibly also in Sulawesi.

Uses In Peninsular Malaysia, a decoction of the leaves is used to treat diarrhoea, and a decoction of the roots against stomach-ache. In Java, the leaves are used to treat dysentery; they are also one of the ingredients of a complex medicine given after childbirth. The fruits are edible but sour. The wood is used to build native and temporary houses, mainly for poles and rafters, and for tool handles.

Observations A shrub or small to medium-sized tree up to 15(–25) m tall, bole up to 40 cm in diameter; leaves obliquely oblong-lanceolate, 2.5–7 cm × 1–3 cm, glabrous or hairy, dull glaucous below, petiole 2–4 mm long; inflorescence sessile; male flowers with 4–5 stamens, female flowers with 5–8-celled ovary; fruit depressed globose, somewhat angular, not lobed, c. 15 mm in diameter, thinly velvety, distinctly stalked. *G. obscurum* is a variable species. It occurs in forest, especially secondary forest, frequently on river banks, up to 1500 m altitude.

Selected sources 19, 21, 22, 23, 62, 121, 334, 883, 990.

Glochidion rubrum Blume

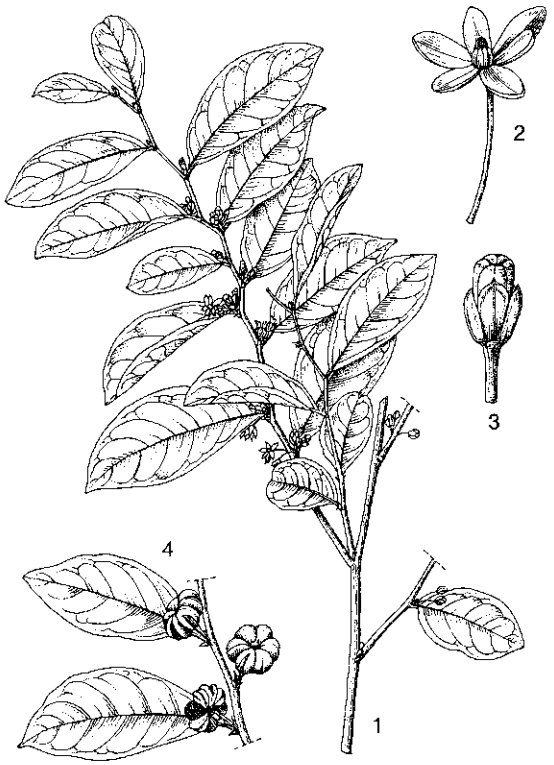
Bijdr. fl. Ned. Ind.: 586 (1826).

Vernacular names Indonesia: dempul (Javanese), ki timbul (Sundanese), ketemung (Madurese). Malaysia: gambiran, senkam, tetimah (Peninsular). Philippines: bagnang-pula (Filipino). Thailand: chum set, khat na (peninsular). Vietnam: b[oj]t [ees]ch ven su[oos]i, s[os]c d[or].

Distribution Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Singapore, Sumatra, Java, Borneo, the Lesser Sunda Islands, the Philippines, Sulawesi and the Moluccas (Tanimbar Island).

Uses In Java, the leaves have been used as an expectorant to relieve cough. The bark is sometimes used for tanning fishing nets. Young leaves are eaten as a vegetable.

Observations A shrub or small to medium-sized tree up to 18 m tall, bole up to 45 cm in diameter; leaves slightly obliquely oblong-ovate-lanceolate, 4–12.5 cm × 2–4.5 cm, leathery, usually glabrous, petiole 2–4 mm long; inflorescence sessile; male flowers with 3 stamens, female flowers



Glochidion rubrum Blume – 1, flowering twig; 2, male flower; 3, female flower; 4, part of twig with fruits.

with 3–5-celled ovary; fruit depressed globose, 3–6-lobed, 8–15 mm in diameter, minutely pubescent, shortly stalked. *G. rubrum* is a variable species. It occurs in forest, mixed lowland dipterocarp forest as well as peat forest, also on river banks, in brushwood and thickets, sometimes also on the seashore, up to 2400 m altitude. It has a slight preference for sandy soils, and is common in many regions.

Selected sources 19, 20, 22, 23, 24, 62, 121, 152, 334, 883, 990.

Glochidion submolle (Lauterb. & K. Schumann) Airy Shaw

Kew Bull. 32: 377 (1978).

Synonyms *Glochidion magnificum* K. Schumann (1905).

Vernacular names Papua New Guinea: hin (Kombo, Western Highlands Province).

Distribution New Guinea.

Uses In Papua New Guinea, the inner bark is cut into small pieces and placed over a sore tooth for relief.

Observations A small to medium-sized tree up to 30 m tall; leaves oblong to ovate-oblong or lanceolate-oblong, 14–25 cm × 4.5–9 cm, rounded at base, puberulous below, petiole 5–7 mm long; inflorescence sessile; male flowers with 4 stamens, female flowers with 8-celled ovary; fruit subglobular, slightly lobed, c. 10 mm in diameter. *G. submolle* is common in secondary forest up to 1600 m altitude.

Selected sources 21, 883.

Yun Astuti Nugroho

Gomphandra quadrifida (Blume) Sleumer

Notitzbl. Berl.-Dahl. 15: 238 (1940).

ICACINACEAE

$2n$ = unknown

Synonyms *Gomphandra affinis* (Miers) Masters (1875), *Gomphandra lanceolata* (Masters) King (1895), *Gomphandra salicifolia* Ridley (1922).

Vernacular names Indonesia: kayu barik-barik, kayu minak-minak, kayu topu lisak (Sumatra). Malaysia: chemperai, kayu gerang jantan, daun ekor bukit derimba (Peninsular). Vietnam: b[oor] b[es]o ch[er] t[uw].

Origin and geographic distribution *G. quadrifida* occurs in Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia a decoction of the root or leaves is used as a protective medicine after childbirth. A decoction of the root is also applied to treat rheumatism. Formerly wood-tar from the stems was used to blacken teeth.

In Vietnam the tuberous root of *G. mollis* Merr. (synonym: *G. tonkinensis* Gagnep.) is used as a tonic, stomachic, appetizer, galactagogue, diuretic and laxative. It is taken as a decoction, elixir or powder.

Botany A dioecious shrub or small to medium-sized tree up to 20 m tall. Leaves arranged spirally, simple, elliptical, lanceolate to oblong, (5–)10–15(–25) cm × (0.5–)4–6(–11) cm, base broadly attenuate, apex acuminate, with (3–)6–8(–10) pairs of secondary veins; petiole up to 1.5 cm long; stipules absent. Inflorescence an axillary cluster of repeatedly branched cymes, few to many-flowered. Flowers functionally unisexual, 4(–5)-merous, pedicellate; calyx cup-shaped, toothed; petals connate to a tube, (3–)4(–5) mm long, white or cream, glabrous; male flowers with free, hairy stamens and rudimentary ovary; female flowers with superior, 1-celled ovary, a thick, discoid stigma and rudimentary stamens. Fruit an ellipsoid drupe c. 1 cm × 0.7 cm, base broadly narrowed, apex gradually attenuate.

Gomphandra comprises about 33 species and occurs from southern India, Sri Lanka and Burma (Myanmar) eastwards to southern China, throughout Malesia, eastwards to the Solomon Islands, Australia (Queensland) and Santa Cruz Island. *G. quadrifida* is divided into 5 varieties based on venation and leaf dimensions; some varieties are linked with ecological conditions and geographically confined.

Ecology *G. quadrifida* occurs in habitats ranging from lowland to montane forest and swamp forest to dry *Dryobalanops* forest, occasionally on limestone, from sea-level up to 1500 m altitude.

Genetic resources *G. quadrifida* is widespread, occurring in a wide range of habitats, and does not appear to be threatened by genetic erosion.

Prospects Pharmacological research is needed to evaluate the potential of the traditional medicinal uses of *G. quadrifida*.

Literature 121, 247, 1008.

Other selected sources 218, 921, 990.

Titi Kalima

Gomphostemma Wallich ex Benth.

Edwards, Bot. Reg. 15: t. 1292 (1830).
LABIATAE
$x = 17$

Origin and geographic distribution *Gomphostemma* comprises about 30 species and occurs in eastern India, Burma (Myanmar), Indo-China, southern China, Thailand and western Malesia to the Philippines, Sulawesi and Bali. In the Malesian region 8 species have been found; Peninsular Malaysia and Sumatra are richest, each with 5 species.

Uses Some uses in traditional medicine in South-East Asia have been recorded for *Gomphostemma*: the leaves and leaf juice are applied externally to wounds, swellings and warts, and internally to treat intestinal troubles, whereas a decoction of the roots is administered after childbirth.

Botany Perennial herbs or shrubs; roots sometimes tuberous; stem quadrangular, pubescent. Leaves decussately opposite, simple, large, entire or crenate-serrate, lower surface usually with stellate hairs often intermixed with simple hairs, usually long-petioled; stipules absent. Inflorescence an axillary fascicled cyme forming densely congested verticillasters, rarely seemingly racemose, bracteate. Flowers bisexual, zygomorphic; calyx campanulate, 10-veined, with 5 subequal teeth; corolla with slender, erect or incurved tube and 2-lipped limb, upper lip galeate, entire or emarginate, lower lip spreading, broadly 3-lobed, creamy to orange-yellow; stamens 4, inserted on the corolla tube, didynamous, filaments pubescent; disk prominent; ovary superior, deeply 4-parted, style gynobasic, with 2 short, slightly unequal branches at apex. Fruit splitting into 1–4 drupaceous nutlets enclosed in the persistent calyx.
Gomphostemma can be found flowering throughout the year.
Gomphostemma is placed in the rather heterogeneous (possibly polyphyletic) tribe *Prasieae*, which is characterized by the fleshy mericarps.

Ecology *Gomphostemma* is most commonly found in humid lowland rain forest below 1000 m altitude, but *G. javanicum* is also found in drier forest types and at higher altitudes.

Genetic resources Most *Gomphostemma* species have sufficiently wide distributions to ensure their survival, but few are narrow endemics which may easily become endangered.

Prospects Particularly the external applications of *Gomphostemma* leaves and leaf juice warrant research on the phytochemistry and pharmacological properties, since data are not yet available.

Literature 247.

Selection of species

Gomphostemma crinitum Wallich ex Benth.

Wallich, Pl. asiat. rar. 2: 12 (1830).

Vernacular names Malaysia: menjulong bukit, chempaku hutan, derita dapur (Peninsular). Vietnam: dinh h[uf]ng l[oo]ng d[af]i.

Distribution Southern Burma (Myanmar), Indo-China, Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia a decoction of the roots is administered after childbirth; pounded leaves mixed with camphor, are applied to swellings of the groin.

Observations A large, perennial herb up to 150 cm tall, with stout, erect stem; leaves elliptical-ovate to oblanceolate, 25–30 cm × 8–15 cm, entire or remotely serrate; calyx 1.5–2 cm long, hispid-tomentose, with linear-subulate teeth, corolla 2.5–3.5 cm long, tube almost straight with narrow throat; nutlets usually 1–2. *G. crinitum* usually occurs on limestone cliffs and hills, up to 500 m altitude; it is locally common.

Selected sources 121, 247.

Gomphostemma javanicum (Blume) Benth.

Labiat. gen. spec.: 650 (1835).

Synonyms *Gomphostemma oblongum* Wallich ex Benth. (1830), *Gomphostemma phlomoides* (Reinw. ex Blume) Benth. (1835), *Gomphostemma philippinarum* Benth. (1848).

Vernacular names Indonesia: galipung bulu (Sundanese), peper (Javanese), kopetan (Madurese). Philippines: ata-ata (Tagalog), kagong (Bagobo), kasunisuni (Bukidnon). Thailand: klon duu (Trang), khon non (Surat Thani), hom hok (Chiang Mai). Vietnam: dinh h[uf]ng java.

Distribution The Andaman Islands, southern Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Bangka, Java, Bali, Borneo, south-western Sulawesi and the Philippines.

Uses In Java the leaves are applied to wounds and the leaf juice is used internally to treat intestinal troubles. In the Philippines the leaf juice is applied to warts.

Observations A large, perennial herb up to 200 cm tall, with erect, woody stem; leaves elliptical-oblong, ovate to obovate, 15–30 cm × 5–10 cm, crenate or crenate-serrate; calyx 1–1.5(–2) cm long, tube conspicuously ribbed, with lanceolate teeth, corolla 4–4.5(–5) cm long, tube broad, distinctly incurved with inflated throat; nutlets usually 4. *G. javanicum* occurs in shaded localities in rain forest or seasonal forest, up to 2400 m altitude.

Selected sources 247, 321, 334.

Trimurti H. Wardini

Gonocaryum gracile Miq.

Fl. Ind. Bat., Suppl. 1: 343 (1861).

ICACINACEAE

$2n$ = unknown

Synonyms *Gonocaryum longiracemosum* King (1895).

Vernacular names Indonesia: tobung-tobung (Sumatra). Malaysia: toyoh, rambai hutan, ruai gajah (Peninsular).

Origin and geographic distribution *G. gracile* occurs in Peninsular Malaysia, Singapore, Sumatra and Bangka.

Uses In Peninsular Malaysia a poultice of *G. gracile* fruits is applied to the head to treat headache. In Sumatra (Riau Province), pounded fresh leaves are used as a remedy for bruises and pains by applying a cataplasm on the affected parts. In the Philippines, *G. calleryanum* (Baillon) Becc. is said to be applied as a medicine against stomach troubles, and its wood is used to produce charcoal. In Thailand *G. lobbianum* (Miers) Kurz is used in prescriptions for jaundice, its wood being mixed with the root of *Neonauclea sessilifolia* (Roxb.) Merr., or its stem or root mixed with the stem of *Dendrolobium lanceolatum* (Dunn) Schindler, the wood of *Diospyros ehretioides* Wallich ex G. Don and the stem of *Erythrina stricta* Roxb.

Properties There is no information on the phytochemistry of *G. gracile*, but numerous secoiridoid glycosides, flavonoid glycosides and flavonoids have been isolated from the leaves, branches, stem and root bark of *G. calleryanum*.

Botany A dioecious shrub or small, low-branching tree up to 12 m tall; bole up to 5 cm in diameter, bark surface smooth, greyish. Leaves arranged spirally, simple and entire, elliptical-oblong, (6–)8–18(–20) cm × 3.5–6.5(–9.5) cm, base broadly cuneate, apex shortly acuminate; petiole characteristically wrinkled and yellow; stipules absent. Inflorescence an axillary, generally elongated spike (3–)5–15(–30) cm long, solitary or 2–3 together, often on defoliated twigs, laxly many-flowered. Flowers unisexual, regular, 5-merous, sessile or short-stalked; calyx small, deeply lobed; petals united, 5.5–6 mm long, lobes inflexed; male flowers with stamens connate to the petals for most of their length and rudimentary ovary; female flowers with superior, 2-celled ovary, conical, short style and rudimentary stamens. Fruit an ellipsoid-oblong drupe, (3–)3.5–4(–4.5) cm × 1.5–2(–2.8) cm, obtusely trigonous with 2–3 longitudinal ribs on each side, 1-seeded. Seed with a thin testa. Seedling with hypogeal germination; cotyledons not emergent, hypocotyl not developed, epicotyl with a few scales; leaves appearing in flushes of 3–5.

Gonocaryum comprises about 11 species occurring in Burma (Myanmar), Indo-China, south-eastern China, Taiwan, Thailand and throughout the Malesian region (except for Java and most of the Lesser Sunda Islands).

Ecology *G. gracile* is found scattered in lowland forest, preferably in valleys along streams, from sea-level up to 1000 m altitude.

Management A germination rate of about 25% has been recorded for *G. gracile* fruits, but germination did not start until after two years.

Genetic resources Although confined to lowland forest areas and of limited geographical distribution, *G. gracile* does not appear to be seriously threatened by genetic erosion as it is rarely harvested.

Prospects Further research is needed to evaluate the potential of the traditional medicinal uses of *G. gracile*.

Literature 121, 137, 169, 174, 247, 883.

Other selected sources 446, 459, 760, 921, 968.

Wongsatit Chuakul,
Noppamas Soonthornchareonnon
& Orawan Ruangsomboon

Gordonia penangensis Ridley

Journ. Roy. As. Soc. Straits Br. 73: 142 (1916).

THEACEAE

$2n$ = unknown

Synonyms *Gordonia excelsa* auct. non Blume.

Origin and geographic distribution Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia a leaf decoction of *G. penangensis* is said to be used as a beverage to

cure diarrhoea and dysentery. In Java the flowers of *G. excelsa* (Blume) Blume, a species primarily used for its timber, are used medicinally instead of those of *Schima wallichii* (DC.) Korth., together with many other ingredients, in a draught applied after childbirth. The bark of *G. amboinensis* (Miq.) Merr., another timber species, has been used as a fish poison. In Taiwan the leaves of *G. axillaris* (Roxb. ex Ker Gawl.) Endl., a species from Indo-China, China, Taiwan and northern Thailand, are applied as an astringent in folk medicine. The bark of various *Gordonia* species yields tannin and has been used in Peninsular Malaysia to dye and tan fishing nets and rough clothing.

Properties An active antifungal phenolic derivative has been isolated from the hexane extract of stem bark of *G. dassanayakei* B.M. Wadhwa & A. Weerasooriya, a Sri Lankan endemic. This compound is active against several plant pathogenic fungi.

A leaf extract of *G. axillaris* exhibits a significant inhibitory effect on Epstein-Barr virus-specified DNA polymerase. An acylated γ-pyrone glucoside was isolated from the ethyl acetate extract of dried leaves as the active compound. Camelliin B, a macrocyclic hydrolysable tannin, showed cytotoxic effects in human carcinoma cells; in an in-vitro assay, camelliin B dose-dependently induced apoptosis in HeLa cells.

Botany An evergreen, small, slender tree up to 13(–20) m tall; bark smooth. Leaves arranged spirally, simple, narrowly elliptical-lanceolate, 6–10 cm × 2.5–4 cm, base attenuate or caudate, apex acuminate to obliquely caudate, remotely serrulate to almost entire, pinnately veined with 5–8 pairs of lateral veins; petiole slender, 0.5–1 cm long; stipules absent. Flowers solitary, terminal or subterminal on small branches, 2.5–3 cm across, 5-merous; bracteoles 2; sepals ovate or suborbicular, 5–7 mm long, thick-coriaceous and with thinner and ciliate edge, persistent in fruit; petals suborbicular to spatulate, connate at base, chartaceous, yellowish to golden yellow; stamens many, indistinctly grouped in 5 fascicles, shortly connate at base and briefly adnate to the corolla; ovary superior, usually 5-celled, woolly, style 6–7 mm long. Fruit a woody, cylindrical capsule 3.5–5 cm × 1.5–2 cm, dehiscing with 5 valves from the apex to the base along a persistent column. Seeds with a unilateral wing, 2.5–3 cm long. Seedling with epigeal germination; cotyledons leafy; hypocotyl elongated; all leaves arranged spirally.

G. penangenis flowers in February–May and fruits in May–June.

Gordonia comprises about 70 species and occurs in tropical Asia and tropical America with a single species in the south-eastern part of the United States. Tropical Asia comprises some 40 species and *Gordonia* is found in India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Taiwan, Thailand, throughout the Malesian region, east to the Bismarck Archipelago. Within Malesia 21 species are recognized. Peninsular Malaysia is richest with 9 species, followed by Borneo (6), Sumatra (4), Java, the Philippines, Sulawesi and the Lesser Sunda Islands (each 2), and the Moluccas and New Guinea (each 1).

Ecology *G. penangensis* is found in open lowland forest up to 500 m altitude.

Genetic resources *G. penangensis* does not seem to be at immediate risk of genetic erosion. However, habitat destruction of lowland forest areas likewise affects *G. penangensis*.

Prospects Nothing is known about the pharmacological properties of *G. penangensis*. The selective cytotoxic compounds as present in other *Gordonia* species warrant further research, and other representavives of the genus should be involved as well.

Literature 56, 121, 458, 883, 978.

Other selected sources 459, 990.

Titi Kalima

Gouania Jacq.

Select. stirp. amer. hist.: 263 (1763).

RHAMNACEAE

x = unknown

Origin and geographic distribution *Gouania* consists of some 50–70 species, and occurs throughout the tropics; in South-East Asia about 10 species occur.

Uses *Gouania* is only little used in South-East Asian folk medicine, primarily as a poultice to treat sores, ulcers, burns and skin complaints.

Properties Leaves and stems of *G. leptostachya* showed distinct antimicrobial activity against *Staphylococcus aureus*. The alkaloids present in bark and leaves of *G. leptostachya* have a tetanizing effect on toads. Saponins are present in numerous *Gouania* species, which may well explain the use to stupefy fish and as a soap substitute.

Botany Unarmed climbing shrubs or lianas; branches often with circinnate tendrils. Leaves alternate, simple, ovate to cordate, entire or crenate, membranous to coriaceous, petiolate; stipules present. Inflorescence a terminal or axillary

spike or raceme, sometimes arranged in panicles. Flowers bisexual or unisexual (polygamous), 5-merous; calyx funnel-shaped; petals free, small, shortly clawed; stamens before the petals; disk filling the calyx tube; ovary inferior, immersed in the disk, 3-celled; style 3-parted. Fruit a capsule, trigonous, 3-winged, crowned by the persistent calyx, splitting into 3 indehiscent, 1-seeded cocci. Seeds obovate, plano-convex; testa shining, horny; albumen thin.

In Java *G. javanica* flowers and fruits from May to October, whereas *G. leptostachya* can be found flowering and fruiting throughout the year.

Gouania in South-East Asia is in great need of revision. The status of *G. tiliaefolia* Lamk deserves more attention; it is not clear whether it should be united with *G. leptostachya* or not.

Ecology *Gouania* species of medicinal importance are found in relatively open forest and forest fringes, often along rivers, at low to medium altitudes.

Genetic resources The *Gouania* species treated here are relatively widespread and apparently adapted to disturbance. The risk of genetic erosion seems to be limited.

Prospects Very little is known on the phytochemistry and pharmacological properties of *Gouania*. Further research is needed to corroborate its traditional use in poulticing.

Literature 62, 121, 927.

Selection of species

Gouania javanica Miq.

Fl. Ned. Ind. 1(1): 649 (1856).

Vernacular names Indonesia: banci putih, kepet (Javanese), musing (Madurese). Malaysia: akar sebueh, ketip-ketip. Thailand: chalit chitcho, nam dap fai (Trang, Pattani). Vietnam: d[aa]y d[of]n g[as]nh.

Distribution Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, the Philippines and Sulawesi.

Uses In Peninsular Malaysia a poultice of the roots is applied to sores.

Observations A liana up to 20 m long, young shoots densely brown-hairy; leaves ovate, 4–10 cm × 3–8 cm, base rounded, truncate or obtuse, apex very shortly acuminate, coarsely serrate-dentate, brown-hairy at least on the veins below, petiole 7–12 cm long; inflorescence a terminal or axillary panicle 6–20 cm long; flowers with densely short-hairy calyx tube, petals c. 1 mm long, processes of disk in bisexual flowers linear, somewhat shorter than the calyx segments; fruit c. 3 mm long, wings thin, 7–10 mm long, 2–3 times wider than cocci, pedicel thick, c. 0.3 mm long. *G. javanica* is found in open forest and brushwood, in Java from sea-level up to 1000 m altitude.

Selected sources 62, 121, 621.

Gouania leptostachya DC.

Prodr. 2: 40 (1825).

Vernacular names Indonesia: areuy sahagi (Sundanese), garangan, sererep (Javanese). Philippines: litiran (Tagalog), pahampak (Pampanga), rungo-rungo (Iloko). Thailand: thao teen toe (Surat Thani), nam dap fai (peninsular), phuang charitaa (Yala). Vietnam: d[aa]y d[of]n g[as]nh, d[aa]y g[aa]n b[oo]ng h[ej]p.

Distribution India, Burma (Myanmar), Indo-China, southern China, Thailand and throughout the Malesian region.

Uses In Java the pounded root, stems and leaves are used to poultice skin complaints. The bark pounded with water is used as a foamy hair wash to get rid of lice and other parasites. In Sumatra leaves and stems are ground with water, and the solution is drunk to treat stomach-ache and diarrhoea. In Vietnam the plant is used to massage swellings, to treat burns and to regulate menses. In India and Burma (Myanmar) the leaves are applied as a poultice to treat sores and as a skin wash to treat ulcers. The pounded bark, alone or in a mixture, is used to stupefy fish and also as a shampoo. In the Philippines the roots are used as a soap substitute.

Observations A liana up to 20 m long, young shoots glabrous; leaves ovate or ovate-oblong, 4–7 cm × 2–4 cm, base truncate or cordate, apex acuminate, shallowly serrate-dentate, glabrous or thinly pale-hairy on the veins below, petiole 6–13 cm long; inflorescence terminal or axillary, often united in a panicle 10–25 cm long; flowers with glabrous or thinly hairy calyx tube, petals c. 0.5 mm long, processes of disk in bisexual flowers broadly oblong, a third or half of the length of the calyx segments; fruit c. 8 mm long, wings thick, 12–14 mm long, as wide as the cocci, pedicel 2–3 mm long. *G. leptostachya* is found in Java below 300 m altitude, whereas in the Philippines it is also recorded at medium altitudes.

Selected sources 181, 217, 295, 296, 334, 621, 731, 760.

A.M. Aguinaldo

Grammatophyllum Blume

Bijdr. fl. Ned. Ind. 6: t. 2, f. 20; 8: 377 (1825).
ORCHIDACEAE
$x = 20$; *G. scriptum*: $2n = 38, 40$, *G. speciosum*: $2n = 40$

Origin and geographic distribution *Grammatophyllum* comprises about a dozen species, and is distributed from Burma (Myanmar) and Laos, through Thailand and the whole Malesian region, to the Solomon Islands and Fiji. Some species, e.g. *G. speciosum* and *G. scriptum*, are cultivated.

Uses In the Moluccas a paste made of *G. scriptum* pseudobulbs together with a little *Curcuma* and salt water has been applied to sores, to the abdomen to expel worms, and to treat dropsy and aphthae, whereas the seeds were mixed with food to treat dysentery. In Thailand the filtrate of crushed *G. speciosum* stems in rice liquor is drunk and the residue applied topically to treat snake bites and stings of scorpions and centipedes.
Some *Grammatophyllum* species are cultivated by orchid amateurs, but they need much space because of their size, and they flower irregularly. However, flowering plants are very spectacular.

Botany Large to very large epiphytic, perennial, usually tufted herbs, at base often with many erect, whitish, branched catch-roots, either with crowded, long, firm, many-leaved stems, or with crowded few-leaved pseudobulbs. Leaves distichously alternate, simple, linear or lanceolate, large, articulate, duplicative, leathery; stipules absent. Inflorescence a raceme borne at the base of a stem or pseudobulb, erect-drooping or deflexed, few- to many-flowered. Flowers bisexual, zygomorphic, large, resupinate, more or less fleshy; tepals free, slightly differing in length between the 2 whorls, lip (labellum) subelastically inserted on a thickening of the base of the column, concave, 3-lobed, with longitudinal thickenings on inner side; stamen 1, anther proclined, with 2 deeply cleft pollinia each placed on a lobule of the small deeply 2-lobed stipe borne on a fat viscidium; ovary inferior, 1-celled. Fruit a usually fusiform capsule opening by longitudinal fissures, many-seeded. Seeds minute.
Grammatophyllum species are amongst the largest orchids, and *G. speciosum* is possibly the largest of all. It may flower uninterruptedly for up to 5 months and produce about 50 inflorescences with a total of up to 3600 flowers during this period. *Grammatophyllum* often shows dimorphy of flowers, having larger sterile flowers at the base of the inflorescence.

Ecology *Grammatophyllum* is a tree epiphyte of the lowland, preferring light and humid conditions on isolated trees or in open forest.

Management To be cultivated successfully *Grammatophyllum* must be given a sunny position with high humidity and excellent drainage. It does best when planted in the fork of a tree, or in a large pot or basket filled with tree fern fibre or broken bricks and charcoal. Regular fertilization is required, especially during active growth.

Genetic resources Both *Grammatophyllum* species treated here are widespread and apparently locally common, and do not seem to be immediately endangered. Their cultivation also contributes to protection.

Prospects The recorded applications of *Grammatophyllum* in traditional medicine are various, but not supported by scientific research. Information on the phytochemistry of *Grammatophyllum* is completely lacking. If reliable means of influencing flowering can be developed, *Grammatophyllum* could be of considerable ornamental value.

Literature 173, 334, 1006.

Selection of species

Grammatophyllum scriptum (L.) Blume

Rumphia 4: 48 (1849).

Vernacular names Indonesia: anggrek boki, bunga putri, saya ngawa (Moluccas). Philippines: tawa-tawa (Tagalog).

Distribution The Philippines, Sulawesi, the Moluccas, New Guinea and the Solomon Islands. Cultivated in Java.

Uses In the Moluccas a paste made of the pseudobulbs together with a little *Curcuma* and salt water has been applied to sores, to the abdomen to expel worms, and to treat dropsy and aphthae. The seeds were mixed with food against dysentery. The plant is cultivated as an ornamental.

Observations A large herb with pseudobulbs of c. 25 cm × 7 cm, 3–5-foliate; leaves 40–70 cm × 6–10 cm; inflorescence erecto-patent to drooping, up to 190 cm long including the peduncle up to 90 cm long, up to 50-flowered; flowers 7–8 cm in diameter, tepals pale green or yellowish with dark brown blotches, lip dark brown-violet streaked. In New Guinea *G. scriptum* often grows on trees along beaches and lagoons, and in coastal forest and coconut plantations.

Selected sources 62, 334, 760, 1006.

Grammatophyllum speciosum Blume

Bijdr. fl. Ned. Ind. 8: 378 (1825).

Vernacular names Tiger orchid (En). Indonesia: anggrek tebu (Java). Malaysia: bunga bidadari, ekur gajah (Peninsular). Thailand: waan phetchahueng (central), ueang phraao (northern), waan nguu lueam (peninsular). Vietnam: thanh tuy[eef]n.

Distribution Burma (Myanmar), Laos, Vietnam, Thailand, Peninsular Malaysia, Sumatra, Bangka, Java, Borneo and the Philippines.

Uses In Thailand, the filtrate of crushed stems in rice liquor is drunk and the residue applied topically to treat snakebites and stings of scorpions and centipedes. *G. speciosum* is cultivated as an ornamental.

Observations A very large herb up to 7 m tall, without pseudobulbs but with thick, many-leaved, erect-drooping, ascending stems; leaves linear, 50–100 cm × c. 3 cm; inflorescence erecto-patent to drooping, up to 3 m long including the short peduncle, many-flowered; flowers 10–12 cm in diameter, tepals pale yellowish-green with reddish-brown blotches, lip reddish-brown streaked. *G. speciosum* is an epiphyte on trees in open forest or on isolated trees, up to 550 m altitude.

Grammatophyllum speciosum Blume – 1, leafy stems and inflorescence; 2, flower.

Selected sources 62, 121, 173, 831, 832.

Diah Sulistiarini

Grangea maderaspatana (L.) Poir.

Lamk, Encycl., Suppl. 2, 2: 825 (1812).

COMPOSITAE

$2n = 18$

Synonyms *Artemisia maderaspatana* L. (1753).

Vernacular names Indonesia: kembang paku konde, serawan hutan. Philippines: pakopatolialog (Ilokano). Thailand: pha-yaa mutti (central), yaa chaam luang (northern). Vietnam: c[ar]i d[oof]ng, c[us]c d[aj]i, rau c[os]c.

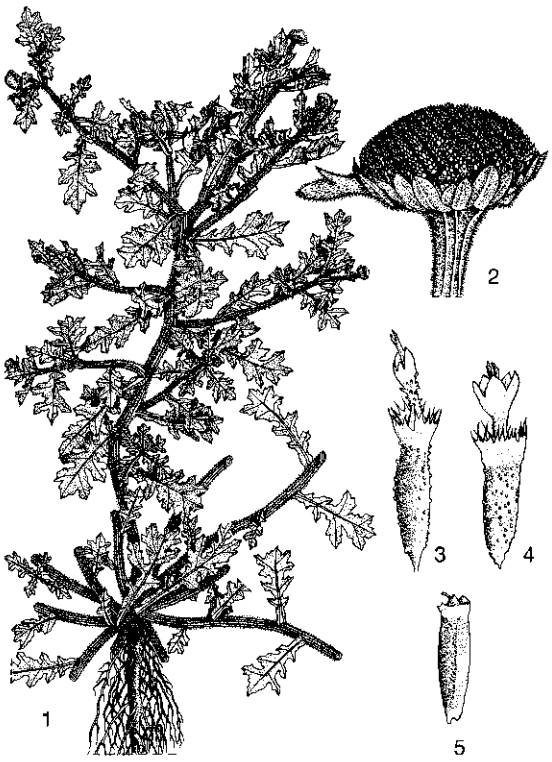
Origin and geographic distribution *G. maderaspatana* is found from Africa and Madagascar to tropical Asia; it occurs throughout South-East Asia.

Uses In the Philippines an infusion of *G. maderaspatana* leaves is employed as a stomachic and antispasmodic. In Indo-China the leaves are used as a stomachic and in antiseptic fomentations. A leaf decoction is given as a post-partum tonic, to soothe coughing and to treat irregular menses. In India the plant is considered a valuable stomachic, with deobstruant and antispasmodic properties. An infusion is used as a remedy for irregular menses and hysteria. The leaves are sometimes employed as an antiseptic or anodyne fomentation. In West Africa *G. maderaspatana* is taken as a stomachic.

Properties The aboveground parts of *G. maderaspatana* contain numerous labdane and clerodane type diterpenoids. In addition, steroidal compounds, hardwickiic acid and derivatives, acetylenic compounds, auranamide, grangolide and eudesmanolides have been isolated. A crude chloroform extract of *G. maderaspatana* exhibits strong cytotoxic activity. A mixture of flavonoids, extracted from dried aerial parts of *G. maderaspatana* possessed oestrogenic and anti-implantation activities in various mouse models.

The methanol extract of whole *G. maderaspatana* plants showed a dose-dependent analgesic activity. At doses of 1 g/kg and 3 g/kg, the extract significantly inhibited acetic acid-induced writhing in mice by 50% and 80%, respectively.

Botany A prostrate-ascending to erect annual herb up to 55 cm tall, branched from the base, with a taproot. Leaves alternate, oblong-obovate in outline, 2–10 cm × 1–6 cm, pinnatilobed, with 3–4 pairs of coarsely dentate, opposite lobes, thinly patently hairy on both sides, sessile. Inflores-



Grangea maderaspatana (L.) Poir. – 1, plant habit; 2, flower head; 3, marginal flower; 4, disk flower; 5, fruit.

cence a terminal, truncate-globose head 6–10 mm in diameter, solitary or 2–3 together, yellow, many-flowered; peduncle 1–4 cm long; involucral bracts 2–3-seriate, outer ones oblong, acute, inner ones elliptical. Flowers all tubular, c. 1.5 mm long; marginal flowers female, with narrowly tubular corolla, shortly lobed; disk flowers bisexual, with cylindrical corolla, 4–5 lobed; stamens 5, loosely cohering; ovary inferior, 1-celled, style with 2 short acute arms. Fruit a turbinate, compressed, truncate achene c. 2 mm long, glabrous, sparingly glandular; pappus consisting of a ciliate cup. Seedling with epigeal germination; hypocotyl 2–2.5 mm long; cotyledons subsessile, elliptical to widely elliptical; epicotyl absent.

G. maderaspatana can be found flowering and fruiting throughout the year. The fruits are dispersed by water and ants.

Grangea comprises 10 species, and is confined to the Old World tropics.

Ecology *G. maderaspatana* occurs on river banks, in desiccated pools, rainfed rice fields, waste places and teak forests, preferring heavy soils but also common in sandy locations. It is often gregarious, up to 800 m altitude.

Genetic resources *G. maderaspatana* is widespread and commonly encountered in disturbed habitats, and is not threatened by genetic erosion.

Prospects The traditional use of *G. maderaspatana* as an analgesic is supported by the observed antinociceptive effect in animal tests. However, in view of the present day limited use and the numerous alternatives available, *G. maderaspatana* is not likely to rise above the level of limited local importance.

Literature 17, 409, 508, 732, 794, 879.

Other selected sources 62, 112, 120, 181.

J.L.C.H. van Valkenburg

Greenea corymbosa (Jack) K. Schumann

Engl. & Prantl, Nat. Pflanzenfam. 4, 4: 37 (1891).

RUBIACEAE

$2n$ = unknown

Synonyms *Greenea jackii* Wight & Arnott (1839).

Vernacular names Malaysia: sekam bulan, jarum-jarum rimba (Peninsular). Vietnam: cho, tr[uw][owf]ng s[ow]n.

Origin and geographic distribution *G. corymbosa* occurs in southern Burma (Myanmar), Vietnam, southern Thailand and Peninsular Malaysia.

Uses In Vietnam, an infusion of the leaves is applied internally and used as a vapour-bath to treat fever. In Peninsular Malaysia, the wood is used for fences and as fuel.

Properties *G. corymbosa* has a very bad smell, and an infusion of the leaves is emetic.

Botany A shrub or small tree up to 10 m tall; bark smooth, dark brown or greyish-brown; twigs more or less densely brown hairy. Leaves opposite, oblanceolate, 20–35 cm × 4–10 cm, acuminate at apex, hairy on veins beneath, with 18–25 pairs of secondary veins and ladder-like tertiary veins; petiole 1–3 cm long; stipules interpetiolar, up to 1.5 cm long, fused at the edges. Inflorescence a terminal panicle, with up to 3 cm long peduncle and flowers alternately in 2 rows on the upper side of the inflorescence branches (scorpioid). Flowers sessile, bisexual, 4–5-merous; calyx very deeply lobed; corolla with tube 5–7 mm long, lobes 1–1.5 mm long, contorted in bud, white turning pink; stamens inserted at the corolla throat, fila-

ments absent; ovary inferior, 2-celled, style filiform, bifid. Fruit a globose capsule 2–3.5 mm in diameter, crowned by the persistent calyx lobes, densely short-hairy, dehiscent with 2 valves from the top, many-seeded. Seeds c. 0.5 mm long, brownish-yellow, areolate.

The leaves wither red. In Vietnam two forms of *G. corymbosa* exist: one with white flowers and another with violet flowers. Only the latter is reputedly used medicinally.

Greenea comprises approximately 7 species and occurs from Burma (Myanmar) and Indo-China to Thailand, Peninsular Malaysia and possibly other parts of Malesia.

Ecology In Peninsular Malaysia, *G. corymbosa* occurs in forest up to 700 m altitude, frequently in secondary forest, near streams, on rocky coasts and hill ridges.

Genetic resources The populations of *G. corymbosa* do not seem to be under pressure because the species is locally common and often occurs in secondary forest.

Prospects *G. corymbosa* hardly figures in traditional medicine in South-East Asia. Therefore, it is unlikely that it will gain importance, unless future research demonstrates interesting active compounds. A taxonomic revision of *Greenea* is still lacking. This is needed to confirm the assumption that the information on medicinal applications from Vietnam refers to the same species as the Malesian *G. corymbosa*.

Literature 732, 990.

Other selected sources 121, 264.

R.H.M.J. Lemmens

Grewia L.

Sp. pl. 2: 964 (1753); Gen. pl. ed. 5: 412 (1754).

TILIACEAE

$x = 9$; *G. abutilifolia*, *G. hirsuta*: $n = 9$

Origin and geographic distribution *Grewia* comprises about 200 species and is confined to the Old World tropics. It extends north to the Himalayas, China and Taiwan, east to Tonga and Samoa and south to northern Australia. It occurs throughout the Malesian region where about 30 species are found.

Uses In Thailand stem decoctions of *Grewia* are used to treat acne and food poisoning, and root decoctions as a febrifuge and diuretic. Leaves, roots and fruits are used to treat various complaints in India. In Timor (Indonesia) a paste of grated bark from a *Grewia* species has been externally applied to bruises; for internal afflictions an infusion of grated bark was drunk.

G. asiatica L., well known as fruit and timber tree, is also used medicinally. Its fruits are considered a remedy for throat problems and the bark is applied as a demulcent, especially for urogenital afflictions. The fibrous bark of *Grewia* is used to make ropes. The fruits of most species are edible. *Grewia* wood is generally used for small articles where toughness is required.

Properties An alcohol extract of whole *G. hirsuta* plants showed diuretic activity in rats. It also showed central nervous system-depressant activity, antiviral activity against Ranikhet disease, and antibacterial activity against *Staphylococcus aureus* at an LD_{50} value exceeding 1000 mg/kg. Alkaloids, phenolic and steroidal compounds have been detected in the leaves.

Botany Evergreen or deciduous shrubs or small trees up to 15 m tall, rarely climbers, with indumentum of stellate and simple hairs. Leaves alternate, distichous, simple, entire, serrate or double serrate, 3- or 5-veined from the base, often whitish below; stipules entire or divided. Inflorescence an axillary or sometimes terminal cyme arranged in a panicle. Flowers bisexual, regular, 5-merous; sepals free; petals shorter than sepals or sometimes absent, whitish or yellowish; stamens many, on a raised torus; ovary superior, (1–)2(–5)-celled, style with a thickened or lobed stigma. Fruit a fleshy or pulpy drupe, usually 2–4-lobed, with 1–4 pyrenes containing 1–2 seeds. Seedling with epigeal germination; cotyledons leafy; hypocotyl elongated.

Maturation of the fruits takes about 1–2 months. The fruits are eaten by birds which may thus disperse the seeds.

There is disagreement whether the genera *Grewia* and *Microcos* should be united or kept separate. *Microcos* differs in its unlobed stigma, terminal paniculate inflorescence, presence of involucral bracts and unlobed fruit.

Ecology *Grewia* is a fairly common element of the understorey of primary and secondary, deciduous or evergreen, lowland to montane forest, up to 1700 m altitude. It is also found in open, dry deciduous forest, scrub vegetation, forest edges and hedges, where it may be encountered as a pioneer. It occurs on many soil types.

Management *Grewia* may be raised from seed, whereas *G. asiatica* can also be propagated vegetatively by cuttings, layering and budding.

Genetic resources *Grewia* is generally not threatened in South-East Asia, because it is only

rarely used and often occurs in secondary vegetation, often even exhibiting a weedy nature. It is occasionally grown in botanical gardens.

Prospects Little is known about the pharmacological properties of South-East Asian *Grewia*. Some of its traditional uses, e.g. as a diuretic, are corroborated in animal tests, but the vast majority of its many uses in Ayurvedic medicine are not yet supported by modern research.

Literature 121, 249, 334, 449, 483, 662, 883.

Selection of species

Grewia abutilifolia Vent. ex Juss.

Ann. Mus. Natl. Hist. Nat., Paris 4: 92 (1804).

Synonyms *Grewia sclerophylla* Roxb. ex G. Don (1831), *Grewia aspera* Roxb. (1832).

Vernacular names Thailand: ya pit (northern), po yap (south-western), khao chi (north-eastern). Vietnam: c[of] ke l[as] r[ooj]ng.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand and drier parts of Peninsular Malaysia and Java.

Uses In Thailand the stems are used as a remedy for acne, and a root decoction as a remedy for fever. The bark produces good fibre for making ropes.

Observations A shrub up to 3 m tall; leaves ovate to rotundate, 7–12 cm × 5–12 cm, base rounded to cordate, apex acute or fringelike, double serrate or serrate, 3-veined from the base, hairy on both sides, petiole 1–2 cm long; inflorescence axillary, erect, 1–2 cm long, peduncle 1–5 mm long; flower buds ovoid to ellipsoid, 4–6 mm × 3 mm, sepals oblong, petals oblong, 2–3 mm × 1 mm, ciliate in lower half, stamens glabrous, ovary ovoid, c. 1.5 mm long, hairy; fruit ovoid, 2–4-lobed, glabrescent. *G. abutilifolia* occurs in open, dry, mixed deciduous forest at 100–1000 m altitude.

Selected sources 249, 742.

Grewia hirsuta Vahl

Symb. bot. 1: 34 (1790).

Synonyms *Grewia tomentosa* Juss. (1804), *Grewia polygama* Roxb. (1832).

Vernacular names Thailand: khao ki wok, ham ma, po pae (northern). Vietnam: c[of] ke l[oo]ng nh[as]m.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand and Java; possibly also drier parts of Peninsular Malaysia.

Uses In Thailand a stem decoction is used as a remedy for food poisoning and a root decoction as a diuretic. In India a distinction is made between plants with bitter and those with tasteless leaves. The bitter leaves are employed for nose and eye afflictions and as an anthelmintic, and the roots of these plants are used as an astringent and recommended to treat cholera, hydrophobia, kidney troubles, piles and as an anthelmintic. The tasteless leaves and fruits are used as a purgative, expectorant, carminative, abortifacient, emmenagogue, vulnerary, galactagogue and to treat an enlarged spleen, eye troubles, painful breasts, piles and rheumatism.

Observations A shrub or small tree up to 5 m tall; leaves oblong to lanceolate, 5–20 cm × 1.5–6 cm, base acute to obtuse, slightly unequal-sided, apex acute, acuminate to cuspidate, double serrate or serrate, 3-veined from the base, hairy beneath, petiole 0.2–1 cm long; inflorescence axillary, erect, 1–3 cm long, peduncle 0–5 mm long; flower buds ovoid to oblong, 4–8 mm × 2–4 mm, sepals lanceolate, petals oblong, c. 2 mm × 1 mm, hairy on both sides, stamens glabrous, ovary globose, c. 2 mm long, hairy; fruit rounded, 2–4-lobed, shining. *G. hirsuta* occurs in mixed deciduous and dry evergreen forest, often on limestone, at 100–1500 m altitude. Sometimes *G. tomentosa* is considered a separate species, and then *G. hirsuta* is confined to continental South-East Asia.

Selected sources 147, 249, 410, 742, 863.

Wongsatit Chuakul,
Noppamas Soonthornchareonnon
& Orawan Ruangsomboon

Gunnera macrophylla Blume

Bijdr. fl. Ned. Ind.: 513 (1826).

HALORAGACEAE

$2n$ = unknown

Vernacular names Indonesia: hariyang gede, tarate gunung (Sundanese), sukmadiluwih (Javanese). Philippines: balai, baloi, debit (Igorot, Bontok).

Origin and geographic distribution *G. macrophylla* occurs in mountainous areas of Sumatra, Java, Borneo (Sabah), the Philippines, Sulawesi, New Guinea and the Solomon Islands.

Uses In Java the infructescences of *G. macrophylla* are employed as a stimulant and tonic.

G. perpensa L. is an ingredient of traditional herbal remedies used for their uterotonic activity during pregnancy and childbirth in South Africa. A decoction of the root is taken to facilitate the ex-

pulsion of the afterbirth and proper clearing of the womb, and as a remedy for colic, especially during pregnancy.

Properties There is no information on the phytochemistry and pharmacological properties of *G. macrophylla*. However, two other *Gunnera* species, one from South America and one from Africa, have been investigated. In a general screening experiment for antithrombin activity, a methylene chloride extract of the leaves of *G. tinctoria* (Molina) Mirb., originally from South America but much cultivated elsewhere, showed about 80% inhibition of thrombin. In a general screening experiment for anti-hypertensive activity a crude extract of *G. tinctoria* inhibited the angiotensin converting enzyme (ACE) by more than 50%.

A crude decoction of *G. perpensa* leaves exhibited direct smooth muscle activity on an isolated rat uterus preparation but not on an ileum preparation. This direct uterotonic activity could justify its use in traditional remedies in Africa.

Botany A perennial, pilose herb, often with numerous stolons; stem very short. Leaves in a rosette, reniform to cordate, angular, rarely irregularly (2–)3-lobed, 2.5–70 cm × 2.5–70 cm, irregularly dentate, bullate; petiole up to 70 cm long, provided with 3 warts at base; stipules absent. Inflorescence a subterminal panicle with numerous lateral spikes, shortly peduncled or sessile, up to 60 cm long in fruit; lower spikes with female flowers, upper ones with male flowers, sometimes intermixed with bisexual flowers. Flowers unisexual, sometimes bisexual, small, with 2(–3) sepals; male flowers with 2 spatulate petals and 2 stamens; female flowers without petals, with inferior, 1-celled ovary and sessile stigma. Fruit a globose drupe c. 2 mm in diameter, glabrous, juicy, 1-seeded; pyrene flattened-globular, c. 1 mm in diameter.

Gunnera macrophylla Blume – habit of flowering and fruiting plant.

Gunnera, including *G. macrophylla*, represents a remarkable case of true symbiosis with cyanobacteria, capable of atmospheric nitrogen fixation. The *Nostoc* colonies reside in the warts at the base of the petiole.

Gunnera consists of some 30–50 species, and occurs in all tropics except continental Asia and Australia, and in temperate regions of the southern Hemisphere. In Malesia only 1 species is found.

Ecology *G. macrophylla* is found in wet or damp locations in the mountains, often gregarious, mostly on open or lightly shaded sites in disturbed habitats, pioneering on bare land, along paths and in openings in secondary forest, at (750–)1250–3000 m altitude.

Management In the Philippines intercropping *Brassica rapa* L. 'Chinese Cabbage' and *Brassica oleracea* L. 'White Headed Cabbage' with *G. macrophylla* resulted in a significant increase in yield of cabbage by as much as 50%. *Nostoc* symbiosis with *G. macrophylla* may fix up to 21 kg N/ha annually.

Genetic resources *G. macrophylla* is widespread, well adapted to disturbed habitats, and does not appear to be threatened by genetic erosion.

Prospects Little is known on the pharmacology of *Gunnera*, and nothing on that of *G. macrophylla*. Preliminary results of pharmacological research for some species outside South-East Asia are promising. Further research is needed to evaluate the potential of medicinal uses of *G. macrophylla*. The use of *G. macrophylla* as an auxiliary plant for soil improvement deserves more attention.

Literature 199, 247, 315, 334, 443, 491.

Other selected sources 77, 621.

R.P. Escobin

Gymnema R.Br.

Prodr.: 461 (1810).
ASCLEPIADACEAE
$x = 11$; *G. sylvestre*: $2n = 22$

Origin and geographic distribution *Gymnema* comprises approximately 20 species and occurs in Africa, tropical and subtropical Asia and Australia. It is represented in Malesia by about 10 species.

Uses *Gymnema* (particularly *G. sylvestre*) has a considerable reputation as a medicinal plant in the treatment of diabetes mellitus in different parts of the world, particularly in India and China. Moreover, the roots and leaves are used to treat rheumatoid arthritis, gout, inflammation of the blood vessels, oedema, fever, cough, haemorrhoids, boils, sores and snakebites, and as a stomachic and diuretic. The leaves are often considered a wholesome vegetable.

Properties *Gymnema* contains triterpenoid compounds with taste-modifying activity, collectively known as the gymnemic acids, and also gurmarin, which is a sweet taste-suppressing polypeptide found in *G. sylvestre*. When the leaf is chewed, the ability to taste sweetness is lost temporarily. Furthermore, 10 alternosides have been isolated from dried roots of *G. sylvestre*, several of which showed antisweet activity.

In India, the hypoglycaemic action of *G. sylvestre* has been confirmed in animal models and in insulin dependent as well as independent diabetic patients. Animal studies have suggested that regeneration of pancreatic tissue may be stimulated. Using in-vitro models, insulin secretagogue activity and inhibition of glucose absorption in the intestine have been attributed to conduritol A, gymnemosides and gymnemic acids. The content of gymnemic acids in leaves of Chinese plants was determined at 0.7–1.1%. Gymnemic acids may be useful in preventing dental caries when added to food or as a tea prepared from *G. sylvestre* leaves. In tests with rats in the United States, ingestion of *G. sylvestre* significantly lowered cholesterol concentration, but it did not lower and even tended to increase the systolic blood pressure. The ethanol extract of *G. sylvestre* leaves exhibited antihepatotoxic activity when administered intragastrically to rats at a dose of 300 mg/kg. It was suggested from tests with rats that a leaf extract of *G. sylvestre* improved serum cholesterol and triglyceride levels through influence over a wide range of lipid metabolism.

Leaf extracts of *G. inodorum* suppressed contractile tension and decreased the oxygen consumption induced by high K^+ solution in guinea-pig ileal longitudinal muscle, and lowered blood glucose levels. Leaf extracts of *G. inodorum* do not suppress sweetness and are not bitter, in contrast to those of *G. sylvestre*. However, crude saponin mixtures extracted from *G. inodorum* leaves inhibited glucose absorption in the isolated intestinal tract and suppressed the increased blood glucose in rats.

Botany Scandent shrubs or lianas up to 10 m long, with latex. Leaves opposite, simple and entire, with numerous trichomes; stipules absent. Inflorescence a raceme-like cyme, often 2 at a node, sessile or shortly pedunculate. Flowers small, bisexual, 5-merous; calyx inside with small basal glands; corolla campanulate, lobes about as long as tube, overlapping to the right, tube inside with 5 longitudinal ridges, sometimes produced into fleshy appendages and/or with lines of hairs along each side; stamens inserted at the base of the corolla, filaments connate into a tube, anthers with membranous apical appendages applied against the stigma; ovaries 2, free, superior, stigma head exceeding anthers. Fruit consisting of 1–2 follicles, beaked or not, dehiscing by a ventral suture, many-seeded. Seeds strongly compressed, with a prominent tuft of silky hairs.

In 1995 it was proposed that *Gymnema* be included in *Marsdenia*, which would then be a large pantropical genus. This proposal has not been adopted here because some new combinations have not been made for South-East Asian species. A taxonomic revision of *Gymnema* and related genera for South-East Asia is needed to confirm this conception.

Ecology *Gymnema* occurs in lowland forest, and has often been recorded for secondary forest, edges of forest and scrub vegetation.

Management In India, a rapid system for regenerating shoots from mature nodal explants of *G. sylvestre* has been developed. Single node stem explants can be inoculated on Murashige and Skoog medium containing 6-benzylaminopurine (5 mg/l) and naphthalene acetic acid (0.2 mg/l), and regenerated shoots are rooted on a half-strength medium without supplementing growth regulators.

Genetic resources The areas of distribution of *Gymnema* species are still unclear because of the lack of information on the taxonomy for South-East Asia. However, there seems no reason to consider them endangered, at least not for most species treated here, because they are widespread

and often have been reported from secondary vegetation types.

Prospects The prospects for *Gymnema* as a medicinal plant seem considerable, particularly for the treatment of diabetes. It has been patented as an antidiabetic. Tissue culture techniques are being developed to obtain a high content of active constituents. However, the results of experiments are somewhat conflicting, and more research is needed. A sound taxonomic overview is badly needed for a correct interpretation of the literature.

Literature 89, 755, 777.

Selection of species

Gymnema acuminatum (Roxb.) Wallich

Tent. fl. napal. 2: 50 (1826).

Vernacular names Malaysia: serapat kuning, sebueh api (Peninsular). Thailand: thong thaa khruea (Prachin Buri).

Distribution Southern Burma (Myanmar), southern Thailand and western Peninsular Malaysia.

Uses In Peninsular Malaysia, a poultice of the leaves has been used to treat small sores.

Observations A large scandent shrub or liana; leaves ovate to elliptical, 7–15 cm × 4.5–5.5 cm, petiole c. 1.5 cm long; corolla glabrous, whitish, appendages exserted; follicle 5–7.5 cm long, glabrous. *G. acuminatum* occurs in forest, often at edges and in open locations, and seems rather uncommon.

Selected sources 121, 789.

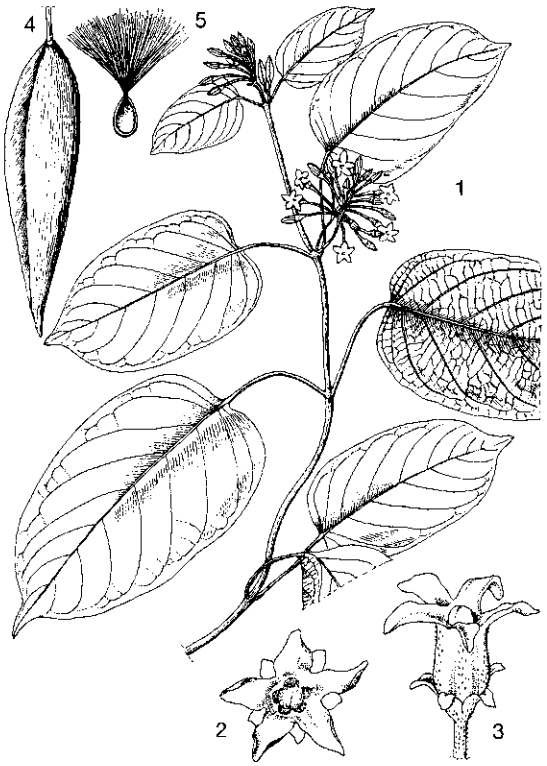
Gymnema inodorum (Lour.) Decne.

A.DC., Prodr. 8: 551 (1844).

Synonyms *Gymnema tingens* (Roxb.) Sprengel (1824), *Bidaria inodora* (Lour.) Decne. (1844), *Bidaria tingens* (Roxb.) Decne. (1844), *Gymnema syringifolium* (Decne.) Boerl. (1899), *Gymnema reticulatum* (Moon) Alston (1929), *Marsdenia tingens* (Roxb.) P.I. Forster (1995).

Vernacular names Indonesia: sayor pepe, uta mata (the Moluccas). Philippines: kalalaki-ti-dugep (Iloko). Cambodia: voë toahs. Thailand: phak chiang daa (Chiang Mai). Vietnam: lo[ax] ti.

Distribution Nepal, India, Burma (Myanmar), Laos, Cambodia, northern Vietnam, southern China, Thailand, Peninsular Malaysia, Java, Borneo, Timor, Sulawesi, the Moluccas and the Philippines.



Gymnema inodorum (Lour.) Decne. – 1, flowering branch; 2, flower in apical view; 3, flower in side view; 4, fruit; 5, seed.

Uses In the Moluccas, the roots are used to treat tightness of the chest and as an antidote against poisoning, and a poultice of the leaves is used as galactagogue. In China, all parts of the plant are used to treat infantile paralysis and pulmonary tuberculosis. The leaves are considered effective for the treatment of diabetes mellitus, rheumatoid arthritis and gout. They yield a blue or greenish-blue dye. In the Moluccas, young leaves and shoots are eaten raw or cooked, and young aerial parts are commonly used as a vegetable in northern Thailand.

Observations A climbing shrub or liana up to 25 m long; leaves ovate-oblong to ovate or broadly ovate, 4–14 cm × 2–9 cm, petiole 2–6 cm long; corolla minutely puberulent outside, yellow, corona lobes included; follicle 8–16 cm × 2.5–3 cm, glabrous, weakly beaked. *G. inodorum* is locally common in thickets and secondary forest.

Selected sources 62, 334, 542, 847, 848, 853, 1013.

Gymnema sylvestre (Retz.) Schultes

Roemer & Schultes, Syst. veg. 6: 57 (1820).

Synonyms *Gymnema affine* Decne. (1844), *Gymnema alterniflorum* (Lour.) Merr. (1935), *Marsdenia sylvestris* (Retz.) P.I. Forster (1995).

Distribution Africa, India, Sri Lanka, Vietnam, southern China, Japan (Ryukyu Islands); there are unconfirmed reports for Malesia: Malaysia, Indonesia.

Uses In China, all parts of the plant (but particularly the roots) are used to treat rheumatoid arthritis, gout, inflammation of the blood vessels, oedema, fever, haemorrhoids and snakebites. The leaves are applied in India to treat diabetes and cough, as a stomachic and diuretic, and the plant is also used to induce abortion. In eastern Africa, pounded and cooked roots are administered internally to treat epilepsy and snakebites and externally to treat boils.

Observations A liana up to 8 m long; leaves obovate to ovate or oblong-elliptical, 3–9 cm × 1.5–5.5 cm, petiole 0.3–1.2 cm long; corolla glabrous, greenish-white or cream-coloured, appendages exserted; follicle 4.5–9 cm × 2 cm, glabrous, with acuminate beak. *G. sylvestre* occurs in open forest and scrub vegetation.

Selected sources 89, 120, 121, 656, 755, 777, 846, 1013, 1038, 1039.

R.H.M.J. Lemmens

Gynochtodes Blume

Bijdr. fl. Ned. Ind.: 993 (1827).

RUBIACEAE

x = unknown

Origin and geographic distribution *Gynochtodes* is a small genus comprising approximately 10 species. It occurs in Vietnam, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines, eastwards to Micronesia and Fiji, and southwards to northern Australia. Peninsular Malaysia and the Philippines are richest in species, with about 3 and 4 species, respectively.

Uses Only little information exists on the uses of *Gynochtodes*: in Peninsular Malaysia, a decoction of leaves and roots has been used internally to treat stomach-ache, whereas leaves have been applied as a poultice to treat headache.

Botany Slender lianas, sometimes shrubs, glabrous, with stem up to 0.5 cm in diameter. Leaves opposite, simple and entire, more or less leathery, usually with domatia below, shortly petiolate; stipules interpetiolar, becoming corky. Inflorescence an axillary umbelliform to glomeruliform cyme; bracts concealing the peduncle and becoming corky. Flowers bisexual or unisexual, small, 4–5-merous; calyx with short tube and annular, toothed limb; corolla rather thick, with short tube and valvate lobes longer than tube, pilose in throat; stamens inserted in throat of corolla, exserted; ovary inferior, 4-celled, style bifid or simple. Fruit a globose, fleshy drupe with 2–4 pyrenes; pyrenes dorsally compressed. Seeds compressed.

Although the genus was originally published as *Gynochtodes*, the orthographic variant *Gynochthodes* is often used in literature. It is related to *Caelospermum*, *Morinda* and *Pogonolobus*, and can be distinguished from these genera by the axillary, usually compound cymes, drupes with 2–4 pyrenes, the morphology of stipules and bracts, and pollen morphology.

Ecology *Gynochtodes* occurs as lianas in forest at low altitudes, sometimes up to 700 m. Some species can also be found in open country, e.g. as a climber in shrub vegetation and hedges. *G. sublanceolata* has been recorded as a common species in species-poor anthropogenic heath forest on extremely acidic soils (pH 3.3–3.9) in Singapore and southern Peninsular Malaysia.

Genetic resources The *Gynochtodes* species treated here do not seem to be immediately endangered as they are fairly widely distributed. However, most of them seem confined to lowland forest and as this habitat is under increasing pressure the species with narrow areas of distribution may become liable to extinction, e.g. species endemic to the Philippines.

Prospects Very little is known about the botany, phytochemistry or properties of *Gynochtodes*. Research is needed on the taxonomy as well as chemical contents and pharmacology before the significance as a medicinal plant can be determined for the various species.

Literature 121.

Selection of species

Gynochtodes coriacea Blume

Bijdr. fl. Ned. Ind.: 993 (1827).

Vernacular names Malaysia: akar lempedu, akar mali, lempedu tanah (Peninsular).

Distribution Peninsular Malaysia, Singapore, Sumatra and Java.

Uses In Peninsular Malaysia, the plant is used as a poultice to treat headache.

Observations A liana with stem up to 0.5 cm in diameter; leaves elliptical-lanceolate to ovate-lanceolate, 6–13 cm × 3–7 cm, obtuse to shortly acuminate at apex, leathery; corolla greenish; fruit c. 1 cm in diameter, white when ripe. *G. coriacea* occurs in lowland forest, in Java up to 300 m altitude.

Selected sources 62, 121, 459, 789.

Gynochtodes sublanceolata Miq.

Fl. Ned. Ind., Suppl.: 548 (1861).

Vernacular names Malaysia: akar sulong, lempedu hitam (Peninsular). Thailand: thao nuai, yo baan (Chumphon).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra, Bangka and Borneo.

Uses In Peninsular Malaysia, a decoction of leaves and roots is used to treat stomach-ache.

Observations A slender liana; leaves elliptical-lanceolate, 6–8.5 cm × 1.5–2.5 cm, acuminate at apex, thin-leathery; corolla white; fruit c. 0.5 cm in diameter, bluish when ripe. *G. sublanceolata* often occurs in open locations in the forest, also as a climber in scrubby vegetation and hedges, often near the sea.

Selected sources 121, 334, 459, 789, 855.

R.H.M.J. Lemmens

Gynura Cass.

Dict. Sci. Nat. 34: 391 (1825).

COMPOSITAE

$x = 10$; *G. aurantiaca*: $2n = 20$

Origin and geographic distribution *Gynura* comprises some 40 species, and occurs in the Old World tropics and more temperate eastern Asia; 7 species occur in Africa, 9 in eastern Asia and the Himalayas, and 19 in South-East Asia, 17 of which are indigenous.

Uses *Gynura* is in general used as a haemostatic, vulnerary and styptic. Various preparations are externally applied to treat numerous skin problems. *Gynura* is well known as a remedy for breast tumours.

In Java a poultice of pounded leaves of *G. aurantiaca* (Blume) DC. or the closely resembling *G. ajakensis* Hochr. is applied to ringworm. *G. japonica* (Thunberg) Juel. (synonyms: *G. pinnatifida* (Lour.) DC., *G. segetum* Lour. ex Merr.) is used in Vietnamese folk medicine as a haemostatic, and as a vulnerary and styptic in traditional Chinese medicine. A water extract of the whole plant is used in China to treat tonsilitis, bruises, sprains and internal bleeding. Similar traditional uses are mentioned for *G. bicolor* (Roxb. ex Willd.) DC. Another Chinese species, *G. divaricata* (L.) DC. (synonym: *G. ovalis* Ker Gawl.), is imported in South-East Asia, and used as a vulnerary and styptic. Young *Gynura* shoots are sometimes eaten as a vegetable. *Gynura* is cultivated as an ornamental.

Properties Phytochemical information on *Gynura* is rather scanty, and most information refers to *G. japonica*. Iridoids, terpenyl coumarins, spirostanol steroids, pyrrolizidines, purines, pyrimidines and chromanones have been isolated from *Gynura* species.

Oral administration of an ethanolic extract of *G. procumbens* leaves significantly suppressed elevated serum glucose levels in streptozotocin-induced diabetic rats; 150 mg/kg was found to be the optimum hypoglycaemic dose. When the optimum dose was given to diabetic rats for 7 days, the extract significantly reduced serum cholesterol and triglyceride levels.

An aqueous extract of *G. procumbens* showed considerable hypotensive activity in a rat model. The compounds 3,5-di-O-caffeoylquinic acid and 4,5-di-O-caffeoylquinic acid isolated from the ethanolic extract of *G. procumbens* posses antiviral activity against herpes simplex virus type I and type II.

The methanolic extract of the roots of *G. elliptica* Yabe & Hayata, a Taiwanese endemic, showed antiplatelet aggregation activity. Of the isolated compounds the chromanone 6-acetyl-2,2-dimethylchroman-4-one and vanillin showed strong and highly selective activity.

Botany Erect, climbing, creeping or prostrate, perennial herbs; stems angular, striate. Leaves alternate or in a rosette, entire, serrate or lyrate-pinnatisect, petiolate or sessile; stipules absent. Inflorescence consisting of rather large heads, combined in axillary or terminal, often panicled corymbs; peduncle with 1 or more small, linear bracts; involucral bracts 1–2-seriate, linear, cohering into a cylindrical tube, with a ring of outer smaller, linear, free bracts. Flowers all tubular, bisexual; corolla abruptly widened at the base, with a narrowly campanulate, 5-lobed limb much shorter than the tube; stamens 5; ovary inferior, 1-celled, style with 2 long, exserted arms. Fruit a linear to linear-fusiform achene, ribbed; pappus hairs numerous, long, thin, white.

The use of *Gynura* as a remedy for breast tumours most likely refers to *G. pseudochina*. However, in Indonesia it may also refer to *G. procumbens* as

both species share their vernacular name 'daun dewa'.

Ecology The *Gynura* species of medicinal importance are found in relatively open and often disturbed habitats such as grassland, hedges, forest margins and plantations.

Management *Gynura* can be propagated by seed or cuttings, and species possessing tubers simply by division.

Genetic resources The *Gynura* species of medicinal importance are relatively widespread and commonly cultivated. The risk of genetic erosion appears to be limited. Several selections of *Gynura* densely covered by purple hairs and often with purple to variegated foliage have become popular ornamentals for outdoor use in tropical regions or indoor use in temperate regions.

Prospects Despite their many medicinal applications, information on the chemical and pharmacological properties of *Gynura* is very scanty. The plants are relatively easy to cultivate and the observed antiviral activity and the claims concerning diabetics and bleeding time merit further research.

Literature 193, 334, 415, 524, 568, 1053.

Gynura procumbens (Lour.) Merr. – 1, flowering branch; 2, flower head; 3, flower without ovary and pappus.

Selection of species

Gynura procumbens (Lour.) Merr.

Enum. Philipp. fl. pl. 3: 618 (1923).

Synonyms *Gynura sarmentosa* (Blume) DC. (1838).

Vernacular names Indonesia: sambung mjawa, daun dewa, kalingsir (Sundanese). Malaysia: akar sebiak, kelemai merah, kacham akar. Cambodia: chi angkam. Thailand: pra-kham dee khwaai, ma kham dee khwaai (Pattani), mu maeng sang (Chumphon). Vietnam: b[aaf]u d[aas]t, rau l[us]i, d[aa]y chua l[ef].

Distribution Western and central Africa, and from southern China throughout continental South-East Asia and Malesia eastward to Papua New Guinea; also widely cultivated.

Uses In Java *G. procumbens* is employed to treat kidney afflictions in Chinese traditional medicine. The leaves are used in herbal baths to treat rheumatism and paralysis. Dried and pounded leaves mixed with oil are externally applied on various skin complaints. In Malaysia, a decoction is used as a remedy for dysentery. In Cambodia the plant is an ingredient of a complex prescription applied as a febrifuge. The leaves are also used as a flavouring for food. In Java young shoots are eaten raw as a vegetable. In Africa boiled leaves are applied to relieve general body pains, whereas fresh leaves are applied to relieve rheumatic pains.

Observations A scrambling or weakly climbing, perennial herb, stems up to 6 m long, leafy, glabrous or sparsely pubescent; leaves ovate to narrowly ovate in outline, extremely variable in shape, 3–10 cm × 0.5–3 cm, lower surface more or less purple, at the base of the stem petiolate, higher up petiolate or sessile, sometimes auriculate; inflorescence a series of axillary and terminal corymbs of up to 20 heads, these cylindrical to turbinate, longer than broad, peduncle up to 6 cm long, inner involucral bracts 8–13, with a length of 8–17 mm, glabrous; corolla 10–16 mm long, yellow, turning red; fruit 5–6 mm long. *G. procumbens* is very variable and has been split into several species at various times in the past, but they all intergrade. *G. procumbens* occurs in a wide range of habitats, but prefers moist forest, up to 2800 m altitude.

Selected sources 78, 120, 121, 671, 732.

Gynura pseudochina (L.) DC.

Prodr. 6: 299 (1838).

Synonyms *Senecio pseudochina* L. (1753), *Gynura biflora* (Burm.f.) Merr. (1921).

Vernacular names Indonesia: daun dewa, beluntas cina (general), sam sit (Chinese). Thailand: kham khok (Khon Kaen, Loei), phakkaat nok khao (Surat Thani), naat haeng (Nakhon Ratchasima). Vietnam: b[aaf]u d[aas]t d[aj]i, ng[ar]i r[is]t, th[oor] tam th[aas]t.

Distribution From India and Sri Lanka (possibly only in cultivation) eastward to Burma (Myanmar), Indo-China, southern China and Thailand; cultivated in Peninsular Malaysia and Java.

Uses In Java the roots are externally and internally used as a remedy for bruises. Likewise a leaf poultice is externally applied, and it is also used against pimples. The leaves and roots are further credited with haemostatic activity, also to regulate menses, and especially for the treatment of breast tumours. A decoction of leafy stems is drunk for these purposes. In Thailand the root is considered antipyretic and vulnerary. Fresh roots and leaves, ground with some water, are externally applied to herpes simplex and herpes zoster infections. The water extract reduces both inflammation and recurrence of the herpes infection. In Vietnamese folk medicine roots are reputed to be a tonic, leaves are considered emollient and resolvent, and leaf sap is employed as a gargle to treat sore throat. A leaf poultice is externally applied to breast tumours and erysipelas. Cooked leaves are sometimes eaten as a vegetable. In Java *G. pseudochina* is often cultivated as a potplant.

Observations An erect, somewhat fleshy, perennial herb (7–)20–50 cm tall, typically with a leaf rosette and single stem, sparsely pubescent, roots producing rounded, sometimes lobed tubers (1–)2–6 cm in diameter; lower rosette leaves simple to shallowly lobed, obovate, spatulate, elliptical or ovate, (1–)7–40 cm × (1–)1.5–12 cm, base tapering, entire or obscurely denticulate, petiole 0.3–3(–8) cm long, upper rosette leaves always more dissected, slightly smaller, pubescent on both surfaces; inflorescence simple or 1–2-branched, heads loosely grouped, 1–5 per branch, heads campanulate, not or little longer than broad, peduncle 0.5–4 cm long, pubescent, inner involucral bracts about 13, 7–12 mm long; corolla 10–13 mm long, yellow to red; fruit 3–4 mm long. *G. pseudochina* occurs in Vietnam and Thailand up to 1200 m altitude.

Selected sources 121, 192, 334, 671, 732, 817, 992.

Lean Teik Ng & Su Foong Yap

Harmsiopanax harmsii K. Schumann ex K. Schumann & Lauterb.

Fl. Schutzgeb. Südsee, Nachtr.: 329 (1905).

ARALIACEAE

$2n$ = unknown

Vernacular names Papua New Guinea: obolo, mak (Southern Highlands Province), mafiong (Kotte).

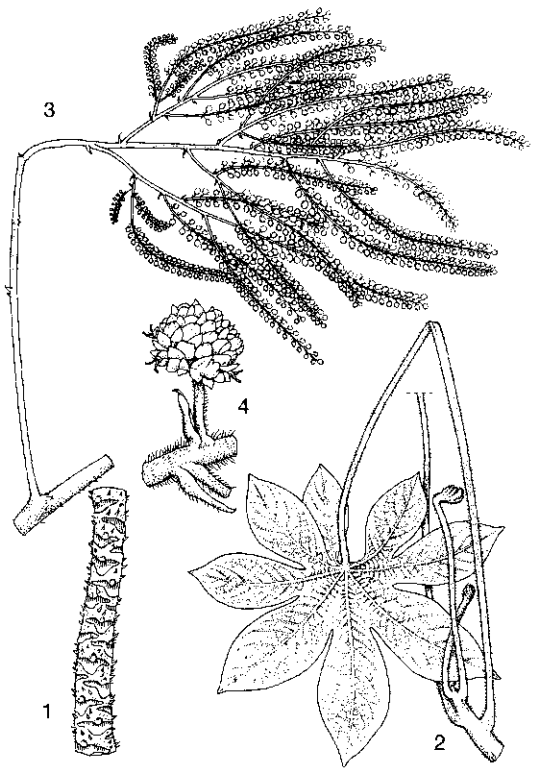
Origin and geographic distribution *H. harmsii* is endemic to New Guinea. It occurs most frequently in the Morobe Province of Papua New Guinea, but can also be found throughout other parts of north-eastern and eastern New Guinea.

Uses In Papua New Guinea, a poison antidote is prepared by squeezing a leaf and mixing the juice with traditional ash salt, wild ginger and two unidentified plant species. The bark and roots are also used as a poison antidote. The leaves are sometimes used as wraps for food and the wood is a good firewood.

Botany A small tree or shrub up to 8 m tall, with a slender, usually single trunk; young stems covered with spines, bristles and hairs, old stems with smooth bark, small rounded lenticels and spines. Leaves arranged spirally in terminal clusters, simple but deeply palmately lobed with 5–9 lobes, lamina rounded in outline, c. 30 cm × 40 cm, cordate at base, densely woolly and with numerous bristles; petiole c. 50 cm long, with clasping base; stipules absent. Inflorescence a terminal panicle with numerous leaf-like bracts soon falling; ultimate branches with small bracts subtending pedunculate umbellules. Flowers bisexual, small, 5-merous, creamy green; calyx a minute, fringed rim; petals free, ovate, c. 1 mm long, imbricate; stamens with very short filaments; ovary inferior, 2-locular, with conical disk and 2 subulate styles. Fruit consisting of 2 dry mericarps, each 3-ribbed and crowned with the divergent styles.

The large inflorescences often develop after the leaves have fallen. The plants often die after flowering and fruiting (monocarpic).

Harmsiopanax comprises 3 species: one (*H. aculeatus* (Blume) Boerl.) in Java, the Lesser Sunda Islands and Sulawesi, and the other two (*H. harmsii* and *H. ingens* Philipson) endemic to New Guinea. The genus has an isolated position within the *Araliaceae*, and some characters seem to indicate a relationship to *Umbelliferae*; the fruit splitting into 2 dry, 3-ribbed mericarps closely approaches *Umbelliferae* fruits, and the monocarpic habit is not uncommon in this family as contrast-



Harmsiopanax harmsii K. Schumann ex K. Schumann & Lauterb. – 1, part of trunk; 2, top of stem with leaves; 3, inflorescence branch; 4, umbellule of flowers.

ed with *Araliaceae*. It is not impossible that the information on uses given here refers to *H. ingens* instead of *H. harmsii*.

Ecology *H. harmsii* occurs on forested hills, grassy slopes, regrowth and on roadsides; it is often common in former gardens and near villages. It rarely exceeds 1800 m altitude, whereas *H. ingens* is more common at higher altitudes.

Genetic resources Although the area of distribution of *H. harmsii* is rather limited, there is no reason to consider it endangered. It is locally common and also occurs in disturbed habitats.

Prospects Research on phytochemistry and pharmacological properties of *H. harmsii* is needed to be able to judge its value as a medicinal plant.

Literature 176, 347.

Other selected sources 743.

R.A. Banka

Hemigraphis alternata (Burm.f.) T. Anderson

Journ. Linn. Soc. 7: 114 (1864).

ACANTHACEAE

$2n = 28$

Synonyms *Hemigraphis colorata* (Blume) Hallier f. (1897).

Vernacular names Metal-leaf, red-flame (En). Brunei: sembangun. Indonesia: keji beling (Javanese), remek daging (Sundanese), lire (Ternate). Malaysia: kemoyan batu. Philippines: dahon-pula (Tagalog). Thailand: daat ta kua, hom khrang (northern), ruesee phasom laeo (central). Vietnam: b[as]n t[uwj] c[ar]nh.

Origin and geographic distribution *H. alternata* is possibly indigenous in the eastern half of Malesia, and often found cultivated, e.g. in Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines, Hawaii and South America. It has become locally naturalized.

Uses *H. alternata* leaves are said to be diuretic because of their high potassium content. In Java, they are considered styptic, and used to stop bleeding wounds, haemorrhage after parturition, venereal discharges, dysentery and haemorrhoids. The leaves in decoction are taken internally for excessive menstruation, and are applied externally for skin complaints. The leaves are eaten as a cure for gallstones. In Vietnam, the leaves are also used to treat haemorrhoids. The use as a styptic may be connected with the reddish colour of the leaves.

H. alternata is often cultivated as an ornamental in borders, particularly for its attractive foliage, but also as a ground cover.

Properties Only very little is known about the phytochemistry and pharmacology of *H. alternata*. Besides a high potassium content, the leaves contain flavonoids. Furthermore, an ethyl-acetate extract of the leaves shows anti-bacterial activity. A leaf infusion also showed some diuretic activity in anaesthetized rabbits, as measured by an increase of the amount of urine droplets.

Botany A prostrate, perennial herb, stems 30–75 cm long, rooting at the nodes. Leaves opposite, ovate to oblong, 4–10 cm × 3–6 cm, base rounded or cordate, apex subobtuse, margins toothed; upper surface purplish grey, lower surface dark purple-green to wine red, rather densely pubescent to subglabrous on veins beneath; petiole 2–5.5 cm long; stipules early caducous. Inflorescence an inconspicuous, short-lived terminal spike, up to 10 cm long, peduncle 1–4.5 cm long,

bracts imbricate, 7–15 mm long, greenish-purple, bracteoles minute or absent. Flowers usually in pairs in the axils of lower bracts, solitary in axils of higher bracts, bisexual; calyx 5-parted, 7–10 mm long, green; corolla tubular, cylindrical below, swollen above, 10–15 mm long, inside posterior side hairy, with 5 subequal lobes, white, sometimes with thin purple veins; stamens 4, inserted at the base of the widening of the corolla tube, slightly didynamous, 2-celled, filaments hairy below, glandular above; ovary superior, 2-celled, stigma lobes subulate, posterior one longer. Fruit a narrowly ellipsoid capsule, 6–12-seeded. Seeds flat, hairy.

H. alternata can be found flowering throughout the year. *Hemigraphis* is a genus of about 90 species of southern China, Malesia, tropical Australia and the Pacific islands.

Ecology *H. alternata* occurs on sunny waste places and is common in lawns, having spread from borders.

Management Fruits do not develop in Java, so *H. alternata* is propagated through stem cuttings 5–8 cm long. The leaves are harvested from cultivated plants whenever the need arises.

Genetic resources *H. alternata* does not seem to be at risk of genetic erosion as it is widely planted as an ornamental. No breeding programmes for medicinal purposes are known to exist.

Prospects Due to the limited amount of data available for *H. alternata*, it is rather difficult to evaluate its prospects. More research on the phytochemistry and pharmacological properties is therefore needed.

Literature 334, 812, 904.

Other selected sources 62, 731, 760, 820.

G.H. Schmelzer

Henckelia Sprengel

Anleit., ed. 2, 2(1): 402 (1817).

GESNERIACEAE

$x = 9$

Origin and geographic distribution *Henckelia* comprises approximately 180 species and occurs in southern India, Sri Lanka, Thailand, Peninsular Malaysia, Sumatra, Borneo, the Philippines, Sulawesi and New Guinea. Peninsular Malaysia is extremely rich in species (about 90), followed by Borneo (about 50) and Sumatra (12). *Henckelia* has been recorded rarely east of Borneo: 2 species in Sulawesi and 1 in New Guinea. There is only 1 species in the Philippines (Palawan).

Uses A few uses in traditional medicine are known for roots and leaves of *Henckelia* in South-East Asia: as a protective medicine after childbirth, as a poultice on wounds, to treat itch and rash, and to treat cough, dysentery and colic.

Properties *H. falcata* (Kiew) A. Weber gave a strong positive reaction in a test for the presence of saponins in Malaysia. No more information is available for *Henckelia*, but some research has been done on chemistry and properties of a few more or less related *Didymocarpus* species in India. Several compounds with insecticidal and fungicidal activities have been isolated, particularly from *Didymocarpus pedicellatus* R.Br. and *Didymocarpus oblongus* D. Don.

Botany Perennial herbs or small shrubs; stem herbaceous or woody, creeping, ascending or erect. Leaves usually opposite with the leaves of a pair often unequal, but sometimes alternate or arranged spirally, often crowded towards apex of stem, simple, usually dentate or serrate, usually pubescent; stipules absent. Inflorescence an axillary cyme, often reduced to solitary flowers, often several together in a leaf-axil. Flowers bisexual, 5-merous; sepals usually free to base; corolla tubular-infundibuliform to campanulate, sometimes very short-tubed with flat spreading limb, limb 2-lipped; stamens 2, with filiform filaments inserted at about the middle of the corolla tube, staminodes 2, short, hooked; disk cup-shaped, sometimes developed as a ventral gland; ovary superior, cylindrical, passing into a long style with capitate stigma. Fruit a cylindrical, sometimes ellipsoid capsule, acuminate, making an angle with the stalk, opening dorsally, many-seeded. Seeds minute, ellipsoid.

The flowers of *Henckelia* are pollinated by insects. They often produce nectar (in flowers with well-developed corolla tube) or they offer only pollen (in flowers with shorter corolla tube). Seed dispersal is by water drops, either by washing out seeds or by ballistic force.

Until recently, all *Henckelia* species were considered to belong to *Didymocarpus*. However, recent studies showed that *Henckelia* should be reinstated. *Didymocarpus* is now an essentially Sino-Himalayan genus of about 80 species, extending southwards through Burma (Myanmar), Vietnam and Thailand to Peninsular Malaysia where there are about 8 species. It is characterized by the fruits (erect on the pedicel, dehiscing loculicidally along both sutures, often distinctly stipitate) and habit (perennials with annual or monocarpic flow-

ering stems). *Henckelia* can be distinguished by the fruits which make an angle with the pedicel and are held more or less horizontally, dehiscent only along the dorsal suture and not narrowed at base, and by the often woody stems or rosettes with continuous growth. *Henckelia* includes *Loxocarpus*, *Codonoboea* and *Platyadenia*.

Ecology *Henckelia* grows on the forest floor, usually in more dense and humid primary forest. It can be locally common, and carpet the forest with flowers for a few days at intervals. Some species are confined to the lowlands, whereas others are restricted to higher altitudes in the mountains.

Management Attempts to cultivate larger-flowered *Henckelia* species for ornamental purposes have failed, maybe because they have an obligate mycorrhizal association, which is lacking in cultivation.

Genetic resources In general, *Henckelia* species have markedly small areas of distribution; many species are restricted to islands or limited regions on the mainland, e.g. single mountains. This indicates liability to genetic erosion. The comparatively widespread *H. platypus* shows considerable variation in flower colour and robustness, indicative of genetic polymorphism.

Prospects Research on phytochemistry and pharmacological properties is needed to establish the value of *Henckelia* as a medicinal plant, which appears to be marginal as yet. Some species have ornamental value if the difficulties in cultivation are solved. The recording of variability and distribution of the species is still incomplete.

Literature 121.

Selection of species

Henckelia atrosanguinea (Ridley) A. Weber

Beitr. Biol. Pflanzen 70: 340 (1997).

Synonyms *Didymocarpus atrosanguineus* Ridley (1893).

Distribution Endemic to the central-eastern part of Peninsular Malaysia.

Uses *H. atrosanguinea* is one of the many ingredients of infusions that were once administered as a protective medicine after childbirth in Peninsular Malaysia. However, this was based on a doubtful identification.

Observations A shrublet with woody, stout stem up to 15 cm tall; leaves crowded at top of stem, lanceolate, c. 25 cm × 10 cm, crenulate to dentate, velvety pubescent; flowers solitary, corolla c. 5 cm long, deep red with yellow throat. *H. atrosanguinea* occurs in lowland forest.

Selected sources 121, 789, 984.

Henckelia crinita (Jack) Sprengel

Syst. veg., ed. 16, 4(2): 13 (1827).

Synonyms *Didymocarpus crinitus* Jack (1820).

Vernacular names Malaysia: meroyan kerbau, pokok ekor kuching, sempoh tarang (Peninsular).

Distribution Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia a decoction of *H. crinita* roots was once used as a protective medicine after childbirth; in peninsular Thailand it is also applied as a poultice to wounds.

Observations A shrublet with unbranched woody stem up to 40 cm tall; leaves crowded at top of stem, sessile, narrowly lanceolate, c. 15 cm × 2.5 cm, serrate, densely velvety pubescent; flowers solitary, corolla c. 4 cm long, pale blue to whitish; fruit up to 7.5 cm long, slender. *H. crinita* occurs in hill forest.

Selected sources 121, 789, 984.

Henckelia platypus (C.B. Clarke) A. Weber

Beitr. Biol. Pflanzen 70: 352 (1997).

Synonyms *Didymocarpus platypus* C.B. Clarke (1883).

Vernacular names Malaysia: julang rimba, semboyan (Peninsular). Thailand: saan tao (Surat Thani).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra; perhaps also Borneo.

Uses In Peninsular Malaysia, a decoction of the roots is used to treat cough.

Observations A shrublet with unbranched woody stem; leaves crowded at top of stem, sessile, oblanceolate, up to 30 cm × 7.5 cm, serrate, with scattered hairs; flowers solitary, corolla c. 3 cm long, whitish or pale purple with yellow throat; fruit c. 3.5 cm long, slender. *H. platypus* occurs in lowland forest.

Selected sources 121, 789, 984.

Henckelia reptans (Jack) Sprengel

Syst. veg., ed. 16, 4(2): 14 (1827).

Synonyms *Didymocarpus reptans* Jack (1820).

Vernacular names Malaysia: bunga jarum, akar sumpu darah, rugum bukit (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia, a decoction of the leaves and roots is used to treat dysentery and colic with constipation.

Observations A creeping herb up to 30 cm long; leaves in distant pairs, petiolate, elliptical to ovate, up to 7.5 cm × 2 cm, crenulate, villous-pubescent; flowers solitary, corolla up to 1.5 cm long, white with purple and yellow streaks in throat; fruit c. 2.5 cm long, scabrid. *H. reptans* occurs in lowland and hill forest.

Selected sources 121, 789, 984.

Erlin Rachman & R. Kiew

Hetaeria obliqua Blume

Coll. Orchid.: 104, t. 34, fig. 1 (1859).

ORCHIDACEAE

$2n$ = unknown

Vernacular names Malaysia: pokok tambak hutan (Peninsular).

Origin and geographic distribution *H. obliqua* occurs in Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia the leaves are applied to sores.

Botany A terrestrial herb with a creeping, ascending stem, up to 30 cm tall. Leaves alternate, simple and entire, obliquely lanceolate, 5–7.5 cm × 2–2.5 cm, dark green, often with a median silver bar; petiole 1–2.5 cm long. Inflorescence a dense spike 7.5–25 cm long, bracteate, many-flowered. Flowers bisexual, small, c. 6 mm long, 3-merous, reddish-white; upper sepal connate with petals, lip small, directed upwards, initially rolled into a narrow tube, enclosed by the sepals; column distinct, yellow, anther with 2 pollinia, rostellum with 2 long branches. Fruit an ellipsoid capsule c. 9 mm long. Seeds very small.

Hetaeria comprises about 30 species, most of them in South-East Asia, but a few in Australia and Pacific islands.

Ecology *H. obliqua* occurs in lowland forest.

Genetic resources *H. obliqua* is locally common, e.g. in southern Peninsular Malaysia, and there is no reason to consider it liable to genetic erosion.

Prospects It is unlikely that the use of *H. obliqua* will increase, unless future research reveals interesting pharmacological properties.

Literature 121.

Other selected sources 789.

R.H.M.J. Lemmens

Heterostemma cuspidatum Decne.

DC., Prodr. 8: 630 (1844).

ASCLEPIADACEAE

$2n$ = unknown

Vernacular names Philippines: buyok-buyok, biniguasan, San Bartolome (Tagalog).

Origin and geographic distribution *H. cuspidatum* is endemic to the Philippines; it occurs in Luzon and Busuanga.

Uses An ointment of *H. cuspidatum* leaves is applied to ulcers; it is credited with antiseptic activity.

In China the roots of *H. brownii* Hayata are used to treat malaria and the aerial parts to treat tumours; a decoction of *H. oblongifolium* Costantin is used as a galactagogue.

Properties There is no information for *H. cuspidatum*, but two purines, heteromines D and E, and three pyrimidines, heteromines F, G and H, were isolated from aerial parts of *H. brownii* from Taiwan. Heteromines D and E showed in-vitro cytotoxicity against 5 cancer cell lines.

Botany A slender liana, with white latex; stem with corky wings or ridges. Leaves opposite, simple and entire, ovate, 6.5–17 cm × 3.5–10 cm, rounded to subcordate at base, acuminate at apex, herbaceous, glabrescent, 3–5-veined from base, with glands at lamina base, long-petiolate; small stipular structures present at base of petiole. Inflorescence a cyme appearing at the nodes between a leaf pair. Flowers bisexual, regular, 5-merous; pedicel 1.5–2 cm long; sepals with glands at base of lobes; corolla rotate, c. 8 mm in diameter, with broadly ovate, fleshy segments spreading horizontally, hairy, purplish; stamens inserted at base of corolla tube, connate into a column, with 2 pollinia in each anther theca, staminal corona of 5 lobes adnate to the staminal column; ovaries 2, superior, free except for tips, 1-celled. Fruit consisting of 2 linear-fusiform, smooth follicles 10–14 cm long, many-seeded. Seeds ovate to oblong, flat, concave-convex, c. 13 mm long, comose at one end with white hairs.

Heterostemma comprises approximately 30 species and occurs from Nepal, India, Sri Lanka and China, through Burma (Myanmar), Indo-China, Thailand and the Malesian region, to northern Australia, Fiji, Samoa, Tonga and New Caledonia.

Ecology *H. cuspidatum* occurs in secondary forest and thickets at low altitudes.

Genetic resources *H. cuspidatum* is endemic to the northern half of the Philippines, and may become endangered, although it has been recorded from disturbed forest.

Prospects Information on most aspects of *H. cuspidatum* is very poor; more research is needed to be able to judge its future value as a medicinal plant.

Literature 570, 760.

Other selected sources 621.

A.M. Aguinaldo

Heynea trijuga Sims

Curtis, Bot. Mag. 41 : t. 1738 (1815).

MELIACEAE

$2n = 28$

Synonyms *Heynea sumatrana* Miq. (1861), *Walsura trijuga* (Sims) Kurz (1875), *Trichilia connaroides* (Wight & Arnott) Bentv. (1962).

Vernacular names Indonesia: mamak (Sumatra). Malaysia: mamak, tangisong burong, duak (Peninsular). Thailand: ka-do-nong aa-pee, song kae (peninsular), mafueang paa (northern). Vietnam: tr[uw][owf]ng n[as]t.

Origin and geographic distribution *H. trijuga* occurs from Nepal, India and Burma (Myanmar), through Indo-China, southern China and Thailand, to Malesia (Peninsular Malaysia, Sumatra, Borneo and the Philippines). Since long it is cultivated as an ornamental in Java.

Uses In Peninsular Malaysia and northern Vietnam a leaf decoction of *H. trijuga* is drunk to treat cholera. In India the bark and leaves are credited with bitter and tonic properties and various plant parts are known to be toxic. Fresh roots are used to treat menstruation disorders in Nepal. The wood is used for beams and agricultural implements.

Properties The pericarp of *H. trijuga* fruits contains tirucallane-type triterpenoids as well as limonoids. A crude bark extract showed a reduction in growth of larvae of the moths *Peridroma saucia* and *Spodoptera litura*. The active component was identified as hirtin.

Botany A small tree up to 15 m tall; bole up to 20 cm in diameter. Leaves alternate, imparipinnate, (1–)3–5(–6)-jugate, up to 50 cm long; rachis transversely compressed at leaflet attachment points; petiole 5–15 cm long; stipules absent; leaflets opposite, ovate-oblong, 4.5–20 cm × 2–7.5 cm, base asymmetric, rounded to acute, apex acuminate. Inflorescence an axillary, corymbose cyme up to 50 cm in diameter, long pedunculate. Flowers bisexual, regular, 4–5-merous, scented, pedicellate; calyx c. 1 mm high, pale pink; petals oblong, c. 2.5 mm × 1 mm, white to pink or cream; stamens 8 or 10, united at base, alternately long and short, anthers inserted between 2 teeth; disk fleshy; ovary superior, 2(–3)-celled, glabrous. Fruit a globose capsule 1–2 cm in diameter, glabrous, pink, dehiscing by 2 valves, 1-seeded. Seed ovoid, almost completely enclosed by a white aril, testa dark brown, dangling from a long funicle. Seedling with hypogeal germination; cotyledons thick.

After a period of dry weather trees may become partially deciduous and flowering is initiated.

Heynea comprises 2 species. *H. velutina* How & Chen from Indo-China and southern China differs from *H. trijuga* by its hairy, 2-seeded fruits.

Ecology *H. trijuga* occurs in rain forest, especially in margins and in regenerating clearings and along roadsides, from sea-level up to 1250 (–2000) m altitude.

Genetic resources *H. trijuga* is widespread, well-adapted to disturbed habitats, and is not threatened by genetic erosion.

Prospects Little is known on the pharmacology of *H. trijuga*. Further research is needed to evaluate the potential of its traditional medicinal uses. *H. trijuga* deserves more attention as an ornamental tree for roadsides and gardens.

Literature 121, 178, 181, 247, 396, 1019.

Other selected sources 62, 669, 731.

S. Brotonegoro & W. Wiharti

Hiptage benghalensis (L.) Kurz

Journ. As. Soc. Beng. 43, 2: 136 (1874).

MALPIGHIACEAE

$2n = 42, 56, 58, 60$

Synonyms *Hiptage madablota* Gaertner (1791), *Hiptage javanica* Blume (1825).

Vernacular names Hiptage (En). Liane de cerf (Fr). Indonesia: jaranan, kakas (Javanese), areuy beurit (Sundanese). Thailand: noraa (central), haen pik (north-eastern), kamlang chang phuek (northern). Vietnam: t[ow] m[af]nh.

Origin and geographic distribution *H. benghalensis* occurs in India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Taiwan, Thailand, Peninsular Malaysia, Sumatra, Java, the Lesser Sunda Islands, Borneo, the Philippines (Palawan) and Sulawesi. It has been introduced in islands of the Pacific, where it is considered an aggressive invasive species.

Uses In the Lesser Sunda Islands the bark of *H. benghalensis* is pounded and applied to fresh wounds. In Thailand the wood is used as an appetizer and credited with antiflatulent, carminative

and aphrodisiac properties; it is said to relieve fatigue and to promote longevity. In Vietnamese folk medicine the wood is used to relieve fatigue and to treat nocturnal emission of sperm. In India the leaves are used in cutaneous diseases. The leaf juice is used to treat scabies, apparently for its insecticidal properties. The plant is further used to treat rheumatism and asthma. The bark is used as an aromatic bitter. *H. benghalensis* is widely cultivated throughout South-East Asia for its attractive, fragrant flowers.

Properties The root bark of *H. benghalensis* contains relatively high concentrations of the aliphatic nitrogen-containing glycoside hiptagin, and additionally mangiferin. The triterpenes friedelin and epifriedelin were isolated from the stem bark.

Botany A scandent shrub or liana up to 30 m long; young shoots densely fulvous-hairy, glabrescent, often lenticellate. Leaves opposite, simple, elliptical to oblong, (8–)10–15(–20) cm × (3–)4–6(–10) cm, base acute to rounded, mostly with 2 glands, apex usually acuminate, margin entire, often with glandular dots below; petiole 7–10 mm long; stipules minute and gland-like. Inflorescence a terminal or axillary raceme or panicle, (4–)10–20(–35) cm long, short-hairy, bracteolate. Flowers bisexual, zygomorphic, 5-merous, 1–2.5 cm in diameter, very fragrant; calyx deeply incised, hairy outside, persistent, with a convex, elliptical to linear gland decurrent on the pedicel; petals free, orbicular to elliptical, (3–)6–12 mm × (2–)5–10 mm, variably clawed, inside glabrous, outside hairy, pink to whitish, partly yellow; stamens 10, unequal, 1 much longer than others; ovary superior, 3-lobed, style long, coiled. Fruit a samara with a large middle wing (3–)5–6(–7) cm × 1(–2) cm, and 2 smaller lateral wings 2–3 cm × 0.5–1(–1.5) cm, sometimes with dorsal crest.

H. bengalensis can be found flowering throughout the year, but flowering is often influenced by seasonality of the climate.

Hiptage comprises 20–30 species, and occurs from India and Sri Lanka to China and Taiwan and throughout South-East Asia eastward to Sulawesi and Timor. Additionally, 1 species is found in Fiji. *H. benghalensis* is very variable, and numerous taxa have been distinguished. However, all these forms are connected by intermediates.

Ecology *H. benghalensis* occurs under both humid and periodically dry conditions, in open forest, secondary forest, clearings and forest margins, on a wide range of soils, from sea-level up to 1000(–2000) m altitude.

Management *H. benghalensis* is easily propagated by seed or by layering.

Genetic resources *H. benghalensis* is widespread, and apparently well adapted to disturbed habitats. It may naturalize easily after introduction and become an undesirable invasive species. It is not threatened by genetic erosion.

Prospects Research on the pharmacological properties of *H. benghalensis* is needed to support its traditional medicinal use.

Literature 121, 173, 247, 287, 334, 731.

Other selected sources 62, 249, 331, 621.

D.S. Alonzo

Homalanthus A.Juss.

Euphorb. gen.: 50, t. 16, f. 53 (1824; *'Omalanthus'*)

EUPHORBIACEAE

x = unknown; *H. populneus*: $n = 76$, $2n = 36$

Origin and geographic distribution *Homalanthus* comprises about 22 species and occurs from Taiwan and southern Thailand, throughout the Malesian region, to the Pacific Islands, New Caledonia and Australia. In Malesia most of the 13 indigenous species are endemic.

Uses Several parts of *Homalanthus* plants are used in traditional medicine. The wood is used as an anodyne, leaves to treat fever and after childbirth, and as a vermifuge in cattle, leaf sap as a mild laxative, terminal buds as abortifacient, a decoction of the bark during and after childbirth, and fruits for treating wounds.

The sap is a fish poison. A decoction of bark and leaves is used as a black dye; the leaves are suitable for wrapping food. The wood is sometimes used for house construction, and as firewood. *Homalanthus* may be suitable for afforestation.

The pulverized wood of *H. nutans* (J.G. Forster) Guillemin steeped in hot water produces a brew that is drunk in Samoa by patients with yellow fever.

Properties The whitish sap from *Homalanthus* plants is irritant to the eyes. It is poisonous and should be administered in low doses.

Ethanol extracts of leaves, stem and roots of *H. nervosus* showed a broad-spectrum antibacterial activity, but no antifungal effect.

A wood extract of *H. nutans* from Samoa exhibited strong in-vitro activity against human immunodeficiency virus (HIV-1), with the phorbol derivative prostratin as the active compound. This compound does not appear to be a tumour promo-

tor as is the case with several related compounds.

Botany Monoecious, small to medium-sized trees, with latex in all parts; bark nearly smooth; branches pseudoverticillate. Leaves alternate, simple and entire, often whitish below, mostly glabrous, glands present, pinnately veined, petiolate and not too distinctly peltate; stipules large, with distinct parallel venation, caducous. Inflorescence a thyrse with female flowers at base and cymules of male flowers higher up, bracteate. Flowers unisexual, zygomorphic, distinctly pedicellate, with calyx consisting of (1–)2(–3) free, kidney-shaped lobes, petals absent; male flowers yellowish, with articulate pedicel and 4–30 free stamens; female flowers with non-articulate pedicel and superior, 2–3-celled ovary, style very short to distinct, stigma usually recurved, undivided or divided. Fruit a thinly woody capsule, opening primarily loculicidally, (1–)2–3-seeded. Seeds usually irregularly foveolate and often flattened, smooth, covered apically or over the whole length by a pale to whitish, membranous arillode.

The foliar glands attract ants, which may protect the plant from grazing and insect damage. The flowers seem to be pollinated by various insects, whereas the often reddish seeds with a pale arillode are probably dispersed by animals such as birds.

Homalanthus has an isolated position within the tribe *Hippomaneae*. The genus was originally described as *Omalanthus*, but recently the later orthographic variant *Homalanthus* has been conserved in the International Code of Botanical Nomenclature.

Ecology *Homalanthus* is characteristically found in secondary forest, where it occasionally dominates the vegetation. It is usually most common in montane forest and may fill there the ecological niche as a pioneer, in the same way as *Macaranga* in the lowland.

Genetic resources *Homalanthus* often occurs in secondary habitats, is locally common and does not seem to be liable to genetic erosion. Most species are relatively homogeneous, but the more widespread ones, such as *H. novoguineensis* and particularly *H. populneus*, are variable.

Prospects More research on the phytochemistry and pharmacological properties of *Homalanthus* seems justified because it is used throughout its area of distribution as a medicinal plant, albeit to a limited extent. *Homalanthus* may also be useful for afforestation and for pulp and paper production.

Literature 234, 304.

Selection of species

Homalanthus fastuosus (Linden) Fern.-Vill.

Blanco, Fl. Filip., ed. 3, Nov. App.: 196 (1880).

Synonyms *Homalanthus alpinus* Elmer (1908), *Homalanthus bicolor* Merr. (1909).

Vernacular names Philippines: botinag, buta, topi (general).

Distribution Taiwan (Orchid Island) and the Philippines.

Uses In the Philippines the leaves are used as a fish poison. The wood is used as fuel, but the smoke may irritate the eyes.

Observations A small tree up to 8(–18) m tall, with bole up to 30 cm in diameter, crookedly branched; leaves orbicular to ovate, 4–23 cm × 3.5–24 cm, peltate or not, petiole 3–30 cm long, apically with a pair of glands; bracts of male flowers with a pair of glands longer than bracts, stamens 6–8; fruit obovoid, 6–9 mm long, often with lateral hooks. *H. fastuosus* occurs on slopes and ridges, in hill forest and montane forest, but also in old garden sites, at (50–)750–2600 m altitude, and is locally common.

Selected sources 117, 234.

Homalanthus longistylus Lauterb. & K. Schumann

Fl. Schutzgeb. Südsee: 407 (1900; *'longistilus'*).

Synonyms *Homalanthus papuanus* Pax & K. Hoffm. (1912).

Vernacular names Papua New Guinea: merom, paba (East New Britain).

Distribution North-eastern mainland Papua New Guinea and the Bismarck Archipelago.

Uses In New Britain, the wood is used externally against aching limbs, and the sap from the inner bark mixed with water is applied internally to pregnant women to induce labour and ease child delivery. The terminal buds are eaten as abortifacient. The wood is used in house building, and the leaves for wrapping taro for cooking.

Observations A small tree up to 12 m tall, with bole up to 20 cm in diameter; leaves orbicular to ovate, 5–17 cm × 4–16 cm, not distinctly peltate, petiole 8–12 cm long, apically with a pair of glands; bracts of male flowers with a pair of glands shorter than bracts, stamens 6–8(–10); fruit subglobose, 6–15 mm in diameter, hardly to distinctly carinate. *H. longistylus* occurs in secondary forest, agricultural plantations and *Nothofagus*-dominated moss forest, at 50–1800 m altitude, and is locally common.

Selected sources 234, 347.

Homalanthus nervosus J.J. Smith

Lorentz, Nova Guinea 8: 792, t. 141 (1912).

Synonyms *Homalanthus vernicosus* Gage (1917), *Homalanthus deltoideus* Airy Shaw (1980).

Distribution New Guinea.

Uses The sap is used as fish poison.

Observations A small tree up to 10(–16) m tall, with bole up to 15 cm in diameter, heavily branched with spreading branches; leaves ovate, 4–17 cm × 3–14 cm, not peltate, petiole 1.5–13 cm long, glandless; bracts of male flowers with a pair of glands shorter than bracts, stamens (6–)8; fruit subglobose, 3.5–6 mm in diameter, not carinate. *H. nervosus* occurs in montane forest, but also in regrowth and open, low scrub vegetation, at 1400–2600 m altitude, and is locally very common.

Selected sources 234, 465.

Homalanthus novoguineensis (Warb.) K. Schumann

Lauterb. & K. Schumann, Fl. Schutzgeb. Südsee: 407 (1900).

Synonyms *Homalanthus tetrandrus* J.J. Smith (1912), *Homalanthus crinitus* Gage (1917), *Homalanthus beguinii* J.J. Smith (1924).

Vernacular names Indonesia: bussi (Timor), palate (Halmahera), gedilule (Ternate).

Distribution The eastern Lesser Sunda Islands, the Moluccas, New Guinea, the Solomon Islands and northern Australia.

Uses In the Moluccas the sap of young leaves is administered to young children as a mild laxative. A decoction of the bark is an ingredient of a mixture taken as a tonic after childbirth. The bark and leaves are used to dye wickerwork blackish, the leaves for wrapping food, and the wood as firewood and in house building.

Observations A small to medium-sized tree up to 25 m tall, with bole up to 50 cm in diameter, much-branched; leaves orbicular to ovate or elliptical, 4.5–22 cm × 3.5–20 cm, peltate or not, petiole 2–13 cm long, glandless; bracts of male flowers with a cluster of glands shorter than bracts, stamens 6–8; fruit subglobose, 5–13 mm in diameter, not to slightly carinate. *H. novoguineensis* occurs in mossy forest, secondary forest and regrowth, old garden sites, *Eucalyptus* savanna and along streams, up to 2300 m altitude, and is locally common or even dominant.

Selected sources 234, 334.

Homalanthus populneus (Geiseler) Pax

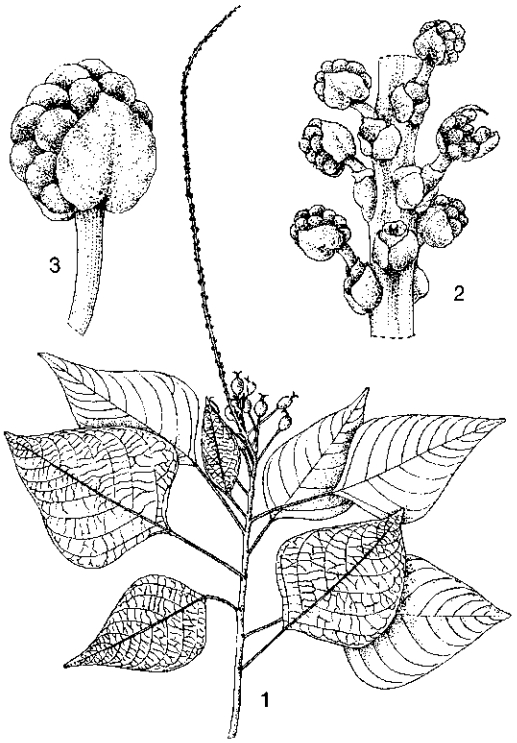
Engl. & Prantl, Nat. Pflanzenfam. 3, 5: 96 (1890).

Synonyms *Homalanthus populifolius* auct. non Graham.

Vernacular names Indonesia: tutup (general), tutup abang (Javanese), totop (Madura). Malaysia: ludahi, kayu mata buta darat (Peninsular). Philippines: malabinunga (Tagalog), balanti (Bisaya, Bikol). Thailand: mae mae (Narathiwat).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra, Java, the Lesser Sunda Islands, Borneo, the Philippines, Sulawesi and the Moluccas.

Uses In Sabah fruits are used for treating wounds. In Peninsular Malaysia heated leaves are applied to the abdomen to treat fever and after childbirth. The leaves are given to cattle as a vermifuge, and pounded leaves are used as a fish poison. A decoction of bark and leaves is used to dye rattan, matting, pandan handicrafts and cotton cloth black. The wood is used as firewood. *H. populneus* may be suitable for afforestation on better



Homalanthus populneus (Geiseler) Pax – 1, flowering branch; 2, detail of male part of inflorescence; 3, male flower.

soils, and the wood is suitable for pulp and paper production.

Observations A small tree up to 10 m tall, with bole up to 18 cm in diameter, much-branched; leaves orbicular to ovate, rhombic-ovate or lanceolate, 3–22 cm × 1.5–20 cm, not peltate, petiole 1–15 cm long, glandless; bracts of male flowers with a pair of glands slightly shorter than bracts, stamens (6–)8–10; fruit subglobose, 4–9 mm in diameter, not carinate. *H. populneus* occurs at edges of primary forest, in secondary forest, on roadsides, along streams and in waste land, up to 3000 m altitude. It is often one of the characteristic plants in recently cleared areas, and may occur gregariously.

Selected sources 121, 234, 542.

P.C. van Welzen

Homalomena Schott

Schott & Endl., Melet. bot.: 20 (1832).

ARACEAE

$x = 20$; *H. griffithii*: $2n = 40$, *H. sagittifolia*: $2n = 40, 80$

Origin and geographic distribution *Homalomena* comprises about 150 species, and occurs from India, Burma (Myanmar), Indo-China and southern China, through Thailand and Malesia, to the Solomon Islands. Approximately 8 species occur in tropical America. Western Malesia is by far richest in species, with about 40 species in each of Peninsular Malaysia, Sumatra and Borneo, and 18 in Java. Towards the east the number of species is lower, with about 4 in each of the Philippines and Sulawesi, 2 in the Moluccas, but again 18 in New Guinea.

Uses In Indonesia (Java, Kalimantan, Sulawesi, the Moluccas) the stems (often the underground part) and leaves of *Homalomena* are used as a poultice to treat cuts, wounds, sores and rheumatism, and a decoction of the stem and roots is used to treat syphilis and after miscarriage. The juice from old petioles is used to improve visual acuity. Similar applications are recorded from Peninsular Malaysia. Leaves are used as a poultice during childbirth, and to treat sores and lumbago. A decoction of the stem and roots is drunk to treat fever, colic and hoarseness. In New Guinea, some *Homalomena* species are applied in traditional medicine: leaves heated in a fire are used for rubbing to treat muscular complaints. In New Ireland, *H. peekelii* is used to treat malaria and headache. The leaves, stems and roots are applied in rituals in New Guinea; they are said to produce hallucinations when ingested in small amounts. The leaves are used in adornment, or as perfume. In Indonesia, pieces of the stem are placed in fish-traps as bait to catch lobsters and shrimps, and leaves are used as packing material for tobacco.

Decoctions of the stem of *H. aromatica* (Roxb. ex Sims) Schott and *H. occulta* (Lour.) Schott (which are perhaps conspecific) are used in traditional medicine in Vietnam, southern China and Thailand to treat rheumatoid arthritis. In Vietnam, infusions and ethanolic extracts of *H. aromatica* stems are also applied against stomach disorders and as a tonic.

Homalomena, mostly called *H. lindenii* (Rodigas) Ridley, is also cultivated as an ornamental in tropical gardens, and as a pot plant.

Properties The major component of the essential oil from *H. aromatica* stems is linalool (up to 80%). The oil has a delicate aroma and antibacterial activity, and has been recommended in Vietnam as an ingredient of toothpaste. Furthermore, several sesquiterpenoids have been isolated from a rhizome extract of *H. aromatica*, whereas its rhizome showed weak antiphlogistic activity. A crude ethanol extract of *H. aromatica* showed larvicidal activity on the cattle tick *Boophilus microplus* in tests in Thailand. Significant anti-inflammatory and analgesic activities have been found for *H. occulta* extracts in tests in China.

Botany Small to large, creeping or decumbent to erect herbs, lower part of stem rhizomatous, vegetative parts usually strongly aromatic when crushed, with pungent smell of citrus, celery, parsley, liquorice, anise or ginger. Leaves arranged spirally, simple, deeply cordate to oblanceolate, often very variable in shape, entire, glabrous, striate-veined; petiole longer or shorter as blade, channelled to terete, with sheath at base; stipules absent. Inflorescence a spadix, erect at anthesis, later decumbent, enclosed by a boat-shaped, green, reddish, yellowish or white, persistent spathe. Flowers unisexual, densely packed; male flowers in upper part of spadix, with 2–4 stamens, filaments very short to absent, anthers usually with cap-like connective; female flowers in lower part of spadix, with superior incompletely 2–4-locular ovary, style very short or absent, stigma button-like or disk-like; male and female zone of spadix usually not separated by sterile flowers. Fruit a small translucent greenish berry, closely packed within the persistent and usually somewhat enlarging spathe, several-seeded. Seeds very small, c. 1 mm long, longitudinally ribbed, albuminous.

Homalomena is taxonomically difficult. The species are often very similar, and many show considerable infraspecific variation. The published information on uses is often not reliably reducible to species, and species names used in the literature are often incorrect.

Ecology *Homalomena* occurs mainly in the understorey of lowland rain forest, but it can also be found up to the mid-montane zone. It is generally shade-loving and grows on the forest floor, often on steep soil banks (e.g. stream banks). It is also often found in swamp forest, and is sometimes rheophytic, and occasionally occurs in regrowth forest. It is absent in regions with a strongly seasonal climate.

Management *H. aromatica* is propagated in Vietnam by stem cuttings. Shoot cultures of ornamental *Homalomena* cultivars have been cultured successfully on modified Murashige and Skoog medium, as well as callus cultures of *H. occulta* in China.

Genetic resources The *Homalomena* species treated here are all at least locally common. However, most species occur in primary lowland rain forest, and the ongoing destruction of this habitat may easily endanger them, particularly those with limited areas of distribution. In some regions, they are popular medicinal plants much collected from the wild, e.g. *H. aromatica* in Vietnam. This may also lead to severe genetic erosion or even extinction of wild populations.

Prospects *Homalomena* is popular as a medicinal plant in many regions of tropical Asia, and often used for similar complaints. Research on its phytochemistry and pharmacological properties has been very limited up to now, but shows promising results. The antirheumatic activity in particular deserves more attention.

Literature 121, 334, 503, 671, 903, 932.

Selection of species

Homalomena griffithii (Schott) Hook.f.

Fl. Brit. India 6: 534 (1893).

Synonyms *Homalomena obliquata* (Schott) Hook.f. (1893).

Vernacular names Malaysia: kelemoyang, kemoyang, asam tikus (Peninsular).

Distribution Peninsular Malaysia, Singapore, Sumatra and northern Borneo.

Uses In Peninsular Malaysia a decoction of leaves and roots is given to women to expedite childbirth, and a poultice is applied externally in cases of lumbago. The leaves may be added to curries for a sour flavour.

Observations A small herb up to 20 cm tall, stem erect, stout; leaves ovate to ovate-lanceolate, 10–18 cm × 4–6.5 cm, base cuneate to rounded, often asymmetrical; spathe 2.5–3 cm long, green, spadix about as long as the spathe. *H. griffithii* is a variable species in which several varieties can be distinguished. It occurs in lowland forest, where it often grows in small clumps and is locally common.

Selected sources 121, 789.

Homalomena peekelii Engl.

Pflanzenr. 55(IV.23Da): 52 (1912).

Vernacular names Papua New Guinea: evarbei (New Ireland).

Distribution Eastern New Guinea, the Bismarck Archipelago, the Solomon Islands and Biak Island.

Uses In New Ireland *H. peekelii* is used to treat malaria and headache. In the Solomon Islands it is said to repel beetles on taro (*Colocasia esculenta* (L.) Schott).

Observations A small herb up to 30 cm tall, stem decumbent to erect, vegetative parts strongly smelling of pineapple, liquorice or anise; leaves more or less triangular, 14–18 cm × 10–15 cm, base more or less truncate; spathe c. 4.5 cm long, green, spadix as long as the spathe. *H. peekelii* occurs on the forest floor in lowland and lower montane rain forest.

Selected sources 326.

Homalomena philippinensis Engl.

Pflanzenr. 55(IV.23Da): 55 (1912).

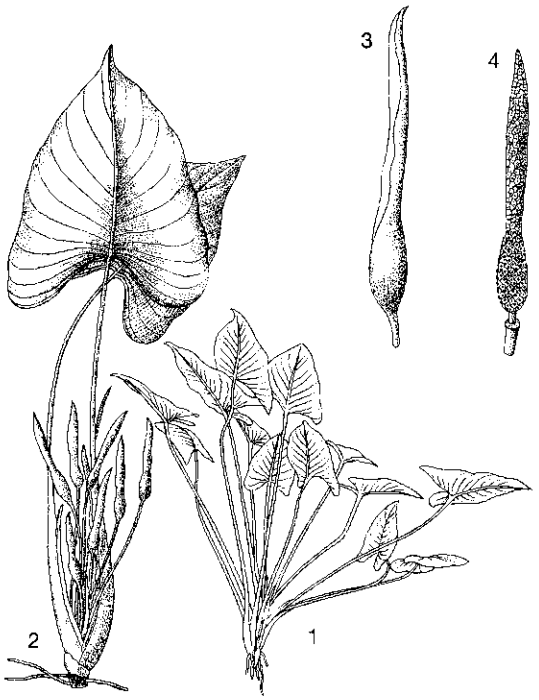
Vernacular names Philippines: payau, alupayi (Tagalog), salet-nga-nalabaga (Iloko).

Distribution The Philippines.

Uses The roots are used as an embrocation to treat rheumatism, and the leaves as vulnerary. The leaves are also used for wrapping food.

Observations A large herb up to 150 cm tall, stem erect, 3–4 cm in diameter; leaves cordate, c. 25 cm × 20 cm, with rounded lobes at base, petiole up to 60 cm long; spathe up to 5 cm long, greenish tinged with purple, spadix c. 3.5 cm long. *H. philippinensis* seems closely related to *H. cordata* Schott from Java. It occurs along small streams in primary forest at low altitudes.

Selected sources 760.



Homalomena sagittifolia Jungh. ex Schott – 1, plant habit; 2, part of flowering plant; 3, inflorescence with spathe; 4, spadix.

Homalomena sagittifolia Jungh. ex Schott

Prodr. Syst. Aroid.: 311 (1860).

Vernacular names Malaysia: kelemoyang, kemoyang, semunyong (Peninsular). Thailand: bon som (Pattani).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and northern Borneo.

Uses In Peninsular Malaysia a decoction of leaves and roots is used to treat fever, and pounded shoots are applied as a poultice against stomach-ache.

Observations A fairly large herb up to 60 cm tall, stem erect, stout, up to 5 cm in diameter, vegetative parts strongly aromatic; leaves ovate-sagittate with spreading lobes, up to 30 cm long; spathe up to 10 cm long, constricted in upper part, greenish-white or white, often tinged pink at apex, spadix slightly shorter than spathe. *H. sagittifolia* is a variable species in which several varieties can be distinguished. It occurs in lowland forest and is locally common.

Selected sources 121, 789.

Harini M. Sangat

Hoya R.Br.

Prodr.: 459 (1810); Asclepiadeae: 15 (1810).

ASCLEPIADACEAE

$x = 11$; *H. australis*, *H. coriacea*, *H. coronaria*, *H. diversifolia*, *H. lacunosa*, *H. multiflora*, *H. rumphii*: $2n = 22$

Origin and geographic distribution *Hoya* comprises over 200 species and is widely distributed in India, Burma (Myanmar), Indo-China, southern China, Thailand, throughout the Malesian region, northern Australia and some Pacific island groups. Major centres of diversity are southern China (with over 30 species), the Philippines and New Guinea.

Uses Several *Hoya* species are used in traditional medicine in South-East Asia. The latex and a poultice of the leaves are applied externally to wounds, boils, ulcers, swellings, burns, stings of insects and poisonous fish and rheumatism. The latex is taken internally to stimulate digestion and as a diuretic, and a decoction of the leaves is used internally against cough, asthma and gonorrhoea.

A number of non-Malesian species are used medicinally in China. Usually the leaves are used mainly externally to treat fractures, swellings, cuts and rheumatoid arthritis, and internally to treat encephalitis, pneumonia and orchitis. The species used include *H. carnosa* (L.f.) R.Br., *H. fungii* Merr., *H. griffithii* Hook.f., *H. kerrii* Craib, *H. lyi* H. Léveillé, *H. pandurata* Tsiang, *H. pottsii* Traill and *H. villosa* Costantin.

Hoya is commonly cultivated as an ornamental, in the tropics and subtropics as a climber in the garden, in temperate regions as a pot plant.

Properties An extract of *H. diversifolia* showed strong antinematodal activity against the pine wood nematode *Bursaphelenchus xylophilus*.

The main flavonoids present in *Hoya* include apigenin-O-glycoside, apigenin-di-C-glycoside, vitexin and isovitexin. Several triterpenes, including australinals and lupeol, have been isolated from *H. australis*, and 3 oligosaccharides and several steroids from *H. carnosa* stems.

Contact with *Hoya* plants may lead to dermatitis or even anaphylactic shock caused by hypersensitivity.

Botany Epiphytic, lithophytic or terrestrial climbers, subshrubs or shrubs, with slender, twining stems, often with adventitious roots; white or occasionally clear latex present. Leaves opposite, simple and entire, usually leathery or fleshy, sometimes papery or membranous, glabrous or

hairy, usually with pinnate venation but sometimes palmate, with or without glands at the base of lamina, often shortly petiolate; stipules absent. Inflorescence an extra-axillary, often umbelliform cyme, becoming racemiform with age and usually producing a succession of globose or flat-topped clusters of flowers for several seasons. Flowers bisexual, regular, 5-merous; calyx small, usually with glands at base of the lobes; corolla rotate or campanulate, fleshy, lobes valvate in bud, margins often recurved, often densely hairy or scurfy inside; stamens inserted at base of corolla tube, shortly connate at base, anthers with short, incurved terminal appendage, with solitary pollinium in each anther cell, with staminal corona consisting of 5 large, fleshy lobes attached to the staminal column; ovaries 2, free, superior, 1-celled, stigma head discoid, rounded or subapiculate, generally enclosed by stamens. Fruit consisting of 1(-2) follicles, fusiform or terete-ovoid, smooth or rough, many-seeded. Seeds ovate, flat, comose. Seedling with leaves alternate.

Ecology *Hoya* is usually an epiphyte, but sometimes a lithophyte or terrestrial plant, and may be found in different types of forest, sometimes also on free-standing trees, usually in the lowland. Many epiphytic species grow on ant nests.

Management Ornamental *Hoya* is propagated by semi-ripe cuttings or by layering. It is cultivated in a coarse, fertile medium that is freely draining but moisture retentive, and rich in organic matter with additional coarse sand and charcoal.

Genetic resources Most of the *Hoya* species treated here are fairly widespread and common, but several others are known only from a few collections and may be endangered. Several species are widely cultivated and several plant growers have large collections of ornamental *Hoya*.

Prospects *Hoya* may be developed as a medicinal plant with wider usage, particularly for external applications. While experience of propagation and cultivation already exists, more research is needed on phytochemistry and pharmacological properties. A taxonomic revision of the genus covering the whole area of distribution is also badly needed.

Literature 62, 121, 257, 334, 1013.

Selection of species

Hoya australis R.Br. ex Traill

Trans. Hort. Soc. 7: 28 (1830).

Synonyms *Hoya lactea* S. Moore (1911).

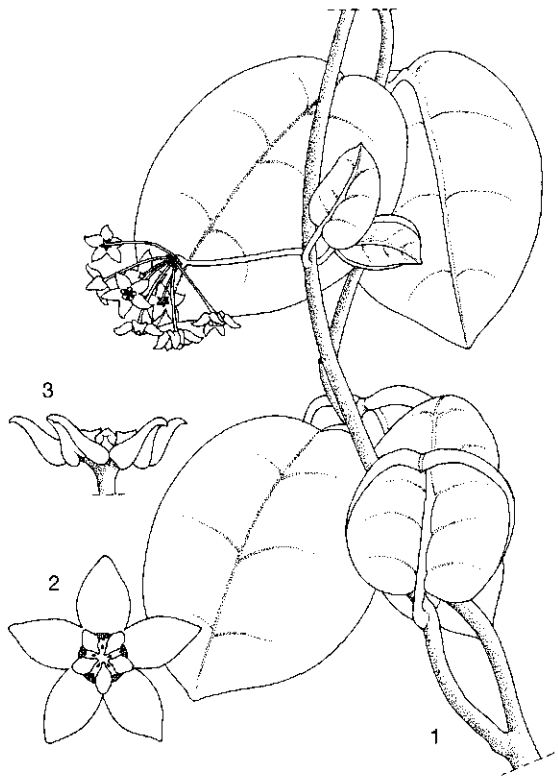
Vernacular names Papua New Guinea: kala-vagala (Milne Bay).

Distribution New Guinea, the Solomon Islands, Australia and Melanesia.

Uses In Papua New Guinea the latex is applied externally to burns.

Observations A climber or subshrub with twining branches; leaves variable in shape, up to 15 cm × 12 cm, fleshy to leathery, petiole up to 2 cm long; flowers campanulate, 10–25 mm in diameter, corolla white to creamy, with red under creamy staminal corona, corolla lobes 5–10 mm long; follicle fusiform, 9–13.5 cm long. *H. australis* occurs as an epiphyte or lithophyte in forest, from the borders of mangrove forest to open eucalypt forest and rain forest; it is common.

Selected sources 258, 347.



Hoya australis R.Br. ex Traill – 1, habit of flowering plant; 2, flower in apical view; 3, flower in side view.

Hoya coriacea Blume

Bijdr. fl. Ned. Ind. 16: 1063 (1827).

Synonyms *Hoya fraterna* Blume (1849).

Vernacular names Thailand: nom mia (Pattani).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Java and Borneo.

Uses In Peninsular Malaysia a decoction of the leaves is drunk to treat cough and asthma.

Observations A climber or subshrub with twining branches; leaves ovate-elliptical-oblong, up to 15 cm × 6.5 cm, leathery, petiole up to 2 cm long; flowers c. 25 mm in diameter, corolla sordidly violet outside, yellowish and shortly pubescent inside, corolla lobes at first horizontal, later with decurved upper halves; follicle fusiform, 11–12 cm long. *H. coriacea* occurs in mixed forest up to 1000 m altitude.

Selected sources 62, 121, 789.

Hoya coronaria Blume

Bijdr. fl. Ned. Ind. 16: 1063 (1827).

Synonyms *Hoya sussuela* (Roxb.) Merr. (1917), *Hoya lauterbachii* auct. non K. Schumann.

Vernacular names Indonesia: areuy ki kandel lalaki (Sundanese), bunga palita (Moluccas). Malaysia: akar setebal (Peninsular). Thailand: takhaa (Malay, Narathiwat), ta-baa (Malay, Pattani).

Distribution Peninsular Thailand, throughout the Malesian region (doubtful in the Philippines), the Solomon Islands and northern Australia.

Uses In Java the latex is mixed with *Capsicum* leaves and taken internally to stimulate digestion. In the Moluccas, the latex is applied to stings from poisonous fish.

Observations A terrestrial climber or subshrub with twining branches; leaves oblong, up to 14 cm × 7.5 cm, leathery, petiole up to 2.5 cm long; flowers 35–55 mm in diameter, corolla campanulate to rotate, reddish, brownish, pinkish or yellowish, corolla lobes more or less reflexed; follicle lanceolate, 14–22 cm long. *H. coronaria* occurs in forest up to 1000 m altitude, often in humid localities, e.g. in mangrove swamps and on river banks, sometimes also in thickets. It is locally very common.

Selected sources 62, 121, 257, 259, 334, 488, 789.

Hoya diversifolia Blume

Bijdr. fl. Ned. Ind. 16: 1064 (1827).

Vernacular names Indonesia: akar susudu bukit (Sumatra). Malaysia: akar sesudu bukit, akar serapat, akar chaping kera (Peninsular). Thailand: lin khwaai (Songkhla). Vietnam: hoa sao kh[as]c l[as].

Distribution Southern Burma (Myanmar), Indo-China, peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Java.

Uses In Peninsular Malaysia and Vietnam, the water in which leaves have been boiled is used as a bath to treat rheumatism.

Observations A climber with branches up to 4 m long; leaves broadly ovate to obovate-oblong, up to 14 cm × 5 cm, fleshy, petiole up to 1.5 cm long; flowers 9–14 mm in diameter, corolla pale outside, tinged with violet and densely appressed white-hairy inside, shallowly lobed, lobes with recurved top; follicle lanceolate, c. 13 cm long. *H. diversifolia* occurs as an epiphyte or terrestrial in open forest, but also on wayside trees, up to 400 m altitude, and is common.

Selected sources 31, 62, 121, 789.

Hoya imbricata Decne.

DC., Prodr. 8: 637 (1844).

Vernacular names Philippines: paui-pauikan (Bisaya).

Distribution The Philippines, Sulawesi and the Moluccas.

Uses In the Philippines the leaves are applied externally as a poultice to ripen boils. The ash of leaves, mixed with coconut oil, is applied to old wounds or ulcers for rapid cicatrization.

Observations A rather long climber; leaves broadly ovate to orbicular, up to 12 cm broad, thinly leathery, convex and glabrous at upper surface, concave and hairy at lower surface; flowers 8–10 mm in diameter, corolla creamy-white, hairy inside, lobes slender, reflexed. *H. imbricata* occurs as an epiphyte in forest and in abandoned plantations at low and medium altitudes.

Selected sources 488, 760.

Hoya lacunosa Blume

Bijdr. fl. Ned. Ind. 16: 1063 (1827).

Vernacular names Thailand: nom mia (Chiang Mai).

Distribution Thailand, Peninsular Malaysia, Singapore, Sumatra, Java and Borneo; introduced to China.

Uses In China a decoction of whole plants is applied to insect stings and swellings.

Observations A subshrub with twining branches; leaves ovate or ovate-lanceolate, up to 5 cm × 3 cm, thick-fleshy, petiole up to 1.2 cm long; flowers 6–7 mm in diameter, corolla white with violet dots, tube conspicuously white villous inside, lobes

with decurved tops; follicle lanceolate, 5–7 cm long. *H. lacunosa* is an epiphyte on trees, and often occurs in secondary forest, but also on wayside trees, up to 1200 m altitude.

Selected sources 62, 789, 1013.

Hoya multiflora Blume

Catalogus: 49 (1823).

Vernacular names Indonesia: kapalan (Java). Thailand: kluaimai phannguu (central). Vietnam: h[oof] hoa gi[ar].

Distribution Burma (Myanmar), Laos, Vietnam, southern China, Thailand, Peninsular Malaysia, Sumatra, Java and the Philippines.

Uses In Java, the latex is used as a diuretic, and a poultice of the leaves to treat rheumatism.

Observations A subshrub with branches up to 2.5 m long; leaves oblong-lanceolate, up to 18 cm × 6 cm, thick-papery, petiole up to 2 cm long; flowers 15–20 mm in diameter, corolla yellowish-white with orange lobe apices, strongly reflexed from almost base of corolla tube, throat white villous; follicle linear-lanceolate, 12–18 cm long. *H. multiflora* occurs as an epiphyte in open forest, sometimes on isolated trees, up to 1200 m altitude.

Selected sources 62, 121, 789, 1013.

Hoya rumphii Blume

Bijdr. fl. Ned. Ind. 16: 1065 (1827).

Vernacular names Indonesia: daun pitis (Moluccas).

Distribution Western Java and the Moluccas.

Uses In the Moluccas, a decoction of the leaves is used to treat gonorrhoea, and the latex to treat stings of poisonous fish.

Observations A climber or subshrub with twining branches; leaves lanceolate to rhomboid, up to 11 cm × 4 cm, thin-leathery, petiole up to 6.5 cm long; flowers c. 15 mm in diameter, corolla brownish, with lobes very shortly pubescent inside; follicle linear, c. 16 cm long. *H. rumphii* is an uncommon species in forest up to 1400 m altitude.

Selected sources 62, 334.

Muhammad Mansur

Hunteria zeylanica (Retz.) Gardner ex Thwaites

Enum. pl. zeyl. 3: 191 (1860).

APOCYNACEAE

$2n = 22$

Synonyms *Hunteria corymbosa* Roxb. (1824).

Vernacular names Indonesia: gitan obat, tahoi (Lampung). Malaysia: getah aguh, kayu gading, kemuning hutan (Peninsular). Thailand: muuk khao (Nakhon Ratchasima, Krabi), yaang khaao (Chanthaburi). Vietnam: b[ee]n bai.

Origin and geographic distribution *H. zeylanica* occurs in eastern Africa, India, Sri Lanka, Burma (Myanmar), Cambodia, Laos, Vietnam, southern China (Hainan), Thailand, Peninsular Malaysia, the Anambas Islands and Sumatra.

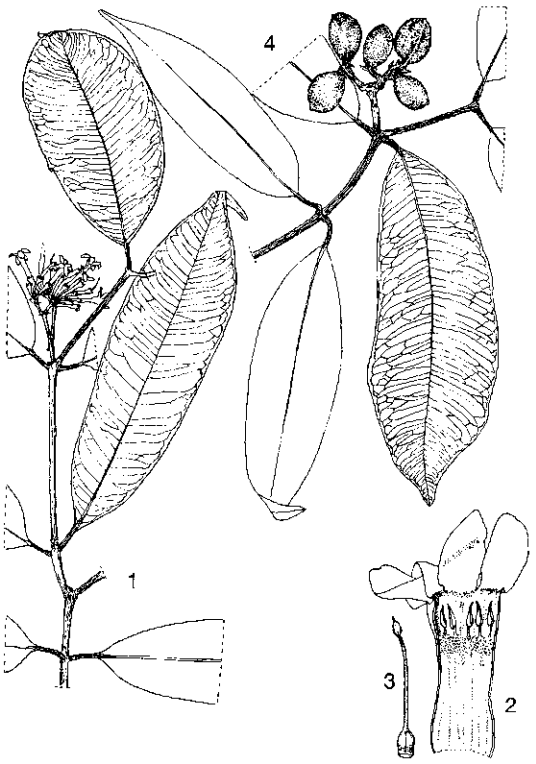
Uses In Peninsular Malaysia, the latex of *H. zeylanica* is used externally to treat yaws. In Thailand, the plant has the same application in traditional medicine, but it is also used to reduce boils and skin irritations.

Some *Hunteria* species are used in traditional medicine in Africa. A root-bark extract of *H. umbellata* (K. Schumann) Hallier f. is applied to sores caused by leprosy, whereas the bark and roots are made into a bitter tonic, a root decoction is used to prevent miscarriage and to treat menorrhagia, and a bark decoction is taken as a stomachic and used as a wash against fever. Seeds of *H. ballayi* Hua are swallowed by women as a fertility drug, and the bark of *H. ghanensis* Hall & Leeuwenberg is used as a stomachic.

The hard, whitish to yellowish wood of *H. zeylanica* (and other *Hunteria* species in Africa) is used to make kris and axe handles, combs, boxes and bows for hunting.

Properties Over 20 indole alkaloids have been isolated from *H. zeylanica*. The alkaloid corymine was extracted from the leaves. This compound potentiated convulsions induced by either picrotoxin or strychnine. In tests with mice, a crude methanol extract of the leaves produced biphasic effects on the central nervous system, depression and stimulation, whereas corymine had a unique central stimulatory effect. A stem bark extract showed anti-inflammatory activity in mice, and an inhibitory effect on 5-lipoxygenase activity in vitro, but neither (–)-eburnamine nor pleiomutinine, major constituents of the alkaloid extract, were responsible for this action. This extract also exhibited antinociceptive and antipyretic effects in mice and rats; the former effect may be mediated by the anti-inflammatory action. The results of tests with mice suggest that a stem bark extract possesses peripheral analgesic and mild antipyretic effects, with strictosidinic acid as the major active constituent.

Botany A shrub or small tree up to 15 m tall, with bole up to 30 cm in diameter, often fluted; colourless or milky latex in all parts. Leaves opposite, simple and entire, elliptical to oblong or obo-



Hunteria zeylanica (Retz.) Gardner ex Thwaites – 1, flowering branch; 2, opened corolla; 3, pistil; 4, fruiting branch.

vate, 2–21 cm × 1–7 cm, cuneate to rounded at base, rounded to acuminate at apex, glabrous, secondary veins in 12–30 pairs, joined into a marginal vein; petiole 1–1.5 cm long; stipules absent. Inflorescence a terminal, compound, dichasial cyme, many-flowered. Flowers bisexual, regular, 5-merous, fragrant; pedicel 4–10 mm long; sepals free, 1–2.5 mm long, with colleters inside; corolla with almost cylindrical tube 6–10 mm long, pubescent inside below the stamens, and spreading lobes 4–9 mm long, white to pale yellow; stamens inserted in upper part of corolla tube, filaments short; ovary superior, composed of 2 separate carpels united at the extreme base by a disk-like thickening, style up to 7 mm long, pistil head composed of a stigmatic subglobose basal part and a stigmoid apex. Fruit composed of 2 separate, obovoid to globose mericarps up to 3 cm long, stiped at base, yellow to orange, usually 2-seeded. Seeds oblong or ellipsoid, up to 1.5 cm long, smooth, orange; cotyledons thin, leafy.

Hunteria comprises 12 species, which all occur in Africa. Only *H. zeylanica* extends to tropical Asia. It belongs to the tribe *Carisseae* and subtribe *Pleiocarpinae*, together with the genera *Picralima* and *Pleiocarpa*, which are both exclusively African.

Ecology *H. zeylanica* usually occurs in the undergrowth of lowland rain forest, up to 550 m altitude, rarely on limestone. It is locally common, e.g. in parts of Peninsular Malaysia.

Genetic resources *H. zeylanica* is widely distributed and is locally common, and does not seem to be endangered by genetic erosion at present.

Prospects The results of pharmacological research, mainly from Thailand, show several interesting activities of *H. zeylanica* extracts: anti-inflammatory, analgesic and antipyretic activities. These warrant more investigations towards the possible development of *H. zeylanica* as a medicinal plant of importance.

Literature 538, 539, 774, 775, 776.

Other selected sources 121, 334, 600, 701.

Sriana Azis

Hydnophytum formicarum Jack

Trans. Linn. Soc. Lond. 14: 124 (1823).

RUBIACEAE

$2n = 44$

Synonyms *Hydnophytum montanum* Blume (1827).

Vernacular names Indonesia: urek-urek polo (Javanese). Malaysia: dedalu api laut, kepala berok, hempedal itek (Peninsular). Philippines: banghai (Bisaya). Thailand: hua roi ruu (central), krachao pheemot (Surat Thani), pum pao (Trat). Vietnam: ki[ees]n k[yf] nam, [oor] ki[ees]n.

Origin and geographic distribution *H. formicarum* is widely distributed, from the Andaman Islands, peninsular Burma (Myanmar), southern Thailand and southern Cambodia and Vietnam, through the whole of Malesia, to the Solomon Islands and northern Australia (Cape York).

Uses In Indonesia the pounded tuber has been applied as a poultice to treat swellings and headache. In the Philippines, a decoction of the woody bases of the stems is used to treat liver and intestinal complaints. In Thailand powdered stems are taken as an anthelmintic and heart tonic, and to treat bone diseases, skin diseases, lung diseases, and pain in knees or ankles; they are also an ingredient in antidiabetic preparations.

Botany An epiphytic subshrub up to 60 cm tall, with a few quadrangular stems (usually 2–4) arising from a tuber-like swollen base up to 25 cm

long, inside with a labyrinth covered with scales. Leaves decussately opposite, simple and entire, elliptical to broadly lanceolate, often broadest above the middle, 4–15 cm × 2–7 cm, base acute, apex obtuse to rounded, leathery, glabrous, pinnately veined; petiole 0.5–4 cm long; stipules interpetiolar, soon falling. Flowers a few together in shallow, cup-shaped cavities in strongly thickened nodes of the stem, bisexual, 4-merous, sessile; calyx campanulate-urceolate, glabrous or sparsely papillose, limb truncate, persistent; corolla tubular, tube c. 3 mm long, lobes elliptical, thickened at apex, white; stamens inserted in the throat of the corolla, alternating with bundles of hairs; disk ring-shaped, thick; ovary inferior, 2-celled, style filiform, exserted, stigma 2-branched, thick, papillose. Fruit a narrowly obovoid drupe 6–7 mm long, constricted at apex, orange when ripe, with 1–2 pyrenes c. 5 mm long.

The tuber is formed by the hypocotyl of the seedling which swells, even in the absence of ants. Phellogens (meristematic layers which arise in the parenchyma) cut out volumes of tissue which die, leaving cavities. Ants (often of the genus *Iridomyrmex*) usually occupy these cavities and provide the plant with a source of macronutrients through their debris. The flowers are probably usually self-fertilizing, although they produce nectar abundantly and ants visit them regularly.

Hydnophytum formicarum Jack – 1, plant habit; 2, flower in longitudinal section.

Hydnophytum comprises about 50 species and occurs from the Andaman Islands, peninsular Burma (Myanmar), southern Thailand and southern Cambodia and Vietnam, through the whole of Malesia, to the Solomon Islands, Vanuatu, Fiji and northern Australia (Cape York). The greatest number of species occurs in the montane areas of New Guinea. *Hydnophytum* is classified in the tribe *Psychotrieae*, and in the subtribe *Hydnophytinae*, together with 4 other ant-inhabited tuberous *Rubiaceae* of which *Myrmecodia* is the most important. These genera are closely related. *H. formicarum* is a variable species in which several botanical varieties can be distinguished.

Ecology *H. formicarum* is an epiphyte of trees (mostly colonizing branches rather than trunks) in primary and secondary forests, most abundant in seasonal, open forest, up to 1000 m altitude. It occurs also in 'kerangas' vegetation and comparatively often in mangrove vegetation and *Casuarina* trees.

Genetic resources *H. formicarum* is widely distributed and common in widely divergent habitats, so it is not endangered. The wide variation deserves more study.

Prospects It is interesting that *H. formicarum* is used in traditional medicine in Thailand and Indo-China, as well as in Indonesia and the Philippines. This warrants research on its pharmacological properties and phytochemistry.

Literature 62, 173, 387, 389, 760.
Other selected sources 121, 334, 388.

Max Joseph Herman

Hydrolea zeylanica (L.) Vahl

Symb. bot. 2: 46 (1791).
HYDROPHYLLACEAE
$n = 9, 12$

Vernacular names Indonesia: gagabusan, sembung ku-uk (Sundanese), gunda (Javanese). Thailand: po phee (Buri Ram). Vietnam: th[urly l[eej].

Origin and geographic distribution *H. zeylanica* is widely distributed in eastern Africa, Pakistan, Nepal, India, Sri Lanka, Burma (Myanmar), Vietnam, southern China, Taiwan, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines, Sulawesi and northern Australia.

Uses In India pulped leaves of *H. zeylanica* are credited with antiseptic properties and applied as a poultice to ulcers. A decoction of the whole plant is taken to treat cough. In Indonesia young, leafy tops of shoots are eaten as a vegetable, either steamed or fresh. They taste slightly bitter.

Properties An oil is present in *H. zeylanica* seeds; oleic acid and linoleic acid are the chief unsaturated acids and palmitic acid the main saturated acid.

Botany A perennial herb, often much branched; stem up to 150 cm long, in the lower part creeping and freely rooting, with many erect branches. Leaves alternate, simple and entire, narrowly lanceolate, sometimes oblong or elliptical, 1.5–12 cm × 1–2.5 cm, cuneate at base, acute at apex, glabrous or slightly puberulous, pinnately veined; petiole 2–5 mm long; stipules absent. Inflorescence an axillary raceme or panicle, or flowers solitary. Flowers bisexual, regular, 5-merous; pedicel 2–10 mm long; calyx partite to near the base, 5–7 mm long, usually glandular hairy, persistent; corolla deeply partite, with whitish tube and lilac-blue segments white at base, 5–8 mm long; stamens free, inserted in the corolla throat, alternating with the corolla lobes; ovary superior, 2-celled, styles 2, widely divergent, with capitate-clavate stigmas. Fruit an ellipsoid capsule 4–5 mm long, bursting irregularly, many-seeded. Seeds very small, oblong, longitudinally ribbed, with transverse ridges.

H. zeylanica can be found flowering and fruiting throughout the year. The seeds are often spread by water, but rooting branches are also a means of multiplication.

Hydrolea comprises 11 species, 7 of which are native to the Americas and 3 to Africa. *H. zeylanica* is the most widespread species. *H. spinosa* L. has been introduced in Sri Lanka, Java and Timor and is locally naturalized.

Hydrolea zeylanica (L.) Vahl – 1, flowering branches; 2, flower; 3, fruit with calyx removed; 4, seed.

Ecology *H. zeylanica* occurs in permanently or periodically swampy or inundated localities, often in rice fields, also in shallow pools and on river banks, up to 1000 m altitude. It often occurs gregariously, but is a weed of minor importance in the Malesian region.

Genetic resources *H. zeylanica* is widespread and often abundant, and not liable to genetic erosion.

Prospects Nothing is known about pharmacological properties of *H. zeylanica*. Research is needed to confirm the assigned antiseptic properties, and a determination of the food value is desirable to evaluate its use as a vegetable.

Literature 121, 247, 689.

Other selected sources 14, 191, 760, 782, 879.

D.S. Alonzo

Hygrophila ringens (L.) R.Br. ex Steudel

Nomencl. bot., ed. 2, 1: 783 (1840).

ACANTHACEAE

$2n = 32, 44$

Synonyms *Hygrophila angustifolia* R.Br. (1810), *Hygrophila quadrivalvis* (Buch.-Ham.) Nees (1832), *Hygrophila salicifolia* (Vahl) Nees (1832), *Hygrophila erecta* (Burm.f.) Hochr. (1934).

Vernacular names Malaysia: keremak, chukal, maman babi (Peninsular). Philippines: binakag (Iloko), kangon-kangon, mamitik (Tagalog). Thailand: toiting (Bangkok), nam dap fai (Prachuap Khiri Khan), sam sam (Loei). Vietnam: c[aa]y h[aj]t ph[or]ng.

Origin and geographic distribution *H. ringens* has a wide area of distribution: from India and Sri Lanka, through Indo-China, southern

China and Japan, to Thailand and the Malesian region, where there are records from Peninsular Malaysia, Singapore, Java, Borneo and the Philippines, but it probably also occurs elsewhere.

Uses In Peninsular Malaysia, the leaves are applied as a poultice to treat wounds, swellings, boils and headache, and also to treat toothache. The seeds are used by the cosmetic and pharmaceutical industry, particularly in central Europe, as a skin-regenerating product. The leaves may be eaten as a vegetable.

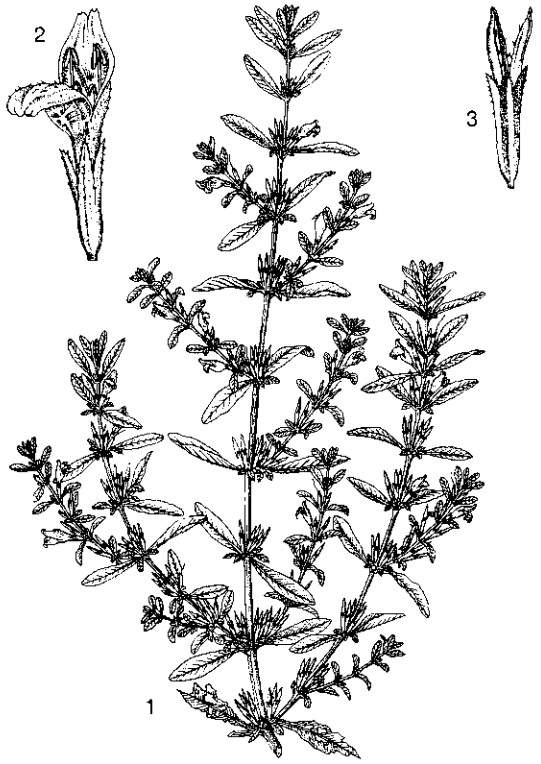
H. schulli (Buch.-Ham.) M.R. Almeida & S.M. Almeida (synonyms: *H. auriculata* (Schum.) Heine, *H. spinosa* T. Anderson) is used in traditional medicine in India and Burma (Myanmar), e.g. to treat liver ailments and spermatorrhoea. In Africa, particularly the roots are applied in the treatment of blennorrhoea, dropsy, anuria, hepatic obstruction and rheumatism. *H. schulli*, which is accredited in India and Africa with diuretic properties, has once been recorded for Malesia (Singapore).

Some *Hygrophila* species are cultivated as ornamental aquatic plants in aquaria. Several species are weeds, often in rice fields.

Properties Lipophilic extracts of *H. ringens* seeds possess neurotrophic activities. They showed a striking effect on the morphological differentiation of cerebral neurons of rat embryos in vitro, and proved to attenuate the degeneration of cholinergic neurons after injury. They also had interesting properties on mice resident peritoneal macrophages by provoking significant morphological changes and by increasing their phagocytosis capacity. A long-chain aliphatic alcohol, n-hexacosanol, proved to be responsible for these activities.

A significant hepatoprotective activity of a methanolic extract of *H. schulli* seeds was reported from tests with rats in India. Studies with rats suggest that an aqueous extract of the same species may exert hypoglycaemic action by mechanisms similar to those of the sulphonylureas. In tests with mice, a petroleum ether extract of the root of *H. schulli* potentiated the sedative-hypnotic action of chlorpromazine, diazepam, pentobarbitone and chlordiazepoxide, and protected against strychnine-induced convulsions. This extract also exhibited haematinic effect in rats and antitumour activity in Ehrlich ascites carcinoma and sarcoma-180 bearing mice.

Botany An erect or ascending annual or short-living herb up to 90(–120) cm tall; stem rooting at the lower nodes, subquadrangular. Leaves decussately opposite, simple, linear-oblong to elliptical-oblong or elliptical-obovate, 1–16 cm × 0.5–5 cm, tapering into petiole at base, acute or obtuse at apex, margin entire to crenulate or undulate, irregularly marked with cystoliths; stipules absent. Inflorescence a dense axillary cluster, conspicuously bracteate. Flowers bisexual, 5-merous; calyx 6–12 mm long, with unequal linear-lanceolate lobes; corolla with ventricose, puberulent tube 7–10 mm long, 2-lipped, upper lip c. 5 mm long, 2-fid, lower lip c. 5 mm long, pale violet-blue or whitish; stamens 4, didynamous, inserted below the middle of the corolla tube; ovary superior, 2-celled, style slender, often with 2 teeth at apex. Fruit a linear-oblong to linear-ovoid loculicidal capsule 1–2 cm long, many-seeded. Seeds globose-ovoid, subcompressed, c. 1.5 mm long, long-hairy.



Hygrophila ringens (L.) R.Br. ex Steudel – 1, plant habit; 2, flower; 3, fruit enclosed in calyx.

H. ringens is an extremely variable species, and is often split up into several species, particularly on the shape of the leaves. A taxonomic account of *Hygrophila* is needed to confirm the broad concept of *H. ringens* as adopted here.

Hygrophila comprises approximately 80 species, and occurs in Africa and Asia, mainly in the trop-

ics. Africa is richest in species (about 45). There are a handful of species in Malesia.

Ecology *H. ringens* occurs in swampy or periodically humid localities, e.g. at watersides, from sea-level up to 1000 m altitude.

Management In tests, the production of n-hexacosanol in tissue cultures of *H. ringens* was not successful, but verbascoside was a major extractable metabolite in callus and cell suspension cultures. This latter compound has antimicrobial properties.

Genetic resources *H. ringens* is widely distributed and is not easily liable to genetic erosion. Its extreme morphological variability should be investigated.

Prospects The uses of *H. ringens* in traditional medicine in South-East Asia as a poultice seem to agree to some degree with the interest of the European cosmetic and pharmaceutical industry in this species as a skin-regenerating product. More research on pharmacological activity may show that it is a promising medicinal plant for primary health care in South-East Asia. Research on *H. schulli*, which is a well-known medicinal plant in India, might also be worthwhile. Neither propagation nor cultivation will be a major impediment.

Literature 64, 121, 644.

Other selected sources 62, 120, 243, 283, 613, 614, 782, 861.

R.H.M.J. Lemmens

Hymenocallis littoralis (Jacq.) Salisb.

Trans. Hort. Soc. London 1: 338 (1812).

AMARYLLIDACEAE

$2n = 44, 46, 48, 68$

Vernacular names Spider lily (En). Philippines: bakong, lirio (Tagalog), ajos-ajos nga maputi (Bisaya). Thailand: phlapphlueng teenpet (Bangkok). Vietnam: b[aj]ch trinh bi[eer]n.

Origin and geographic distribution *H. littoralis* originates from South and Central America, but it is cultivated and naturalized in tropical Africa, Asia and the Pacific islands. In the Malesian region, it is recorded as naturalized in Java, the Philippines and the Bismarck Archipelago.

Uses In the Philippines the bulbs of *H. littoralis* are used as a vulnerary. However, in Thailand they are considered too toxic to be eaten. In Chinese traditional medicine *Hymenocallis* leaves are applied externally to swellings and bruises.

The bulbs of *Hymenocallis* are commonly used in traditional medicine in Central America, most commonly in a decoction taken internally to treat asthma, and as a poultice on boils. Sometimes the flowers are also used in a decoction against cough. Several *Hymenocallis* species, including *H. littoralis*, are commonly cultivated as a garden ornamental in the warmer parts of the world. A cultivar of *H. littoralis* ('Variegata') with leaves striped bright green and edged cream is popular among gardeners.

Properties Several compounds with antitumour and antiviral activities have been isolated from *H. littoralis* bulbs. Lycorine alkaloids (also known as amaryllidaceae alkaloids) are responsible for these activities, e.g. littoraline, which shows inhibitory activity of HIV reverse transcriptase, and lycorine, haemanthamine, which show potent in-vitro cytotoxicity, also against drug-resistant cell lines. The antiproliferative effects of lycorine and haemanthamine result from their complex formation with RNA. Biosynthetically, these compounds are derived from the amino acids tyrosin and phenylalanin. Pancratistatin, narciclasine and 7-deoxynarciclasine are isocarbostyril-type compounds which have antineoplastic activity against a panel of human tumour cell lines and which are present in several *Hymenocallis* species including *H. littoralis*. Pancratistatin has been under development as an anticancer agent. The related compound 7-deoxy-trans-dihydronarciclasine, isolated from *H. littoralis* and some other *Hymenocallis* species, inhibited the cytopathicity and/or replication of various viruses. Lycorine inhibited feeding of desert locusts when sprayed on cabbage leaves in a concentration of 0.05% under laboratory conditions. Antifungal properties have also been recorded for bulb extracts of *H. littoralis*. Some *Hymenocallis* species showed marked activity against avian malaria.

Botany A perennial herb up to 80 cm tall, with spherical bulb 7.5–10 cm in diameter. Leaves radical, 2-seriate, simple, lorate to linear, 40–120 cm × 1.5–5(–7) cm, acute at apex, sessile. Inflorescence a pseudo-umbel with somewhat compressed peduncle up to 60 cm long, with 2 spathes, 6–11-flowered. Flowers bisexual, large, regular, 3-merous, white, fragrant, sessile; tepals 6, equal, united into a long tube 9–17 cm long, segments linear, 7.5–12 cm long, channelled, with an apical cusp; stamens 6, inserted in the perianth throat and connate at base into a false corona 2.5–3 cm long, free part of filaments c. 6 cm long, anthers with orange pollen; ovary inferior, 3-celled, style filiform, slightly exceeding the stamens, stigma small and capitate. Fruit a fleshy capsule, finally

rupturing laterally, few-seeded. Seeds large, with thick, spongy, green testa.

Hymenocallis comprises about 50 species and its natural area of distribution is Central and South America. Several species other than *H. littoralis* are cultivated as an ornamental in the Malesian region, e.g. *H. caribea* (L.) Herbert, *H. narcissiflora* (Jacq.) MacBr. and *H. speciosa* (Salisb.) Salisb., but only *H. littoralis* has become naturalized.

Ecology *H. littoralis* occurs along the seashore and inland in moist, sandy locations at low altitude. It is cultivated in gardens up to 1500 m altitude.

Management *H. littoralis* is best grown in a light, well-drained potting mix of equal parts of loam, leaf mould and sand. Propagation is by seed, but more usual by offsets. Methods for large-scale propagation by tissue culture have been developed for *H. littoralis*. In-vitro production of pancratistatin was also successful in callus cultures, but the concentration was only about 10% of that in bulbs of field-grown plants. Experiments in the United States showed that atmospheric CO_2 enrichment may increase the concentration of active constituents in the bulbs by 75%.

Genetic resources *H. littoralis* is widely cultivated and consequently does not seem to be threatened. However, nothing is known about the genetic diversity of cultivated and naturalized plants in South-East Asia, and this may be very low. In Central America several *Hymenocallis* species are classified as endangered. In Puebla (Mexico) a germplasm collection of ornamental geophytes is maintained, including *Hymenocallis*.

Prospects *H. littoralis* is an interesting medicinal plant, which deserves more attention in South-East Asia. It is a source of compounds with anticancer and antiviral (including anti-HIV) activities, but the reputed beneficial effects of bulb extracts internally on asthma and cough as well as externally on wounds, swellings, bruises and boils also merit more attention and research.

Literature 63, 247, 393, 563, 737, 760.

Other selected sources 62, 120, 346, 646.

Noorma Wati Haron

Hypobathrum Blume

Bijdr. fl. Ned. Ind.: 1007 (1827).

RUBIACEAE

x = unknown

Origin and geographic distribution *Hypobathrum* comprises about 20 species and occurs from India and Burma (Myanmar), through Indo-China and Thailand, to the Malesian region.

Uses There are some records of the use of a root decoction of *Hypobathrum* in traditional medicine in South-East Asia. This is used externally to treat rheumatism, smallpox and yaws, as well as internally to treat stomach-ache. The sour fruits are sometimes used in chutneys. In Java, the astringent young leaves and shoot tips of a *Hypobathrum* species (possibly *H. racemosum*) are eaten raw as vegetable.

Botany Shrubs or small trees, often with straight trunk and pairs of horizontal branches. Leaves opposite, simple and entire, leathery, pinnately veined, with intramarginal vein, shortly petiolate; stipules interpetiolar, triangular, each pair fused at base forming a prominent median keel and encircling the twig, more or less persistent. Inflorescence an axillary spike, raceme, simple dichasium or panicle with paired short branches. Flowers bisexual, 4-merous, stalked; calyx cup-shaped or bell-shaped, with tiny lobes; corolla with short, trumpet-shaped tube and narrowly triangular to ovate lobes, contorted in bud; stamens inserted in the corolla throat; disk annular; ovary inferior, 2-celled, style hairy, with 2-lobed stigma. Fruit berry-like, fleshy, indehiscent, 1-many-seeded. Seeds flat, arranged imbricately, pendulous, with endosperm.

Malformations of the floral parts of the plant are often found. *Hypobathrum* is classified in the tribe *Hypobathreae*, together with about 20 other genera from Africa, Madagascar and tropical Asia. The taxonomy of *Hypobathrum* is poorly known. Several species have probably been confused in the literature, and it is, for example, possible that the information given here under *H. racemosum* partly applies to other *Hypobathrum* species.

Ecology *Hypobathrum* usually occurs in lowland forest, also in secondary forest and swamp forest, but some species may grow in the mountains, up to over 2000 m altitude.

Genetic resources The *Hypobathrum* species treated here are locally common and do not seem to be liable to genetic erosion.

Prospects Information on *Hypobathrum* is extremely scarce, including botany and medicinal properties. This precludes a judgement on the prospects as medicinal plants.

Literature 121, 689.

Selection of species

Hypobathrum racemosum (Roxb.) Kurz

Forest fl. Burma 2: 51 (1877).

Synonyms *Petunga roxburghii* DC. (1830).

Vernacular names Indonesia: kihapit (Sundanese), apit, babalan (Javanese). Malaysia: kayu ekur gajah, tulang betina (Peninsular). Thailand: khan laen (peninsular). Vietnam: s[uws]a, s[uws]a ca.

Distribution Southern Burma (Myanmar), southern Indo-China, southern Thailand, Peninsular Malaysia, Java and Borneo.

Uses The roots are used in a complex decoction to treat yaws in Cambodia.

Observations A shrub or small tree up to 12 m tall; leaves lanceolate, 6–15(–20) cm × 2.5–4 cm; corolla 5–6 mm long, white or greenish-white; fruit ellipsoid or globose, c. 6 mm long, usually with about 8 seeds. *H. racemosum* occurs in lowland forest, often in swampy locations and secondary forest, in Java up to 600 m altitude.

Selected sources 62, 121, 732, 789, 990.

Hypobathrum venulosum (Hook.f.) K.M. Wong

Tree Fl. Mal. 4: 355 (1989).

Synonyms *Petunga venulosa* Hook.f. (1880).

Vernacular names Malaysia: kayu gading, tulang betina, umpaong puteh (Peninsular).

Distribution Peninsular Malaysia; possibly also Borneo.

Uses In Peninsular Malaysia, a decoction of the roots is used to treat rheumatism (externally) and stomach-ache (internally), and pounded roots are applied as a poultice against smallpox. The sour fruits are sometimes used in chutneys.

Observations A shrub or small tree up to 6 m tall; leaves elliptical-oblong, 7.5–15 cm × 4–7.5 cm; corolla c. 8 mm long, white; fruit club-shaped, c. 12 mm long. *H. venulosum* occurs in lowland and hill forests, also in swampy locations.

Selected sources 121, 334, 789, 990.

Sudibyo Supardi & Hurip Pratomo

Hypoestes polythyrsa Miq.

Fl. Ned. Ind. 2: 852 (1858).

ACANTHACEAE

$2n$ = unknown

Synonyms *Hypoestes psilostachyus* C.B. Clarke ex S. Moore (1925).

Vernacular names Indonesia: trembuku, landep iju, lucung asu (Javanese).

Origin and geographic distribution *H. polythyrsa* occurs throughout Java, but seems endemic to this island.

Uses In central Java, a decoction of young branches of *H. polythyrsa* mixed with flower heads of *Artemisia cina* Berg ex Poljakov (a well-known anthelmintic plant which is imported) has been recommended as a poultice to expel maggots and intestinal worms.

Some other *Hypoestes* species are used in traditional medicine in Africa, particularly *H. forskaolii* (Vahl) Sol. ex Roemer & Schultes and *H. aristata* (Vahl) Sol. ex Roemer & Schultes (these species are often confused under the name *H. verticillaris*), the roots of which are used internally to treat cough and meningitis. The leaves are used externally to treat swellings and sores. *H. triflora* (Forssk.) Roemer & Schultes is frequently used in Rwanda to treat hepatic diseases.

Some *Hypoestes* species are valued as ornamentals, particularly *H. phyllostachya* Baker, often with rose to pale lavender spotted leaves.

Properties There is no information on the phytochemistry or pharmacological properties of *H. polythyrsa*.

The phenanthroindolizidine alkaloids hypoestestatins 1 and 2 have been isolated from *H. forskaolii* from East Africa; these are anti-neoplastic agents, which markedly inhibited the growth of murine P-388 lymphocytic leukaemia cell lines. Several fusicoccane diterpene ketones have also been reported in the aerial parts of this species. A hepatoprotective principle has been demonstrated in a water extract from the leaves of *H. triflora* from Rwanda; the compound responsible for the protective activity in tests with mice was benzoic acid.

Several diterpenoids have been isolated from extracts of the African *H. rosea* P. Beauv.: roseanalone, roseadione, roseatoxide, hypoestoxide and dihypoestoxide. Hypoestoxide showed anti-inflammatory activity in tests with mice and could be useful in treating various inflammatory diseases.

The diterpene serpendione has been isolated from *H. serpens* (Vahl) R.Br. from Madagascar; it exhibited relaxant activity on isolated rat aorta.

Botany An erect herb up to 120 cm tall; stem thickened above the nodes, apically more or less densely short-hairy. Leaves opposite, simple and entire, elliptical-ovate to oblong-lanceolate, 3–14 cm × 1–6 cm, pubescent below or on both surfaces, often with a pale blotch above; petiole 0.5–4 cm long; stipules absent. Inflorescence an axillary

cyme with distant, spiciform ultimate branches. Flowers in pairs within an involucre, one flower of each pair rudimentary, involucre consisting of 2 narrow connate bracts up to 1.5 cm long, bisexual; calyx 5-fid; corolla 2–3 cm long, resupinate by torsion of the tube, 2-lipped, upper lip entire or 2-lobed, lower lip 3-lobed, reddish-violet, sometimes white; stamens 2, inserted at the apex of the corolla tube, exserted; ovary superior, 2-celled, style shortly branched. Fruit a clavate capsule, c. 1 cm long, 1–4-seeded. Seeds flat, densely verruculose.
Hypoestes comprises approximately 120 species, and occurs in Africa, Madagascar, Asia from the Himalayas to Indo-China, China, Thailand, Malesia, and Australia. Perhaps a dozen species occur in the Malesian region. *Hypoestes* belongs to the tribe *Justicieae*, and has close affinities with *Peristrophe* and *Dicliptera*. It can be separated from other *Acanthaceae* on the combination of resupinate corollas with monothecous anthers and inelastic placental bases.

Ecology *H. polythyrsa* occurs in more or less shaded localities in open forest and shrub vegetation, up to 1500 m altitude, and is locally common, e.g. in central Java.

Management *H. polythyrsa* can be easily propagated by seed and cuttings.

Genetic resources No taxonomic study of *Hypoestes* has yet been made, which would confirm the endemic status of *H. polythyrsa* in Java. It might be endangered by the ever-increasing pressure on the forest in Java.

Prospects The use of *H. polythyrsa* seems limited and unimportant, and it is unlikely that this situation will change, unless future chemical research demonstrates interesting compounds, as has been the case for some African species.

Literature 62, 334, 491.

Other selected sources 39, 120, 121, 696, 736, 950.

R.H.M.J. Lemmens

Hypoxis aurea Lour.

Fl. cochinch. 1: 200 (1790).
HYPOXIDACEAE
$2n = 54$

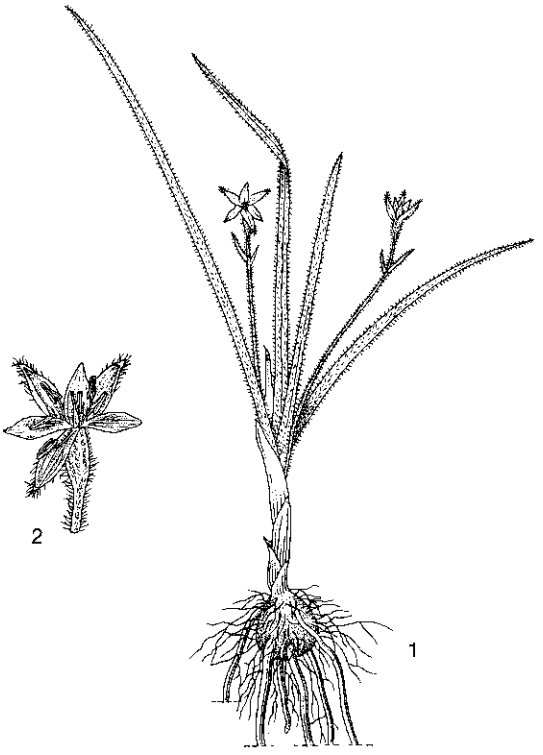
Vernacular names Philippines: kitkitli (Igorot). Vietnam: h[aj] tr[aa]m.

Origin and geographic distribution *H. aurea* occurs in Pakistan, India, Indo-China, southern China, Taiwan, Japan, Thailand and the Malesian region (Peninsular Malaysia, Sumatra, Java, Flores, the Philippines, Sulawesi and New Guinea).

Uses The rhizome of *H. aurea* is used in Chinese traditional medicine; it is considered reconstructive, rejuvenating, aphrodisiac and tonic. It is imported in Malaysia, and sold in Chinese shops. In India the aerial parts of *H. aurea* are considered aphrodisiac.
The rhizomes of several *Hypoxis* species are used in traditional medicine in southern Africa, as a convalescent and tonic. They are also used in cases of tuberculosis and cancer, to treat benign prostatic hypertrophy, urinary tract infections and testicular tumours, and as a laxative and vermifuge. Preparations based on lipophilic extracts of African *Hypoxis* rhizomes have been introduced into the market for the treatment of prostatic hypertrophy. Capsules based on standardized *Hypoxis* extracts are also prescribed for cancer therapy, e.g. to treat lung cancer. In the West Indies some *Hypoxis* species are used for curing tumours of the testicles.

Properties Glycosides of norlignan constituents, uncommon aglycones, have been isolated from African *Hypoxis* species. The active compound in the treatment of cancer is considered to be hypoxoside, the major diglucoside isolated from the rhizomes, which showed good results in patients in South Africa with slow-growing necrotising lung tumours that are inoperable, and which showed no toxicity. This compound can be converted by endogenous β-glucosidase activity into its cytotoxic aglycone rooperol. Tests with mice indicated that hypoxoside exerts analgesic effects probably through an anti-inflammatory mechanism.
Phytosterols, with β-sitosterol as the main component, have also been isolated from African *Hypoxis* species. These were found to be an effective option in the treatment of benign prostatic hyperplasia in a double-blind, placebo-controlled clinical trial. The action may be due to the decrease of testosterone levels through inhibition of 5-α-reductase, or to the decrease of the binding of dihydrotestosterone to its receptor in the prostate tissue. In addition, β-sitosterol and its glucoside isolated from *Hypoxis* stimulate human peripheral blood lymphocyte proliferation.

Botany A small perennial herb up to 30 cm tall, with globose to elongate rhizome. Leaves in a radical rosette, linear, 4–30 cm × 1–5 mm, hairy. Inflorescence with a filiform peduncle 4–12 cm long, leafless or with a single sheathing leaf, hairy, 1–2-flowered; bracts setaceous. Flowers bisexual, 3-merous, shortly pedicellate; tepals 6, free, nearly



Hypoxis aurea Lour. – 1, habit of flowering plant; 2, flower.

equal, oblong to elliptical-lanceolate, 5–7 mm long, spreading, villous outside, bright yellow; stamens 6, inserted at the base of the perianth segments, with sagittate anthers; ovary inferior, 3-celled, villous, style short but robust, with 3 decurrent stigmas. Fruit an ellipsoid to clavate capsule c. 7 mm long, many-seeded. Seeds globose, with crustaceous, tuberculate, black testa.

Hypoxis comprises about 50 species, although the number is obscure because of the occurrence of polyploid apomicts. It is widespread in Africa, Asia, Australia and America, but southern Africa is richest in species. *Hypoxidaceae*, including *Hypoxis*, are sometimes considered as belonging to *Amaryllidaceae*, then usually as a separate subfamily.

Ecology *H. aurea* is found in dry sunny localities, often in grassland, at 900–2300 m altitude, scattered, but locally common.

Management In southern Africa *H. hemerocallidea* Fisch. & C.A. Mey. (synonym: *H. rooperi* S. Moore) and some other *Hypoxis* species are cultivated as a medicinal plant. In-vitro propagation was successful using callus from young flower buds and rhizome explants cultured on a modified Murashige and Skoog medium supplemented with growth hormones. In tests, in-vitro production of hypoxoside was only possible in tissues showing some degree of root differentiation, the amount produced was considerably less than is found in rhizomes of grown plants. Plants take about 3 years to produce rhizomes of extractable size.

Genetic resources Although *H. aurea* is not very common in the Malesian region (only occurring locally in Peninsular Malaysia and Java, perhaps more common in the Philippines), it has a wide distribution on mainland Asia and does not seem to be easily liable to genetic erosion. Experience in southern Africa with *Hypoxis* has shown that when a plant becomes of interest for medicinal applications it may rapidly become endangered in the wild.

Prospects Pharmacological research in South Africa has demonstrated promising medicinal properties of *Hypoxis* rhizomes and their compounds for the treatment of important diseases such as lung cancer and prostatic hypertrophy. This may encourage research on the phytochemistry and pharmacological properties of the poorly-known South-East Asian *Hypoxis*.

Literature 64, 121, 247, 489, 760, 873, 956.

Other selected sources 62, 675, 676, 716.

R.H.M.J. Lemmens

Hyptis Jacq.

Collectanea 1: 101, 103 (1787).

LABIATAE

x = 14, 15, 16; *H. capitata*: $2n$ = 30, 32, *H. pectinata*: $2n$ = 32, *H. spicigera*: $2n$ = 32, *H. suaveolens*: $2n$ = 24, 28, 30, 32

Origin and geographic distribution *Hyptis* comprises about 250 species and is indigenous in the American tropics and subtropics. Some weedy species are also found in the tropics of Africa, Asia and Australia. In the Malesian region 5 species have been introduced and are naturalized.

Uses All *Hyptis* species occurring in South-East Asia are used medicinally, although sometimes outside this region. The leafy parts are most commonly used, the roots less commonly. The major applications are externally to treat wounds, skin diseases and rheumatism, and internally against bronchial and gastro-intestinal problems, headache and fever. The leafy parts are commonly used as insect repellent, and sometimes as food flavouring.

Properties The leaves of many *Hyptis* species contain an essential oil (usually 0.05–0.5%) with a high amount of sesquiterpenes. Crude extracts of several *Hyptis* species (e.g. *H. pectinata* and *H. suaveolens*) showed significant antimicrobial activity against *Candida albicans* and selected gram-positive and gram-negative bacteria, which supports their use as an antiseptic on wounds. Cytotoxic activity has been demonstrated for a number of *Hyptis* species.

The triterpenoids oleanolic acid and pomolic acid have been isolated from whole *H. capitata* plants. These compounds showed anti-human immunodeficiency virus (HIV)-activity. Derivatives of ursolic acid isolated from *H. capitata* exhibited cytotoxicity.

Three 5,6-dihydro-α-pyrones, pectinolides A, B and C, have been isolated from *H. pectinata*. They showed antimicrobial activity and, moreover, exhibited significant in-vitro cytotoxic activity against a variety of tumour cell lines. An aqueous extract of dried *H. pectinata* leaves exhibited analgesic and anti-inflammatory activities in experimental animals. Inflorescences showed considerable molluscicidal activity. The lactonoid bitter principle ovatolide has been isolated from *H. pectinata* leaves.

The unsaponifiable fraction of dried *H. suaveolens* leaves and flowers exhibited chronotropic effect in frogs, hypotensive effect in dogs, inotropic and spasmogenic effects in rabbits, and spasmolytic and vasodilator effects in rats. An extract of *H. suaveolens* showed moderate inhibition of mycelial growth of the keratinophilic fungi *Chrysosporium tropicum*, *Microsporum gypseum* and *Trichophyton terrestre*. A test in Africa (Guinea Bissau) showed that fresh and smouldering *H. suaveolens* has significant mosquito repellent activity.

A water extract of the whole plant of the South and Central American *H. lantanifolia* Poit. was a potent inhibitor of human immunodeficiency virus-reverse transcriptase (HIV-RT) with an IC_{50} of 6–8 μg/ml. Ethanol extracts of *H. lantanifolia* and *H. obtusiflora* C. Presl ex Benth. (also from tropical America) showed considerable xanthine oxidase inhibitory activity. Extracts of another tropical American species, *H. verticillata* Jacq., showed antibacterial, antisecretory and cytotoxic (KB and Ht 29 cell lines) activities. The essential oil (with main components α-pinene, β-pinene and thymol), (R)-5-hydroxypyrrolidin-2-one, rosmarinic acid and dehydropodophyllotoxine contributed to the antibacterial effects; rosmarinic acid showed significant capillary stabilizing effects and sideritoflavone inhibited prostaglandin synthase to a significant extent and also had antisecretory effects. In addition, several lignans with cytotoxic activity against a number of human cancer cell lines have been isolated from *H. verticillata*. Several *H. verticillata* extracts showed anti-inflammatory activity.

Botany Herbs or shrubs, often aromatic. Leaves decussately opposite, simple, serrate, gland-dotted, shortly to long-petiolate; stipules absent. Inflorescence a usually axillary dense spurious head, spike, raceme or a few-flowered cluster, often secund; bracts subulate or setaceous. Flowers bisexual, 5-merous, zygomorphic; calyx tubular or campanulate, straight or oblique, tube 10-veined, teeth subequal; corolla 2-lipped, upper lip 2-lobed, lower lip 3-lobed with midlobe abruptly deflexed; stamens 4, free, declinate; disk entire; ovary superior, 4-celled, style subentire or shortly 2-fid. Fruit consisting of 4 oblong or ovoid, 1-seeded nutlets enclosed in the persistent calyx.

All *Hyptis* species treated here can be found flowering and fruiting throughout the year.

Hyptis is classified in the tribe *Ocimeae*, subtribe *Hyptidinae*, characterized by the stamens held in the lower lip of the corolla, which is usually strongly compressed to form an explosive pollination mechanism, powdering visiting insects from below with pollen. Cladistic studies showed that *Hyptis*, as usually delimited, is a paraphyletic group. For this reason, about 45 species have been transferred recently to other genera: *Hypenia*, *Hyptidendron* and *Eriope*.

The name *H. rhomboidea* is often used for the species here treated as *H. capitata*. It is not clear to which species (*H. capitata* Jacq. or *H. rhomboidea* M. Martens & Galeotti) the South-East Asian material with long-stalked spurious heads belongs, or whether these species are even conspecific.

Ecology The *Hyptis* species of South-East Asia occur in waste places, as a weed in fields, grassland and sometimes in open forest, usually in the lowland, sometimes up to 1300 m altitude. They are usually weeds of minor importance, e.g. in rice fields.

Genetic resources The *Hyptis* species treated here are very widespread, often weedy herbs that do not merit attention concerning genetic erosion and conservation.

Prospects *Hyptis* definitely deserves more attention for medicinal and insecticidal applications in South-East Asia. Comparatively much research has been done on bioactivity of *Hyptis* extracts

and compounds, and these studies showed promising results for the development of plant-based drugs for possible treatment of important diseases such as AIDS and different forms of cancer, as an antiseptic agent for external application, and as an insect repellent. The worldwide use in traditional medicine is another indication of the efficiency of *Hyptis* drugs.

Literature 319, 516, 604, 796.

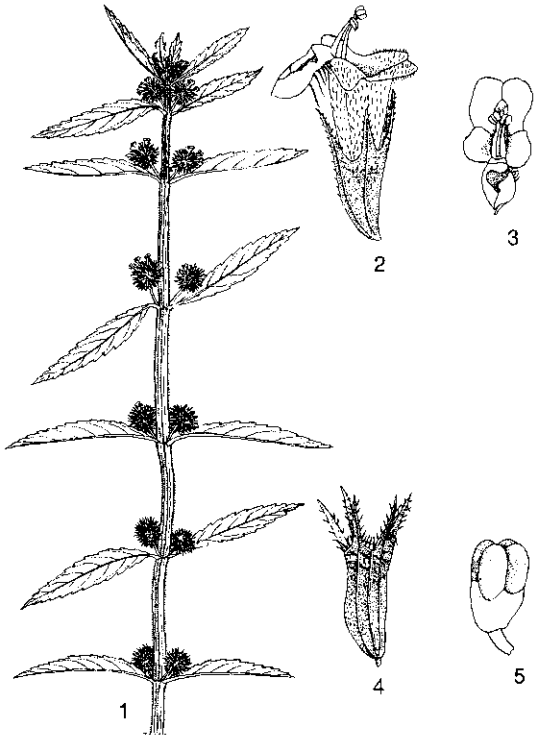
Selection of species

Hyptis brevipes Poit.

Ann. Mus. Hist. Nat. Paris 7: 465 (1806).

Vernacular names Indonesia: boborongan, genggeyan (Sundanese), godong puser (Javanese). Malaysia: sawi enggang, sawi hutan, ati-ati puteh (Peninsular). Thailand: chat pra in (southern). Vietnam: [es] cu[oos]ng ng[aws]n.

Distribution Native to Central America, but naturalized pantropically, and throughout Indo-China, Thailand and Malesia.



Hyptis brevipes Poit. – 1, top of flowering and fruiting stem; 2, flower in lateral view; 3, flower in front view; 4, fruiting calyx; 5, fruit after removal of calyx.

Uses In Indonesia the leaves are applied to wounds. A decoction of leaves and stems is applied after childbirth in Malaysia, and a poultice of the leaves to the abdomen of children to expel worms. In Central America a decoction of the plant is used to treat headache and diarrhoea. The leaves are sometimes eaten as a vegetable.

Observations An erect herb up to 150 cm tall, not aromatic; leaves narrowly lanceolate to ovate-oblong, 4–8 cm × 1–2.5 cm, long-cuneate at base; inflorescence a dense, subglobose spurious head c. 1 cm in diameter with peduncle up to 1 cm long; flowers with subtubular calyx up to 4 mm long and corolla up to 4 mm long, white but lower lip yellowish. *H. brevipes* occurs in waste places, mainly under per-humid climatic conditions up to 1200 m altitude; it is often abundant in fallow rice fields.

Selected sources 121, 247, 334, 646.

Hyptis capitata Jacq.

Collectanea 1: 102 (1787).

Vernacular names Philippines: botonesan (Tagalog), palapasagi (Panay Bisaya), tultulisan (Iloko). Vietnam: [es] h[if]nh thoi, [es] hoa d[aaf]u.

Distribution Native to tropical America, but naturalized in the Old World tropics and throughout Malesia.

Uses In the Philippines a decoction of the leaves is used externally to treat wounds, and a decoction of the roots internally against amenorrhoea. In Central America a decoction of the plant is applied against toothache, gastro-intestinal troubles, oedema, intermittent fever, bronchial complaints and sore eyes.

Observations A large, erect herb up to 250 cm tall, not aromatic; leaves lanceolate to rhomboid-elliptical, 6–10(–14) cm × 1.5–4(–6) cm, cuneate and decurrent at base; inflorescence a dense, subglobose spurious head c. 1 cm in diameter with peduncle up to 5(–8) cm long; flowers with tubular calyx up to 8 mm long and corolla up to 6 mm long, white, violet-dotted. *H. capitata* occurs in waste places, along water courses, on fallow rice fields and in open teak forest, up to 1300 m altitude, sometimes gregariously.

Selected sources 247, 451, 646, 760.

Hyptis pectinata (L.) Poit.

Ann. Mus. Hist. Nat. Paris 7: 474, t. 30 (1806).

Distribution Native to tropical America, but naturalized in many other tropical regions; in Malesia found in West Java and New Guinea (Morobe District).

Uses The leaves are commonly used in traditional medicine in Africa, e.g. as a purgative, analgesic and febrifuge, and to treat dysentery, chest complaints, cough, rheumatism, boils, internal piles, early rectal cancer and scabies. Similar uses are known for Central America. The leaves are also used for flavouring soup.

Observations A large, shrubby herb up to 250 cm tall, aromatic; leaves ovate or elliptical, 2–3 cm × 1–1.5 cm, rounded or truncate at base; inflorescence a spurious raceme up to 8(–15) cm long, consisting of many secund cymes and generally forming a large, terminal panicle; flowers with tubular calyx up to 4 mm long and corolla up to 3.5 mm long, violet or pale mauve fading to cream. *H. pectinata* occurs in waste places and along water courses, up to 700 m altitude, locally gregariously.

Selected sources 95, 120, 247, 646, 729.

Hyptis spicigera Lamk

Encycl. 3: 185 (1789).

Vernacular names Indonesia: mossolan (Lesser Sunda Islands), babalu bugis (Sulawesi). Philippines: kalu-ui (Cebu Bisaya), ikugkuting (Sulu).

Distribution Native to tropical America, but naturalized in many other tropical regions; in Malesia found in south-eastern Borneo, the Lesser Sunda Islands, the Philippines, Sulawesi and the Moluccas.

Uses The whole plant and leaves are commonly used in traditional medicine in Africa, e.g as febrifuge, bechic and expectorant and to treat bronchial troubles, headache, dysentery, wounds, skin diseases and ophthalmia. The plant is commonly used to repel insects, e.g. mosquitoes and termites. The seeds are used as a flavouring in stews and sauces.

Observations An erect herb up to 150 cm tall, aromatic; leaves lanceolate to elliptical-lanceolate, 2.5–6 cm × 1–3 cm, cuneate and decurrent at base; inflorescence a terminal and axillary spurious spike or head up to 1.5 cm long (up to 4.5 cm in fruit); flowers with tubular calyx up to 7 mm long and corolla purplish, pale blue or violet. *H. spicigera* occurs in waste places, rice fields, dry grassland and on coastal coral limestone, up to 900 m altitude, locally gregariously.

Selected sources 120, 247.

Hyptis suaveolens (L.) Poit.

Ann. Mus. Hist. Nat. Paris 7: 472, t. 29, f. 2 (1806).

Vernacular names Indonesia: lampesan (Javanese), jukut bau (Sundanese), mang-kamang (Madurese). Malaysia: malbar hutan, selaseh hutan, pokok kemangi (Peninsular). Papua New Guinea: iliplua (New Britain), pedidi (Milne Bay). Philippines: suob-kabayo (Tagalog), loko-loko (Bisaya), amotan (Bikol). Thailand: kaaraa (Surat Thani), maeng lak khaa (Chumphon). Vietnam: [es] th[ow]m, ti[as] t[oo] d[aj]i.

Distribution Native to tropical America, but naturalized in the Old World tropics and throughout Indo-China, Thailand and Malesia.

Uses In the Philippines the stem tips and leaves are used externally to treat wounds and skin diseases, in a bath to treat rheumatism and as sudorific, and internally as antispasmodic. The root has emmenagogue and stomachic properties, and is also used to treat rheumatism. The leaves are also used as insect repellent, e.g. against bedbugs. In Papua New Guinea leaves are applied externally to cuts and wounds, and internally to treat fever and catarrh. In Indonesia the plant is used as galactagogue. In China stems and leaves are used in traditional medicine to treat colds, rheumatism, eczema and bruises. In Africa and Central America *H. suaveolens* has similar medicinal applications. In Thailand pounded branches and leaves are used as lice repellent for chickens. The shoot tips sometimes serve as a food flavouring and the roots as an appetizer. The whole plant is occasionally used as forage for cattle.

Observations A large, much-branched herb up to 200 cm tall, strongly aromatic, almost fetid; leaves ovate to broadly obovate, 3–5 cm × 2–4 cm, rounded or truncate, often slightly oblique, at base; inflorescence a lax, 2–5-flowered secund cyme arranged racemosely towards the ends of branches; flowers with campanulate calyx up to 10 mm long and corolla up to 8 mm long, blue to violet. *H. suaveolens* occurs in waste places, roadsides, along water courses and the sea-shore, in fallow fields and plantations, garden regrowths and savanna, up to 1300 m altitude, often gregariously.

Selected sources 120, 121, 173, 196, 247, 334, 347, 646, 718, 760, 761, 811, 1030.

Rini Sasanti Handayani

Illigera luzonensis (Presl) Merr.

Philipp. Gov. Lab. Publ. Bur. Bull. 17: 18 (1904).

HERNANDIACEAE

$2n$ = unknown

Synonyms *Illigera ternata* (Blanco) Dunn (1908), *Illigera cardiophylla* Merr. (1914), *Illigera*

ovatifolia Quis. & Merr. (1928) p.p.

Vernacular names Philippines: lagitik (Tagalog), alibalibin (Pampanga), kuripatong (Iloko).

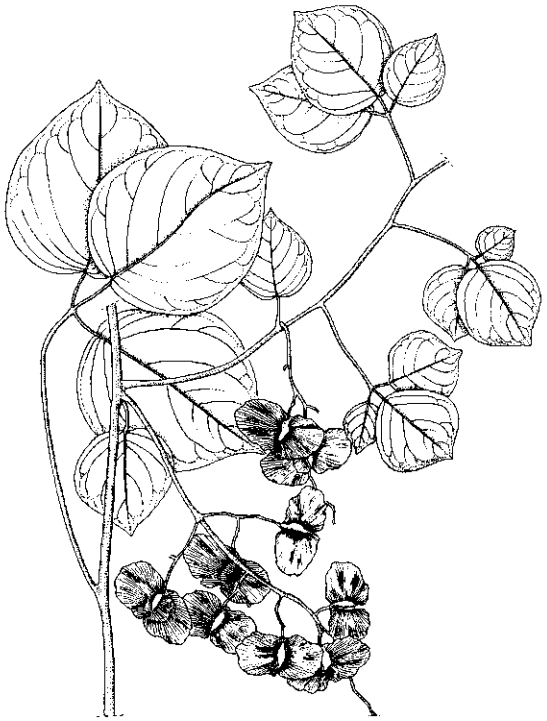
Origin and geographic distribution *I. luzonensis* is found from the southern Ryukyu Islands southwards to Taiwan and the Philippines (Luzon, Palawan, Mindoro, Samar).

Uses The traditional use of *I. luzonensis* in the Philippines is very limited. Sap from the stem was drunk as a remedy for headache in central Luzon. In Peninsular Malaysia traditional uses are recorded for two other *Illigera* species of slightly unclear identity. The leaves of what is possibly *I. parviflora* Dunn (synonym: *I. appendiculata* auct. non Blume) are used for poulticing boils. Apparently an extract of the bark of *I. pulchra* Blume (synonym: *I. lucida* Teijsm. & Binnend.) is used to cure rheumatism.

Properties Pharmacological studies have revealed that extracts of *I. luzonensis* exhibit significant biological activities, e.g. antispasmodic, analgesic, antifebrile and local anaesthetic effects. Aporphines and oxoaporphines were isolated from *I. luzonensis* stems. Several of these compounds (actinodaphnine, N-methylactinodaphnine, launobine, dicentrine, O-methylbulbocapnine, hernovine and liriodenine) showed significant antiplatelet aggregation activity, whereas actinodaphnine and dicentrinone exhibited significant vasorelaxant activities in tests with rats.

Results from experiments using various animal models indicate that N-methylactinodaphnine is a selective α-adrenoceptor antagonist. α-Adrenoceptors mediate many important physiological functions, and the development of α-adrenoceptor antagonists is important in clinical medicine, particularly for the treatment of cardiovascular diseases.

Botany A liana up to 5 m long, climbing with the aid of twisted petioles. Leaves alternate, 3-foliolate; petiole 4–12 cm long; stipules absent; leaflets (sub)orbicular or ovate, 4–13 cm × 3–10.5 cm, base truncate, cordate or cuneate, apex acute or acuminate, 3–5-veined, glabrous or hairy, petiolulate. Inflorescence a terminal or axillary thyrse up to 20 cm long. Flowers bisexual, 5-merous, bracteolate; tepals 10, in two rows, subequal, lanceolate, c. 10 mm × 3 mm, green or pale pink; stamens 5, inserted opposite the outer tepals and alternating with sessile glands, staminal appendages inflated, spathe-like; ovary inferior, 1-celled. Fruit a samara, nut 1.5–3.5 cm long, wings hemi-orbicular or sublingulate, 2 longer ones 1.5–2.5 cm long, (1–)2 shorter ones 0.5(–1) cm long. Seed without endosperm; embryo straight; cotyledons large.



Illigera luzonensis (Presl) Merr. – fruiting branch.

In the Philippines *I. luzonensis* flowers in September–October. Short-range dispersal of the seeds is probably by wind.

Illigera comprises some 20 species, and occurs in Africa and Madagascar (3 species) and tropical and subtropical Asia; in Malesia 9 species are indigenous.

Ecology *I. luzonensis* is common on lower mountain slopes, also in secondary regrowth and forest plantations, from sea-level up to 1300 m altitude.

Genetic resources *I. luzonensis* is locally common and occurs also in secondary habitats, and therefore does not appear to be threatened by genetic erosion.

Prospects Some of the alkaloids isolated from *I. luzonensis* may serve as model compounds for the treatment of cardiovascular diseases. Further research is needed to evaluate their potential.

Literature 151, 247, 299.

Other selected sources 121, 380, 618, 621, 731.

J.L.C.H. van Valkenburg

Indigofera L.

Sp. pl. 2: 751 (1753); Gen. pl. ed. 5: 333 (1754).
LEGUMINOSAE
$x = 8$; *I. linnaei*, *I. tinctoria*: $2n = 16$

Origin and geographic distribution *Indigofera* consists of about 700 species, and is widely distributed in the tropics and subtropics of Africa, the Americas, Asia and Australia. Africa is richest in species, but the southern Himalaya region is also comparatively rich. Approximately 35 species occur naturally in South-East Asia, 16 of which are found in the Malesian region. Additionally, several species have been introduced in South-East Asia.

Uses *Indigofera* is used in traditional medicine in South-East Asia for various complaints, externally, e.g. to treat sores, ulcers and aphthae, as well as internally, e.g. to treat epilepsy and as a diuretic. Some *Indigofera* species are well-known dye plants throughout the world, especially *I. arrecta* Hochst. ex A. Rich. and *I. tinctoria* L., the leaves of which are also used in traditional medicine to treat epilepsy and nervous disorders, and to heal sores and ulcers. Several *Indigofera* species are used as a cover crop, green manure or fodder, e.g. *I. hirsuta* L. and *I. suffruticosa* Miller, both of which have medicinal applications: the leaves of the first are used to treat stomach complaints in the Philippines and Thailand, the roots of the second to treat stomach-ache and diarrhoea, the leaves against fever and the juice against diarrhoea in Malaysia. Seeds are used occasionally as a famine food, including those of *I. linifolia* and *I. linnaei*.

In Taiwan the roots of *I. zollingeriana* Miq. are used to treat stomach-ache and snakebites. In Burma (Myanmar) the roots of *I. cassioides* Rottler ex DC. (synonym: *I. pulchella* Roxb.) are applied to treat cough.

Properties An ethanol extract from the leaves of *I. oblongifolia* showed in-vitro antibacterial activity against *Enterococcus faecalis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Small proteins or peptides in the leaves of *I. oblongifolia* show considerable in-vitro antibacterial and antifungal activity. These compounds probably play a role in the defence mechanism of the plant.

An extract of the above ground parts of *I. tinctoria* shows hypoglycaemic and central nervous system-depressant effects in rats, and potentiates pentobarbital sodium-induced sleep in mice. An ethanol extract possesses protective effects against carbon tetrachloride-induced liver damage in rabbits, rats and mice, as confirmed by histopathological studies.

Pharmacological research on *I. arrecta* supports its traditional use in Ghana, where an aqueous extract of leaves from immature shoots is administered orally to patients with diabetes mellitus. This extract prevented the development of hyperglycaemia in genetically obese diabetic mice. In tests with rats, an intraperitoneal administration of a hot water extract of dried leaves decreased the plasma glucose levels of fasting normoglycaemic rats, but did not prevent the rise in plasma glucose after an oral glucose load. It was suggested that the extract is insulinotropic and may require functional β-cells to be active. The extract was devoid of acute and subchronic toxic effects in tests with mice. Clinical test data suggest that the plant may not have overt toxic reactions in humans but could affect the immune status of users. A medicine based on *I. arrecta* for the management of peptic ulcer has been patented.

Many *Indigofera* species contain toxic compounds. The toxic effects of *I. linnaei* may well be attributed to the presence of nitropropanoyl esters that upon hydrolysis yield 3-nitropropanoic acid. This compound inhibits succiniate dehydrogenase and other essential respiratory enzymes. Several flavonoids have been isolated from *Indigofera*, including *I. linifolia*.

Botany Annual or perennial herbs or shrubs, with a taproot; branches spreading or ascending; indumentum consisting of 2-branched hairs. Leaves alternate, imparipinnate, sometimes trifoliolate or unifoliolate; stipules usually persistent. Inflorescence an axillary raceme, bracteate. Flowers bisexual, pedicellate; calyx campanulate, 5-toothed; corolla papilionaceous, standard without appendages, usually pubescent outside, wings usually with an auricle at base, keel with auricles at base and with lateral pockets; stamens 10, 9 connate and 1 free, all fertile, alternatingly shorter and longer; ovary superior, sessile, 1-celled, style curved upwards. Fruit a linear to globose pod, 1–20-seeded, dehiscent or not. Seeds globose to ellipsoid, cylindrical or quadrangular. Seedling with epigeal germination; cotyledons thick, short-lasting.

In Java flowering and fruiting of *I. linifolia* is limited to March–June, whereas *I. linnaei* and *I. oblongifolia* can be found flowering and fruiting throughout the year. *I. linifolia* and *I. linnaei* both have nodulating ability.

The large number of species makes a worldwide

taxonomical study of *Indigofera* a daunting task. In many regions the genus has been incompletely studied, and in regions where a taxonomic revision has been accomplished, comparisons with other regions have usually not been done.

Ecology Most *Indigofera* species occur in open locations, such as grassland, roadsides and open deciduous forest, in the lowland. In South-East Asia several species are bound to monsoon areas. *I. linifolia* prefers an extremely dry monsoon climate.

Management Propagation of the *Indigofera* species treated here is by seed. Soaking for 5 minutes in concentrated H_2SO_4 increased the germination rate of *I. oblongifolia* seeds from 10% to 90%, whereas gibberellic acid was ineffective. In *I. linifolia* pretreatment with KNO_3, 1-naphthalene acetic acid (NAA) and 3-indole acetic acid (IAA) proved to be effective in breaking seed dormancy, whereas for *I. linnaei* this did not work. Thiourea proved to be effective in both species.

Genetic resources In view of their wide distribution and presence in dry open habitats, the *Indigofera* species treated here do not appear to be threatened by genetic erosion.

Prospects Several fractions of *Indigofera* showed various interesting pharmacological effects, both in vitro and in vivo. Further research is needed to fully evaluate these preliminary results for future applications.

Literature 198, 239, 542, 688, 731, 870.

Selection of species

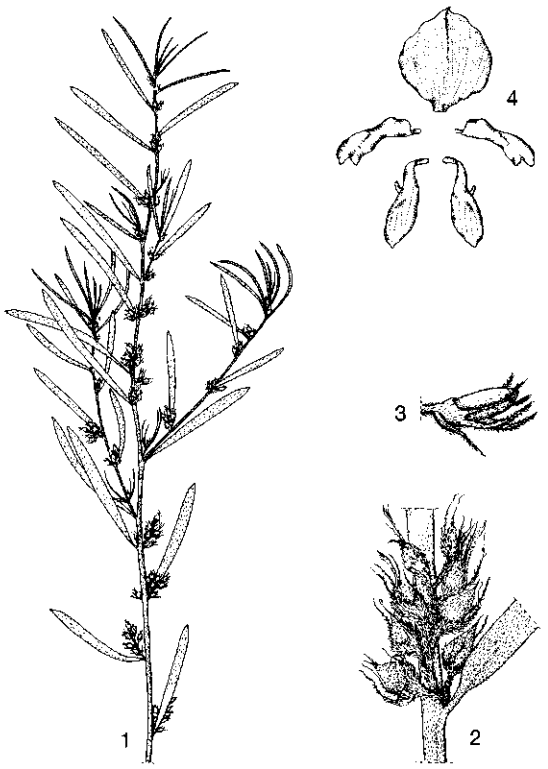
Indigofera linifolia (L.f.) Retz.

Obs. 4: 29 (1786).

Vernacular names Indonesia: rumba mutong (Sumba), rhema mon-hoi (Flores). Vietnam: ch[af]m l[as] lanh.

Distribution From Sudan and Ethiopia eastward to Indo-China, China, the Ryukyu Islands, Taiwan and Thailand, and throughout the drier parts of South-East Asia (in Malesia in eastern Java, the Lesser Sunda Islands, the Philippines (Luzon) and New Guinea), southward to northern Australia.

Uses In India the whole plant is given as a febrifuge. In combination with *Euphorbia thymifolia* L. it is used to treat amenorrhoea. It is further credited with vermifuge properties. The leaves are used to treat cuts and wounds. *I. linifolia* is recommended as a fodder for goats in very dry areas.



Indigofera linifolia (L.f.) Retz. – 1, flowering and fruiting twig; 2, old inflorescence; 3, flower bud; 4, corolla.

Observations An annual or perennial, prostrate or erect herb or shrublet up to100 cm tall; leaves unifoliate, elliptical to linear, 0.5–4 cm × 0.2–0.4 cm, base cuneate, apex acuminate; inflorescence up to 15 mm long; calyx 3–4 mm long, standard elliptical, up to 5 mm long, pale with a red base, wings and keel slightly shorter, bright red; fruit globose, beaked, 2–3 mm × 1.5 mm, densely appressed grey-hairy, 1-seeded, endocarp not blotched; seed rounded, laterally flattened, 1.2 mm × 1 mm. *I. linifolia* is found on very arid localities on grassland, cropped land, roadsides, beaches and grassy deciduous forest from sea-level up to 750 m altitude.

Selected sources 35, 62, 121, 181, 198, 250, 334, 965.

Indigofera linnaei Ali

Bot. Notis. 3: 549 (1958).

Synonyms *Hedysarum prostratum* Burm.f. (1768), *Indigofera enneaphylla* L. (1771), *Indigofera prostrata* (L.) Domin (1926).

Vernacular names Indonesia: dedekan, trus-

pala (Javanese), met gamet (Madurese). Vietnam: ch[af]m linne.

Distribution From Pakistan and India eastward to Indo-China, Thailand, throughout the drier parts of Malesia (eastern Java, the Lesser Sunda Islands, Sulawesi and New Guinea) to Australia.

Uses In Java the plant is used against aphthae and as a diuretic. In India the plant juice is used as an antiscorbutic, diuretic and alterative. Boiled with oil, the aboveground parts are applied to burns. A decoction is given to treat epilepsy and insanity. *I. linnaei* is recommended as a green manure. In pastures it is a fodder for cattle, but it is poisonous to horses.

Observations An annual or perennial herb or shrublet up to 90 cm tall; leaflets 3–11, alternate, ovate to narrowly ovate, the terminal one 0.5–1.5 cm × 0.3–0.5 cm, the lateral ones 0.3–1.3 cm × 0.2–0.4 cm, base cuneate, apex obtuse to truncate; inflorescence 0.5–2.5 cm long; calyx up to 4 mm long, standard broadly ovate to orbicular, 3–5 mm long, bright red with a pale base, wings and keel slightly shorter, orange-red; fruit spreading, globose, slightly beaked, 3–8 mm × 1.5–2 mm, hairy, (1–)2–3-seeded, endocarp not blotched; seeds rounded, 1 mm × 1 mm. *I. linnaei* is found in grassland, along roadsides and on dykes from sea-level up to 400 m altitude.

Selected sources 35, 62, 121, 181, 198, 250, 334, 965.

Indigofera oblongifolia Forssk.

Fl. Aegypt.-Arab.: 137 (1775).

Synonyms *Indigofera paucifolia* Delile (1813).

Vernacular names Indonesia: tom (Javanese).

Distribution From tropical Africa to northern India and Sri Lanka, and Java (probably introduced).

Uses The plant is reported as an antisyphilitic. In the traditional Ayurvedic system the root is considered cooling, improving the appetite and a remedy for rheumatism. All parts of the plant are considered useful in enlargements of the liver and spleen. The leaf is a vulnerary, and it is used to treat dysentery. In Yemen the leaves are traditionally used for urinary infections, urolithiasis and skin infections. In East Africa the root is boiled with milk and used as purgative; a decoction of the stem is applied as a gargle. In India *I. oblongifolia* is planted as a green manure in wet lands, and recommended as a fodder for sheep.

Observations A small shrub up to 180 cm tall; leaflets 1–5, alternate, sometimes almost opposite, obovate to narrowly obovate, the terminal one 1.6–4 cm × 0.5–1 cm, the lateral ones 1.2 cm × 0.4–0.8 cm; inflorescence 1.5–8 cm long; calyx up to 2 mm long, standard orbicular, 4 mm long, greenish-yellow with red streaks, wings and keel shorter and elliptical; fruit slightly curved, constricted between the seeds, rounded in cross-section, 10–20 mm × 2 mm, hairy, (3–)7–9-seeded, endocarp blotched; seeds broadly elliptical, 2 mm × 1 mm. *I. oblongifolia* occurs in grassland and along roadsides, especially along the coast below 100 m altitude.

Selected sources 59, 62, 121, 181, 198, 944.

Sudibyo Supardi & Hurip Pratomo

Indorouchera griffithiana (Planchon) Hallier f.

Beih. Bot. Centralbl. 39: 50 (1923).

LINACEAE

$2n$ = unknown

Synonyms *Roucheria griffithiana* Planchon (1847).

Vernacular names Brunei: akar katjap. Indonesia: akar tanduk, takkolan (Malay), wa bakar (Iban). Malaysia: akar garam-garam, akar serawan (Peninsular), dingkai (Sabah).

Origin and geographic distribution *I. griffithiana* occurs in the Nicobar Islands, southern Thailand, Peninsular Malaysia, Sumatra, western Java (rare) and Borneo.

Uses In Peninsular Malaysia, the leaves and flowers are applied to the head to treat headache, and a decoction of the roots is used against bowel complaints. A decoction of the roots and stem is applied to treat fever, e.g. in case of malaria. The bark and sap are used as a blow-pipe dart poison. The fruits are edible, and have a tomato-like flavour. When a liana is cut in the forest, fresh water can be obtained from it. The wood is sometimes used for small objects such as knife handles.

Properties According to old records, lupeol and saponin are present in the bark. More recent investigations gave contradictory results: one sample showed the presence of terpenes in the leaves, but negative results for alkaloids and saponins in leaves and stems, whereas another sample showed very high contents of alkaloids and saponin in the stem and a low content of these compounds in the leaves.

Botany A large liana up to 30 m long, with stem

up to 10 cm in diameter, rarely a shrub up to 4 m tall; hooks present at the end of climbing shoots or arranged distichously in the leaf axils or inflorescences; buds, stipules and pedicels often covered with resin. Leaves alternate, distichous, simple, elliptical to obovate, (4–)7.5–11.5(–19) cm × (1–)2.5–4(–7) cm, cuneate at base, usually acuminate at apex, margin glandular to crenate, with (5–)7–10 pairs of secondary veins; petiole (0.5–)1–2 cm long; stipules triangular to ovate, up to 1 mm × 2 mm, crenate. Inflorescence an axillary fascicle without bracts, (1–)3–7(–10)-flowered. Flowers bisexual, regular, 5-merous, heterodistylous; pedicel articulate, densely beset with bracteoles; sepals free, unequal, elliptical to ovate or orbicular, up to 3 mm long; petals free, elliptical to obovate, up to 8.5 mm long, thin, white to bright yellow, pale orange or reddish-brown; stamens 10, alternately shorter and longer, filaments basally connate into a tube; ovary superior, 3(–4)-celled, styles 3–4(–5). Fruit an ovoid to ellipsoid drupe up to 7 mm long, yellow to red, with raised ribs on the mesocarp (especially conspicuous in dried fruits), 1(–2)-seeded. Seed semi-ovoid, up to 4.5 mm long, with short aril; endosperm copious, oily.

I. griffithiana can be found flowering and fruiting throughout the year.

Indorouchera belongs to the subfamily *Hugonioideae*, together with *Hugonia* and *Philbornea*. This subfamily is sometimes distinguished as a separate family *Hugoniaceae*. Within *Hugonioideae*, *Indorouchera* is characterized by the glabrous plants with distichously arranged leaves, usually 1-seeded fruit, and buds and stipules often covered by resin. It comprises 2 species, both occurring in the Malesian region. *I. contestiana* (Pierre) Hallier f. is much rarer than *I. griffithiana*; it has only been found in coastal regions of southern Cambodia, southern Vietnam and northwestern Borneo.

Ecology *I. griffithiana* occurs in rain forest, primary as well as secondary, also in swamp forest, up to 1500 m altitude, and is common in most regions within its area of distribution.

Genetic resources *I. griffithiana* is not liable to genetic erosion; it is common in many locations and widely distributed, unlike *I. contestiana*. The variation in chemical contents recorded in the literature deserves attention.

Prospects Chemical and pharmacological investigations are needed to determine the prospects of *I. griffithiana* as a medicinal plant with wider utilization.

Literature 121, 247.

Other selected sources 249, 282, 334, 705, 731.

H.C. Ong

Kigelia africana (Lamk) Benth.

Hook., Niger Fl.: 463 (1849).

BIGNONIACEAE

$n = 20, 21, 2n = 40$

Synonyms *Kigelia aethiopica* (Fenzl) Decne. (1845), *Kigelia pinnata* (Jacq.) DC. (1845).

Vernacular names Sausage tree (En). Saucissonnier, faux baobab (Fr). Thailand: sai krok africaa (Bangkok). Vietnam: d[oof]i, b[is] d[awj]c.

Origin and geographic distribution *K. africana* originates from tropical Africa, where it is widespread. It is widely cultivated in other tropical regions as an ornamental tree in parks and along roads. It is locally planted in South-East Asia, e.g. in Vietnam, Thailand, Peninsular Malaysia, Java and the Philippines.

Uses In Africa, *K. africana* is a true multipurpose tree. It is highly esteemed for ritual purposes as well as for medicinal applications, as a shade and ornamental tree, and for its wood. In traditional medicine, the fruits are most commonly used and sold on markets, and their uses are often interwoven with ritual uses as they are considered a strong fetish. A decoction of the fruit is administered as a galactagogue, internally as well as externally, and is also used to treat oedema of the legs and cancer. The fruit is purgative and toxic, and is applied in poultices to treat syphilis and rheumatism, and as a sexual stimulant. A decoction with peppers is used to treat constipation and piles, and powdered fruits are applied to ulcers and to treat rheumatism. The fruit is commonly used in the preparation of beer, to make it stronger. The leaves and bark are sometimes applied to treat dysentery, and stomach and kidney complaints. The slightly bitter bark is used in mixtures with other plants to treat epilepsy, and also to treat snakebites, rheumatism, asthma, syphilis, gonorrhoea, and externally to treat wounds, sores and ringworm. The likewise bitter root is administered as a remedy for boils, sore throat, constipation and tapeworm.

The wood is whitish to yellowish with a pale brown heart, and medium-weight. It is used in Africa for dugout canoes, tool-handles, small implements and boxes, and occasionally for fence posts.

In South-East Asia, it is apparently only planted

as a roadside tree and in parks, and no medicinal uses have yet been recorded. It is a conspicuous ornamental tree, with extremely large flowers and fruits.

Properties Chemical investigations showed that the aqueous extracts of the stem bark contain iridoids as major components. These extracts showed significant antimicrobial activity. The naphthoquinones kigelinone, isopinnatal, dehydro-α-lapachone and lapachol and the phenylpropanoids p-coumaric acid and ferulic acid have been isolated as the compounds responsible for the observed antibacterial and antifungal activity of the roots, as well as kigelinone and caffeic acid from the fruits. Flavonoids such as luteolin and quercetin have been isolated from the leaves and fruits.

Aqueous leaf extracts protected rats and mice from castor oil-induced diarrhoea; they reduced faecal output and decreased the propulsive movement of the gastro-intestinal contents. Oral administration of an ethanolic extract of the fruits to mice resulted in a significant inhibition in the tumour incidence and burden in the benzo[a]pyrene-induced forestomach tumourigenesis model. The extract also evinced anti-inflammatory effects in rats against albumen-induced paw inflammation. A dichloromethane extract of the stem bark showed significant and dose-dependent inhibitory activity on the growth of melanoma and renal carcinoma cell lines in vitro, with norviburtinal as the most active compound. Lapachol showed similar activity, and therefore might be one of the active compounds too. Dichloromethane extracts of the root bark and stem bark exhibited antitrypanosomal activity against *Trypanosoma brucei* in vitro. Some naphthoquinones have been determined as active compounds. Naphthoquinones were also identified as the active compounds in a hexane extract of *K. africana* exhibiting antimalarial activity against *Plasmodium falciparum*. A bark extract showed acute toxicity to fish, and it also has molluscicidal activity. It caused total suppression of larval hatching of *Meloidogyne incognita*. The observed cytotoxicity of the root bark in the brine shrimp assay was attributed to the presence of γ-sitosterol, which showed activity similar to lapachol.

Botany A small to medium-sized tree up to 20 m tall, widely branched; branchlets with large leaf scars. Leaves decussately opposite or whorled, usually in whorls of 3, pinnately compound, up to 50 cm long; stipules absent; leaflets 7–13, ovate to elliptical, up to 20 cm × 7 cm, entire or serrate distally. Inflorescence a terminal, pendent panicle up to 200 cm long. Flowers bisexual, large; pedicel 8–18 cm long, apically upcurved; calyx 3.5–5 cm long, irregularly lobed, greenish; corolla above the narrow base funnel-shaped, 10–14 cm long, with tube as long as calyx or longer, 2-lipped, upper lip 2-lobed, lower lip 3-fid, outside veined, yellowish, inside dark wine-red; stamens 4, inserted at the top of the narrow part of the corolla tube, 1 large staminode present; ovary superior, 2-celled. Fruit a large sausage-like, pendulous berry, 25–50 cm × 7.5–15 cm, shortly beaked, often on still flowering panicles, many-seeded. Seeds obovoid, wingless.

K. africana trees are in general fast-growing. In bud, the calyx contains much watery slime. The flowers open in the evening, have a disagreeable acid smell, and are much visited by bats, although hawkmoths apparently also provide pollination. The corolla falls off the next morning. In Java, the trees can be found flowering throughout the year.

The genus *Kigelia* is now usually considered to comprise only one single extremely variable species.

Ecology In Africa, *K. africana* occurs naturally in rain forest and in remnants of forest in the savanna, usually in damp sites, often along rivers. In South-East Asia, it is planted in the lowlands, up to 700 m altitude. However, it has been observed to flower poorly in the per-humid climate of Singapore.

Management *K. africana* is easily cultivated. Fresh seeds germinate well, and seedlings grow reasonably fast and straight upwards, beginning to branch only after some years.

Genetic resources There are no large ex situ germplasm collections of *K. africana*. In Africa, it is widespread and subject to some protection because it is often considered valuable by the local population. The extremely great variation in morphology and chemical composition is remarkable and warrants further research. The genetic basis of the planted *K. africana* trees in South-East Asia is not known, but is likely to be quite narrow.

Prospects Although up to the present time *K. africana* has only been used as an ornamental tree in South-East Asia, it has fairly good prospects as a medicinal plant. The results of tests on pharmacological activities in animal models add credence to the folklore use of *K. africana* fruits for the treatment of cancer and oedema in traditional systems of medicine in Africa. The antimicrobial activity deserves more attention. It may be tried for planting on a larger scale in South-East Asia as a multipurpose tree.

Literature 26, 29, 61, 93, 120, 247, 372, 406, 986.

Other selected sources 62, 121, 468, 639, 760.

R.E. Nasution & R.H.M.J. Lemmens

Labisia pumila (Blume) Fern.-Vill.

Nov. app.: 123 (1880).

MYRSINACEAE

$2n = 46–50$

Synonyms *Ardisia pumila* Blume (1823), *Labisia pothoina* Lindley (1845).

Vernacular names Indonesia: kelimparan tuli (Belitung), udu mudung bio' (Kenyah, East Kalimantan). Malaysia : kacip fatima, mata pelandok rimba, bunga belangkas hutan (Peninsular).

Origin and geographic distribution *L. pumila* occurs in Indo-China, peninsular Thailand and throughout the Malesian region.

Uses In Peninsular Malaysia a root decoction is taken in the months before giving birth to induce and ease delivery. A decoction of leaves and roots, often mixed with other plants, is drunk as a protective post-partum tonic. *L. pumila* is further used to treat flatulence and dysentery, and a decoction of leaves and stems is drunk to treat dysmenorrhoea and a root decoction to treat gonorrhoea. Capsules based on *L. pumila* roots are commercially available in Malaysia. In Indonesia a root decoction is taken to treat syphilis, and a decoction of leaves and stems to treat menorrhagia.

Properties In a general screening experiment, a crude ethanol extract of *L. pumila* showed biocidal activity against brine shrimp (*Artemia salina*) nauplii. In an in-vitro bioassay based on the oestrogen-specific enhancement of alkaline phosphatase (AlkP) in human endometrial adenocarcinoma cells, an ethanolic root extract revealed weak oestrogenicity. In a modified disc-diffusion assay, a methanol leaf extract showed moderate antibacterial activity against gram-positive *Pseudomonas* spp. and gram-negative *Staphylococcus* spp. and weak antifungal activity against *Candida lipolytica* and the dermatophytic fungus *Trichoplyton rubrum*.

Botany An erect or ascending undershrub up to 30(-50) cm tall; stem unbranched. Leaves alternate, simple, oblong-lanceolate, (8–)15–25 cm × (2.5–)5–7 cm, decurrent at base, shallowly crenulate or subentire, variably lepidote below; long-petiolate to subsessile; stipules absent. Inflorescence an axillary raceme 2–8 cm long, ferrugineously puberulous. Flowers bisexual, regular, 5-merous; sepals united at base, c. 0.5 mm long, finely pubescent outside; petals united at base, c. 2 mm long, violet to dirty white, lobes valvate, ovate; stamens opposite the petals, anthers sessile; ovary superior, 1-celled, style filiform. Fruit a globose, 1-seeded berry, red at maturity.

In Java *L. pumila* can be found flowering and fruiting throughout the year. *Labisia* consists of some 6–9 species, most of them confined to western Malesia. *L. pumila* is the only widespread species. It is variable and sometimes several varieties are recognized.

Ecology *L. pumila* is a locally common understorey plant of primary forest and old secondary forest. In Peninsular Malaysia and Borneo it is found from sea-level up to 750 m altitude, but in West Java it occurs at 900–1200 m altitude.

Management *L. pumila* can be propagated by seed and is harvested after 7–8 months. Small-scale planting experiments have been done in Malaysia.

Genetic resources Since *L. pumila* is widespread, occurring in both primary and secondary forest, the risk of genetic erosion appears to be limited. However, overcollecting may locally seriously deplete wild populations, e.g. in Peninsular Malaysia.

Prospects Recent research on pharmacological properties of *L. pumila* shows weak oestrogenic activity, which may be related to its traditional use as a pre- and post-partum medicine. More research is desirable. The apparently easy propagation and rapid production add to the prospects as a medicinal plant of wider use.

Literature 121, 411, 534, 637, 638, 894.

Other selected sources 62, 264, 334.

Sriana Azis

Legazpia polygonoides (Benth.) Yamazaki

Journ. Jap. Bot. 30: 359 (1955).

SCROPHULARIACEAE

$2n$ = unknown

Synonyms *Torenia polygonoides* Benth. (1835), *Legazpia mucronulata* (Benth.) Yamazaki (1955).

Vernacular names Malaysia: kerak nasi, terutap batu, rumput sisek naga (Peninsular). Philippines: lalagang (Subanun), monko (Manobo). Thailand: mak dip namkhang (south-eastern). Vietnam: l[ee] ga d[af]y, c[or] b[uw][ows]m tr[aws]ng.

Origin and geographic distribution *L. poly-*

gonoides occurs in eastern India, Burma (Myanmar), Indo-China, southern China, south-eastern and peninsular Thailand, Peninsular Malaysia, Borneo, the Philippines, New Guinea and Micronesia. In Java, it is locally naturalized along ditches in the botanical garden in Bogor.

Uses In traditional medicine in Peninsular Malaysia, pounded whole plants are applied externally as a poultice to treat sores on the legs, ulcers and dropsy. A decoction of whole plants is used against problems of the urinary tract.

Botany A perennial herb, with creeping stems up to 60 cm long, rooting at nodes, quadrangular. Leaves opposite, simple, ovate or orbicular-ovate, 0.5–3 cm × 0.5–2 cm, rounded or cuneate at base, acute at apex, serrate, usually glabrous; petiole 0.5–1.5 cm long; stipules absent. Inflorescence umbellate at the apex of axillary flowering shoots, 1–4-flowered; bracts linear, c. 1 mm long. Flowers bisexual; pedicel slender, as long as or slightly longer than calyx; calyx suborbicular, 4–5 mm × 3–4 mm in flower, 7–9 mm × 6–8 mm in fruit, with 3 broad wings, shortly auriculate at base, teethed at apex; corolla 7–12 mm long, with cylindrical tube, 2-lipped with orbicular upper lip and 3-lobed, spreading lower lip, yellow; stamens 4, didynamous, pairs inserted at different level on upper corolla tube, anterior filaments each with a clavate spur at base, anthers of each pair touching; ovary superior, obliquely oblong, 2-celled, style filiform, stigma 2-lamellate. Fruit an oblong-lanceolate capsule c. 5 mm long, included within the calyx, septicidally dehiscent with 2 valves, many-seeded. Seeds ellipsoid-globose, c. 0.3 mm long, thinly reticulate, scrobiculate.

Legazpia comprises a single species.

Ecology *L. polygonoides* occurs in open sites in evergreen forest, on riversides and in rice fields, usually in wet locations, up to 500 m altitude.

Genetic resources *L. polygonoides* has a wide distribution, is common in many regions, and often found in secondary habitats. Consequently, it is not likely to be vulnerable to genetic erosion.

Prospects The wide availability of wild *L. polygonoides* and its easy cultivation offer possibilities for wide usage as a medicinal plant. Since data on phytochemistry and pharmacological properties are not available, research is needed before any claimed activity can be confirmed.

Literature 121, 249.

Other selected sources 62, 250.

R.H.M.J. Lemmens

Leonotis nepetifolia (L.) R.Br.

W.T. Aiton, Hortus kew. ed. 2, 3: 409 (1811; *'nepetaefolia'*).

LABIATAE

$n = 13, 2n = 24, 28$

Vernacular names Indonesia: nampong (Sundanese). Thailand: chat phra in (central). Vietnam: s[uw] nh[ix].

Origin and geographic distribution *L. nepetifolia* is native to tropical Africa, but is introduced and naturalized in many tropical regions. In the Malesian region there are records for Peninsular Malaysia, Singapore, Sumatra, Bangka and Java.

Uses There is a record from Peninsular Malaysia of *L. nepetifolia* leaves being used externally to treat wounds. In India and Thailand, the ash of flower buds is applied externally to burns, scalds, itch and ringworm. In Africa *L. nepetifolia* is more commonly used in traditional medicine. The leaves are applied externally to wounds, sores, ulcers, piles, swellings and skin infections. A decoction of whole plants is used to steam the head to relieve catarrh, fever and headache. The same decoction is used in a bath to treat rheumatism, sciatica, neuritis and rickets, and it is taken internally as tonic, purge and taenifuge and to treat fever, gastro-intestinal troubles and dysmenorrhoea. The plants are also used to expel vermin from stored grain. In tropical America medicinal applications are also numerous; decoctions of leaves, roots and inflorescences are used as a febrifuge, diuretic, stomachic, vermifuge and tonic, and against asthma and skin diseases. *L. nepetifolia* is sometimes planted as an ornamental.

In southern Africa *L. ocymifolia* (Burm.f.) Iwarsson is used to treat cancer, ulcers and wounds, and *L. leonurus* (L.) R.Br. as an emmenagogue, febrifuge and narcotic.

Properties *L. nepetifolia* contains labdane diterpenes such as nepetaefolin. The anti-oxidative phenylethanoid glycosides acteoside, martynoside and lavandulifolioside have been isolated from *L. nepetifolia*, together with some iridoid glycosides. The coumarins 6-methoxysiderin and 4,6,7-trimethoxy-5-methylchromen-2-one have also been isolated. The essential oil hydrodistilled from the leaves has as major components β-caryophyllene (20.5%), α-humulene (12%), germacrene D (8.5%), caryophyllene oxide (7.5%), octene (7%), (Z)-β-ocimene (5%) and β-copaene (3.5%). The seed oil contains the fatty acid laballenic acid.

Hydroalcoholic and aqueous extracts of *L. nepetifolia* relaxed rat uterine preparations in vitro. They also caused contractions in guinea-pig ileum and inhibited twitch responses. A methanolic extract of the leaves exhibited antibacterial activity against *Pseudomonas aeruginosa* in tests in India, whereas an ethanolic seed extract showed distinct antifungal activity against *Alternaria alternata* and *Aspergillus niger*. Seeds have a mild antimalarial activity.

Ethanolic extracts of the southern African species *L. leonurus* and *L. ocymifolia* showed high prostaglandin-synthesis inhibitory activity. Several diterpenes, e.g. leonitin, have been isolated from the latter species.

Botany A large annual herb up to 250 cm tall; stem and branches deeply furrowed, finely pubescent. Leaves decussately opposite, oblong-ovate to ovate, 4.5–6(–12) cm × 3–5(–9.5) cm, rounded to truncate at base, acute to acuminate at apex, coarsely crenate-serrate, finely pubescent on both surfaces; petiole 2–7.5 cm long; stipules absent. Inflorescence an axillary, globose, dense verticillaster 2.5–7 cm in diameter, composed of several, deflexed, 2-seriate, many-flowered cincinni; bracts linear-subulate, up to 1.5 cm long, deflexed. Flowers bisexual, zygomorphic; calyx funnel-shaped, 1.2–1.5 cm long, enlarging in fruit up to 2 cm, 8–10-toothed with unequal teeth, 8–10-veined, with long white hairs above; corolla 2–2.5 cm long, tube with 3 rings of hairs inside, 2-lipped, upper lip arched, concave, outside densely hairy, lower lip 3-lobed, orange; stamens 4, inserted on the corolla tube, didynamous, ascending under upper corolla lip; ovary superior, 4-celled, style subulate, gynobasic, upper stigmatic segment reduced to a tiny tooth. Fruit consisting of 4 nutlets 2.5–3 mm long, oblong or obovoid, glabrous, dull black, enclosed in the persistent calyx.

L. nepetifolia can be found flowering throughout the year. The lower lip of the corolla withers immediately after the flower opens. The flowers are pollinated by honey birds, and in Africa several species of sunbirds commonly feed from flowers; bees have also been recorded as pollinators. However, research has shown that autogamy prevails.

Leonotis comprises about 10 species, which occur in Africa. However, *L. nepetifolia* is naturalized in tropical Asia, Australia and America.

Ecology *L. nepetifolia* occurs in waste places, roadsides, fallow fields and along ponds and lakes, up to 1350 m altitude.

Management Research showed that seed germination of *L. nepetifolia* is strongly influenced by temperature. Seeds do not germinate at 15–20°C, but 100% germination can be reached at 28–32°C and 40–60% soil moisture for 6-month-old seeds. Seeds withstand high fluoride concentrations, making *L. nepetifolia* very suitable for reclamation of polluted areas.

Genetic resources *L. nepetifolia* is only locally common in South-East Asia, e.g. in western Java, but its pantropical distribution and weedy aspect assure sufficient protection against genetic erosion.

Prospects *L. nepetifolia* has been used very little medicinally in South-East Asia. However, its common applications in Africa and tropical America, several of which have been confirmed by pharmacological research, warrant more attention.

Literature 120, 121, 247, 646, 910.

Other selected sources 125, 288, 408, 710.

Sri Hayati Widodo

Lepidagathis Willd.

Sp. pl. 3(1): 400 (1800).

ACANTHACEAE

$x = 11$; *L. incurva*: $n = 22, 42$

Origin and geographic distribution *Lepidagathis* comprises approximately 100 species, and occurs in tropical and subtropical Africa and Asia, with about 50 species in each of these continents. It is still unclear how many species occur in South-East Asia.

Uses A few uses in traditional medicine in South-East Asia have been recorded for the leaves: internally to treat cough, and externally to treat wounds and headache. A few species are used medicinally in Africa, e.g. *L. heudelotiana* Nees as a purgative and depurative. Some *Lepidagathis* species have ornamental value.

Properties A triterpenoid saponin with antimicrobial activity against various plant-pathogenic bacteria and fungi has been isolated from a *L. incurva* leaf extract. An essential oil has been isolated from *L. incurva* seeds; it showed antimicrobial activity in in-vitro tests with bacteria and fungi. In addition, a very high oleic acid content (72%) was found in the fatty seed oil from *L. trinervis* Nees from India; the oil content of the seed was 8.6%.

The immunosuppressive tryptophan-derived alkaloid cristatin A and the flavonoid-glycoside 6-hydroxyluteolin 7-O-apioside have been isolated from leaves of the Indian *L. cristata* Willd.

Botany Erect or ascending herbs or under-

shrubs; nodes thickened. Leaves opposite, simple and entire to crenate-serrate, with short cystoliths, subsessile to distinctly petiolate; stipules absent. Inflorescence a terminal or axillary spike or head, distinctly bracteate. Flowers bisexual, sessile; calyx with 5 unequal segments, 2 anterior ones basally connate; corolla with tube narrowed upwards, widened at apex, 2-lipped, upper lip entire to emarginate, lower lip deeply 3-lobed, white to pinkish or purplish, often with darker spots on lower lip; stamens 4, didynamous, deeply inserted in the corolla tube, very short, anthers muticous; ovary superior, 2-celled, style short. Fruit a small box-shaped capsule, 2–4-seeded. Seeds compressed, long-pubescent.

Lepidagathis is placed in the tribe *Lepidagathideae*, together with e.g. the related small genus *Chroesthes*, which differs in bicalcarate anthers, larger capsules and shortly pubescent seeds.

Ecology The *Lepidagathis* species treated here often occur in more or less disturbed habitats such as waste places; they are also found on river banks, open forest, scrub vegetation, and as a weed in gardens.

Genetic resources *L. incurva* and *L. rumphii* are not liable to genetic erosion because they occur in anthropogenic habitats.

Prospects More research on phytochemistry and pharmacological properties is needed before the prospects of *Lepidagathis* as medicinal plants can be determined. As is the case in many *Acanthaceae* genera, a revision of *Lepidagathis* is still lacking. This is needed to unravel the status of many species described, e.g. of *L. rumphii*, the identity of which is still uncertain.

Literature 648, 767.

Selection of species

Lepidagathis incurva Buch.-Ham. ex D. Don

Prodr. fl. nepal.: 119 (1825).

Synonyms *Lepidagathis hyalina* Nees (1832).

Vernacular names Thailand: yaa khon kai (Loei). Vietnam: l[aa]n ch[uf]y, v[ar]y cong.

Distribution From the subtropical Himalayas, through India, Sri Lanka, Burma (Myanmar), Indo-China, southern China and Thailand, to Peninsular Malaysia and the Philippines.

Uses The leaves are chewed to cure coughs in Peninsular Malaysia. *L. incurva* is also used in traditional medicine in India. A form with brown-striped dark green leaves from India has been recommended as an ornamental in flower beds.

Lepidagathis incurva Buch.-Ham. ex D. Don – 1, plant habit; 2, flower; 3, fruit.

Observations A perennial, suberect or ascending herb up to 60 cm tall; leaves lanceolate-oblong to broadly lanceolate-ovate, 7–12.5 cm × 2–3.5 cm, entire, minutely pubescent, petiole 1–2.5 cm long; flowers in up to 3.5 cm long spikes, corolla c. 6 mm long, whitish, brownish spotted; fruit 5–6 mm long. *L. incurva* is a variable species in which several varieties have been distinguished. It occurs abundantly in waste ground in northern Peninsular Malaysia, and in forests and thickets at low to medium altitudes in the Philippines.

Selected sources 121, 621, 789, 1022, 1023.

Lepidagathis rumphii Merr.

Interpr. Herb. amboin.: 473 (1917).

Vernacular names Indonesia: bungo-bungo laki-laki (Moluccas).

Distribution The Moluccas.

Uses The leaves have been applied as a poultice to treat wounds and on the head to treat headache.

Observations An erect or suberect herb about 50 cm tall; leaves oblong to oblong-lanceolate, 4–7

cm × 1.5–2.5 cm, entire, glabrous, petiole 1–2.5 cm long; flowers in up to 2.5 cm long spikes, corolla c. 5 mm long; fruit c. 5 mm long. *L. rumphii* occurs along river banks, in thickets and as a weed in gardens, up to 50 m altitude.

Selected sources 334, 620.

R.H.M.J. Lemmens

Lepionurus sylvestris Blume

Bijdr. fl. Ned. Ind. 17: 1148 (1827).

OPILIACEAE

$2n = 20$

Synonyms *Lepionurus oblongifolius* (Griffith) Masters (1875).

Vernacular names Malaysia: chemperai, chipras, pelir kambing (Peninsular). Thailand: maak mok (peninsular). Vietnam: l[aa]n v[ix].

Origin and geographic distribution *L. sylvestris* is widely distributed in Nepal, north-eastern India, Bangladesh, Burma (Myanmar), Vietnam, southern China, Thailand and Malesia (Peninsular Malaysia, Sumatra, western Java and Borneo).

Uses In Thailand a decoction of *L. sylvestris* roots is applied to relieve muscular pain; roots are also used as a febrifuge. In Pahang (Peninsular Malaysia) a poultice made from aerial parts of the plant or pounded root is applied to treat headache in children.

Properties The presence of alkaloids has been recorded for *L. sylvestris* leaves and flowers.

Botany An erect or straggling evergreen shrub up to 2(–6) m tall. Leaves alternate, simple and entire, obovate, oblong, lanceolate or ovate, (5.5–)10–16(–25) cm × (1.5–)3–7(–9) cm, base attenuate, apex acuminate; petiole 1–5(–8) mm long; stipules absent. Inflorescence an axillary raceme, up to 8(–17) together per axil, 2–5 cm long, with large, ovate, pale green bracts. Flowers 3 per bract, bisexual, regular, (3–)4(–5)-merous; hypanthium cupular; tepals united, deeply lobed, tube 0.5 mm long, lobes patent, ovate, c. 2 mm long, yellowish; stamens as long as the tube; disk cupular; ovary superior, 1-celled, stigma sessile. Fruit an ellipsoid drupe 9–16 mm × 6–10 mm, on the thickened disk, orange-red, 1-seeded. Seed without testa, with 3–4 linear cotyledons and copious endosperm.

L. sylvestris can be found flowering and fruiting throughout the year. *Lepionurus* is a monotypic genus closely related to *Urobotrya* and *Gjellerupia*, and characterized by its bisexual flowers with united tepals.

Ecology *L. sylvestris* usually occurs in the undergrowth of evergreen rain forest, sometimes in village groves and hedges, from sea-level up to 1250(–2000) m altitude.

Genetic resources *L. sylvestris* is widespread and locally common, and does not appear to be threatened by genetic erosion. However, with the disappearence of vast stretches of primary lowland rain forest its preferred habitat is becoming reduced.

Prospects Research is needed to evaluate the potential of the traditional medicinal uses of *L. sylvestris* since information on its pharmacological properties is lacking.

Literature 121, 173, 247.

Other selected sources 62, 178, 331, 731.

J.L.C.H. van Valkenburg

Leptonychia caudata (Wallich ex G. Don) Burrett

Notizbl. Bot. Gart. Berlin-Dahlem 9: 729 (1926).

STERCULIACEAE

$2n$ = unknown

Synonyms *Leptonychia glabra* Turcz. (1858), *Leptonychia heteroclita* Kurz (1870).

Vernacular names Indonesia: kayu balut-balut, sibassa (Sumatra), pakan manok (Central Kalimantan). Malaysia: cheremai hantu, jarum (Peninsular), karai (Sabah). Thailand: phak waan (peninsular).

Origin and geographic distribution *L. caudata* occurs in southern India, scattered in Burma (Myanmar), Vietnam and Thailand, and is fairly common in Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia a root decoction of *L. caudata* is drunk during childbirth, and as a febrifuge. The leaves are used as a poultice to treat ulcerated noses and their juice as a cooling lotion in fever. Pounded leaves are also applied to the stomach against stomach-ache.

Botany A shrub or small tree up to 12(–20) m tall; bole up to 30 cm in diameter, young parts white to yellowish velutinous, glabrescent, with black lenticels. Leaves alternate, simple, ovate or obovate to ovate- or obovate-lanceolate, 4.5–22 cm × 1.5–6.5(–9) cm, base cuneate to obtuse, apex acute to caudate, margin obscurely undulate, 3-veined at base, nearly glabrous to velutinous with stellate hairs, domatia present; petiole 0.5–1 mm long, pulvinate in the upper half; stipules lanceolate. Inflorescence an axillary, solitary cyme, 1–7-

flowered, bracteate. Flowers bisexual, regular, 5-merous; sepals ovate-oblong, shortly connate at base; petals rectangular, shortly clawed, greenish-white to yellowish or cream-coloured; outer staminodes filiform, stamens 10, lower part united into a ring, inner staminodes 5, connate, triangular, short; ovary superior, globose, 2–5-celled, style 1, stigma 2–5-lobed. Fruit a subglobose capsule 1.5–4 cm × 1–2.5 cm, warty, opening by 2–5 valves, 1–3-seeded. Seeds ellipsoid to obovoid, 11–13 mm × 6–9 mm, testa shiny black, smooth, covered with a bright orange aril.

Leptonychia comprises about 45 species. Most of these occur in tropical Africa, 3 species in South-East Asia.

Ecology *L. caudata* occurs in both primary and secondary forest, including kerangas forest, often along forest edges and logging roads, from sea-level up to occasionally 1300 m altitude (in Sumatra).

Genetic resources *L. caudata* is relatively widespread and not threatened by genetic erosion.

Prospects As nothing is known with respect to the phytochemistry and pharmacological properties of *L. caudata*, research is needed to support its traditional use or indicate its potential in herbal medicine.

Literature 121, 460, 963.

Other selected sources 990.

J.L.C.H. van Valkenburg

Leucosyke capitellata (Poir.) Wedd.

A.DC., Prodr. 16(1): 235 (1869).

URTICACEAE

$2n$ = unknown

Vernacular names Indonesia: ki beunteur (Sundanese), jurang gunung (Javanese), kayu te pa'ei (Kalimantan). Malaysia: teh kampung (Sarawak), kuliat-mato (Sabah). Philippines: alagasi, lagasi (Bisaya, Tagalog), hanlagasi (Tagalog).

Origin and geographic distribution *L. capitellata* occurs in Java, Borneo, the Philippines, Sulawesi, the Moluccas and New Guinea.

Uses In the Philippines a decoction of *L. capitellata* roots is used to treat phthisis, cough, headache and gastralgia. In Kalimantan a decoction of the bark and leaves is drunk as a stimulant, and to treat stomach-ache and diarrhoea. A tea prepared from the leaves is drunk in Sabah to treat diabetes, high blood pressure and gastric ailments. In Sarawak the leaves are eaten as a vegetable. The yellowish wood is considered durable and used for implements such as rice-pounders. The bark yields a strong fibre that is used to produce ropes.

Properties The leaves of *L. capitellata* have a high magnesium content(625 mg/100 g). The wood is rich in silica. The bis-styryl ether leucosykol has been isolated from the stem of *L. quadrinervia* C.B. Robinson from Taiwan, as have the triterpenoids friedelin, epifriedelinol, taraxerone and taraxerol, and β-sitosterol.

Botany A dioecious shrub or small tree up to 8 m tall. Leaves arranged spirally, upper ones often distichous, simple, elliptical-oblong, 8–17.5 cm × 3–6.5 cm, acute to obtuse at base, acuminate at apex, finely serrate, white tomentose below, 3-veined from the base and with 1–4 pairs of secondary veins; petiole 1–3 cm long; stipules connate into an axillary scale up to 2.5 cm long, caducous. Inflorescence a pseudo-axillary, peduncled, globose head 0.5–1 cm in diameter, often 2 heads close together. Flowers unisexual, regular, small; male flowers with 5-parted perianth, 5 stamens and rudimentary pistil; female flowers with cup-shaped, 4–5-dentate perianth and obliquely ovoid, superior, 1-celled ovary, stigma sessile, capitate. Fruit an achene with fleshy pericarp and thinly crustaceous, white endocarp.

Leucosyke comprises about 35 species and occurs in South-East Asia and Polynesia.

Ecology *L. capitellata* occurs in forest, often secondary forest, but also in thickets, up to 2400 m altitude, and is common in many regions.

Genetic resources *L. capitellata* is widespread and common, and not liable to genetic erosion.

Prospects The investigation of the multipurpose *L. capitellata* in experimental plantings merits consideration. As long as no information on its pharmacological properties is available its value as a medicinal plant cannot be determined.

Literature 10, 334, 345, 534, 760.

Other selected sources 62, 117, 936.

R.H.M.J. Lemmens

Limacia Lour.

Fl. cochinch. 2: 620 (1790).

MENISPERMACEAE

x = unknown

Origin and geographic distribution *Limacia* comprises 3 species and occurs in southern Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, northern Borneo, Buton Island (south-east of Sulawesi), the Lesser Sunda

Islands (Sumba and Timor), and Mindanao (the Philippines).

Uses In Peninsular Malaysia, a decoction of the root of *L. oblonga* is used to treat sore eyes and ophthalmia. In Indonesia, an unidentified part of *L. oblonga* is reputedly applied internally, finely cut and mixed in water, to treat snakebites. In traditional medicine in Malaysia, *L. scandens* is used in the treatment of depression and affective disorders. The fruits of *L. oblonga* are sweet and edible.

Properties Several alkaloids have been isolated from stem bark of *L. oblonga* from Peninsular Malaysia: the hasubanan type alkaloids (+)-limalongine and (+)-clolimalongine, the oxoaporphine alkaloids lysicamine, homomoschatoline, imenine and splendidine, and the pro-aporphine alkaloid (+)-stepharine. The alkaloids cuspidaline, limacine and limacusine have been reported for Bornean *L. oblonga* plants.

Pharmacological studies showed that extracts of *L. scandens* have a sympathomimetic activity similar to noradrenaline (norepinephrine). A crude extract injected intravenously induced a dose-dependent increase in arterial blood pressure in anaesthetized rats and cats. It induced an increase in contractions in superfused rabbit aorta preparations, and physiological and behavioural changes in mice, with serious malfunctioning of the autonomic nervous system and motor activity. Furthermore, it induced excitatory responses in the snail *Achantina fulica* which were similar to those of serotonin stimulation.

Botany Dioecious lianas, sometimes with tendrilliform young shoots. Leaves arranged spirally, simple and entire, 3(–5)-veined from the base, petiolate; stipules absent. Inflorescence axillary or supra-axillary, cymose or pseudo-paniculate. Flowers unisexual, small, regular, whitish to greenish-yellow; sepals 6 (rarely 9), tomentose; petals 6, free, concave; male flowers with 6 free stamens and with or without 3 rudimentary carpels; female flowers with 3 tomentose superior carpels having reflexed styles and with or without 6 staminodes. Fruit consisting of 1–3 drupes; drupes obovoid, slightly compressed, abruptly narrowed into a short stipe at base and with stylescar near base, 1-seeded; endocarp with 2 large lateral cavities, dorsally with a raised longitudinal band. Seed horseshoe-shaped, with copious endosperm.

The fruits are mainly dispersed by animals; fruits of *L. oblonga* are transported by civet-cats.

Limacia seems related to, and is sometimes confused with *Hypserpa*, which differs in its imbricate sepals, which are irregular in number and not arranged in whorls. *Hypserpa nitida* Miers is often treated in the literature under its synonymous name *Limacia cuspidata* Hook.f. & Thomson.

Ecology *Limacia* is found in lowland forest, often also in secondary forest and in thickets and regrowth.

Genetic resources There are no indications that *L. oblonga* and *L. scandens* are subject to genetic erosion. However, *L. blumei* (Boerl.) Diels, is known from only few collections in southern Thailand, Java, Borneo, Sumba and Sulawesi, and is consequently apparently rare.

Prospects Unlike many other *Menispermaceae*, little research has been done on *Limacia*. As many alkaloids found in this family have proved beneficial in medicine, more research on pharmacological properties of *Limacia* and its compounds seems worthwhile.

Literature 83, 121, 247, 478.

Selection of species

Limacia oblonga Hook.f. & Thomson

Fl. ind. 1: 189 (1855).

Vernacular names Malaysia: akar china, akar kuning, akar kunyit-kunyit (Peninsular).

Distribution Southern Thailand, western Peninsular Malaysia, Singapore, Sumatra (east coast) and Borneo (Sarawak).

Uses In Peninsular Malaysia, a decoction of the root is used to treat sore eyes and ophthalmia. In Indonesia, the plant is reputedly applied internally, finely cut and mixed in water, to treat snakebites. The fruits are sweet and edible.

Observations A liana up to 10 m long; branchlets, petioles and inflorescences covered with a velvety yellow-brown indumentum; leaves elliptical to oblong-elliptical or elliptical-obovate, 9–25 cm × 3–10 cm, petiole 1.5–4 cm long; inflorescence a lax pseudo-panicle, male one up to 16 cm long; drupes obliquely obovoid, 14–20 mm long, yellow. *L. oblonga* occurs in primary and secondary lowland forest, up to 350 m altitude.

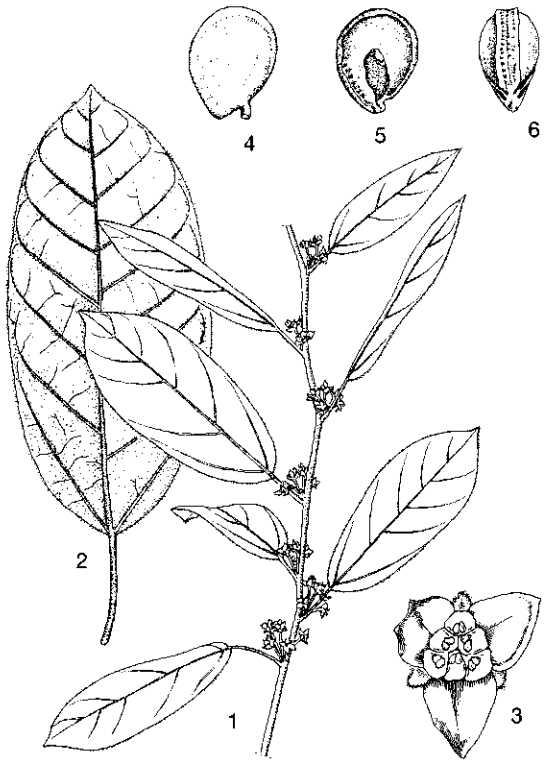
Selected sources 83, 121, 247, 249, 331, 334.

Limacia scandens Lour.

Fl. cochinch. 2: 620 (1790).

Synonyms *Limacia velutina* Hook.f. & Thomson (1855).

Vernacular names Malaysia: akar minyak,



Limacia scandens Lour. – 1, flowering branch of male plant; 2, leaf; 3, male flower; 4, fruit; 5, endocarp in lateral view; 6, endocarp in median view.

akar kuning, akar kunyit-kunyit (Peninsular). Vietnam: m[eef] g[af], m[oof]ng g[af].

Distribution Southern Burma (Myanmar), southern Indo-China, southern Thailand, western Peninsular Malaysia, Singapore, Sumatra, western Borneo and the Philippines; perhaps also Java.

Uses In traditional medicine in Malaysia, *L. scandens* is used in the treatment of depression and affective disorders.

Observations A liana; branchlets, petioles and inflorescences yellowish to golden-brown tomentose; leaves elliptical to ovate-elliptical or obovate-elliptical, 7–17 cm × 3–8 cm, petiole 1–3 cm long; inflorescence a peduncled congested cyme, less than 3 cm long; drupes obliquely obovoid, 20–25 mm long. *L. scandens* occurs in secondary lowland forest and regrowth, sometimes also in primary swamp forest.

Selected sources 121, 247, 249, 478.

Rini Sasanti Handayani

Liparis treubii J.J. Smith

Merr., Interpr. Herb. amboin.: 172 (1917).
ORCHIDACEAE
$2n$ = unknown

Synonyms *Liparis confusa* J.J. Smith var. *amboinensis* J.J. Smith (1905), *Liparis amboinensis* J.J. Smith (1914) non J.J. Smith (1905).

Origin and geographic distribution Until present, *L. treubii* has only been recorded from the Moluccas (Ambon) and eastern Sulawesi. However, the exact area of distribution has still to be clarified.

Uses According to a very old record, *L. treubii* is used in eastern Sulawesi to treat intestinal complaints and constipation. The marrow of sliced pseuso-bulbs is chewed, and the juice swallowed, whereas the abdomen is rubbed with leaves which have been withered over a fire.
L. nervosa (Thunberg) Lindley is used in traditional medicine in China to stop bleeding, internally as well as externally, and as antidote against snakebites. It also occurs in Thailand, and possibly in Malesia as well.

Properties Several pyrrolizidine-based alkaloids have been isolated from other *Liparis* species, but there is no information on chemistry or properties of *L. treubii*.

Botany An epiphytic herb up to 40 cm tall; pseudo-bulbs narrowly cylindrical from a thickened base, c. 12 cm × 2.5 cm, each with 2 leaves. Leaves narrowly lanceolate, c. 21 cm × 3 cm, duplicate at base, acute at apex, articulate (consequently deciduous). Inflorescence a terminal, many-flowered, slightly nodding raceme up to 30 cm tall, with c. 2 cm long sheath at base; bracts c. 0.5 cm long. Flowers very small, 3-merous, pale green; sepals and petals recurved, oblong and linear respectively, convex, lip oblong, pale brownish-yellow, with 2 dentiform basal thickenings, 2-lobed at apex, lobes faintly crenate and ciliate; column broadened at base; anther subglobular, with 4 pollinia; ovary inferior, c. 1 mm long, 1-celled, stigma small. Fruit a many-seeded capsule, 6-edged, at maturity bursting along the sides while the top remains whole. Seeds minute.
L. treubii flowers in the rainy season. *Liparis* comprises approximately 300 species and occurs in a large part of the world. The total number of species is not known for South-East Asia, but about 30 species have been recorded for Thailand, 20 for Peninsular Malaysia, 40 for Sumatra, and 30 for Java.
L. treubii closely resembles *L. condylobulbon* Rei-

chenb.f. from Sumatra and Java. It differs in its thicker pseudo-bulbs, broader leaves and longer, slightly nodding inflorescence. A complete revision of *Liparis* for the Malesian region is needed to unravel species limits and distributions.

Ecology *L. treubii* grows as an epiphyte on trees; in Ambon, for instance, on *Inocarpus* trees.

Management In some *Liparis* species, nodal cultures have been successful; plantlets were induced from nodes on modified Knop medium. Leaf-tip culture was successful on Heller's medium containing 1 mg/l of benzyladenine.

Genetic resources As long as a sound taxonomic study of Malesian *Liparis* is lacking, it is not possible to judge the potential threat of genetic erosion for *L. treubii*.

Prospects It is not likely that the importance of *L. treubii* as a medicinal plant will increase.

Literature 46, 334.

Other selected sources 121, 731.

Max Joseph Herman

Liriope graminifolia (L.) Baker

Journ. Linn. Soc., Bot. 17: 499 (1879).

CONVALLARIACEAE

$2n = 36, 72, 108$

Synonyms *Liriope spicata* Lour. (1790).

Vernacular names Vietnam: t[os]c ti[ee]n r[uwf]ng, th[oor] m[aj]ch m[oo]n.

Origin and geographic distribution *L. graminifolia* occurs in Indo-China, southern China, Taiwan, Korea, southern Japan and the Philippines (Batan Islands, Luzon and Mindoro).

Uses The tubers of *L. graminifolia* are used in traditional medicine in Indo-China and China. A decoction or infusion is prescribed to treat chronic cough, haemoptysis, fever, dysentery, and as a galactagogue. Candied tubers are considered tonic and aphrodisiac. Whole plants are used to treat diabetes in China.

The tubers of *Ophiopogon japonicus* (L.f.) Ker Gawl., a species also occurring wild in the Philippines and often cultivated as an ornamental elsewhere in Malesia, are used for similar purposes in Chinese medicine. They are often traded under the same Chinese vernacular name ('Mai Dong'). In fact, *Ophiopogon japonicus* tubers are official in the Chinese pharmacopoeia, but *L. graminifolia* tubers often substituted for them.

Liriope, mainly *L. muscari* (Decne.) L.H. Bailey, is much cultivated as an ornamental. Many cultivars exist, often with variegated leaves. *Liriope* is used successfully as ground cover along highways in the United States.

Properties The tubers of *L. graminifolia* are yellowish-grey, translucent and flexible, with a central longitudinal, ligneous cord. Several steroidal glycosides and steroidal saponins have been isolated from *L. graminifolia* tubers, e.g. spicatosides, some of which showed anti-inflammatory activity in the mouse ear oedema test. An aqueous extract of the tubers had effect on the immune function in mice; it increased the spleen weight, enhanced the clearance rate of charcoal particles and considerably antagonized the leucopenia caused by cyclophosphamide. In tests with anaesthetized cats, it also increased ventricular contractile force and it was concluded that it might increase the cardiac pump function. The saponin fraction showed anti-ischaemic effect when administered intraperitoneally to rats. It inhibited the release of creatine kinase.

Flower extracts of *L. graminifolia* showed strong molluscicidal activity against *Oncomelania hupensis*, the intermediate host of schistosomiasis caused by *Schistosoma japonicum*. The steroid saponins might very well be responsible for this activity.

Ruscogenin glycoside isolated from *L. muscari* improved immunological liver injury induced in mice.

Botany A stemless herb with horizontal, slender, moderately woody rhizome; roots with distant, oblong tubers 4–5 cm × c. 0.5 cm. Leaves basal, numerous, tufted, simple, linear to narrowly linear-oblanceolate, 25–90 cm × 2–9 mm, minutely denticulate on the margins, many-veined, with membranous wings towards the base. Inflorescence a pseudoraceme with erect peduncle (12–)30–50 cm long; bracts deltoid, up to 4 mm long. Flowers bisexual, slightly zygomorphic; pedicel 2–12 mm long, articulated near apex; tepals 6, free, 3.5–4 mm long, fleshy, violet; stamens 6, attached at base of tepals, c. 3 mm long; ovary superior, 3-celled, style short and thick, stigma capitate. Fruit a 1-seeded berry, rupturing in early development, exposing the seed, with persistent tepals. Seed subglobose to ellipsoid, c. 5 mm long, testa fleshy, black.

Liriope comprises about 5 species and is naturally distributed in Indo-China, China, Japan and the Philippines. It is classified in the tribe *Ophiopogoneae*, together with *Ophiopogon* and *Peliosanthes*. It is not completely certain that *L. spicata* Lour. is synonymous with *L. graminifolia*. The name *L. graminifolia* has often been used for or-

namental plants, but probably mostly incorrect.

Ecology In the Philippines *L. graminifolia* occurs on open slopes up to 1400 m altitude, and seems to be uncommon.

Management As an ornamental *Liriope* is propagated by seed, sown fresh in a sandy propagation mix, or by division. It is easy to grow.

Genetic resources *L. graminifolia* is rare in the Malesian region, and therefore easily liable to genetic erosion in the area. However, it seems to be, at least locally, common in mainland Asia.

Prospects *L. graminifolia* is an interesting medicinal plant, which is very poorly known in the Malesian region, probably mainly due to its rarity. Its pharmacological properties, especially its anti-inflammatory activity, deserve more attention. The fact that it is easy to grow is advantageous for its possible development as a medicinal crop. A taxonomic study of wild *Liriope* is desirable.

Literature 247, 267, 481, 671, 882, 1043.

Other selected sources 186, 215, 760, 1009, 1044.

D.S. Alonzo

Lophatherum gracile Brongn.

Duperrey, Voy. monde, phan.: 50, t. 8 (1831).
GRAMINEAE
$2n = 48$

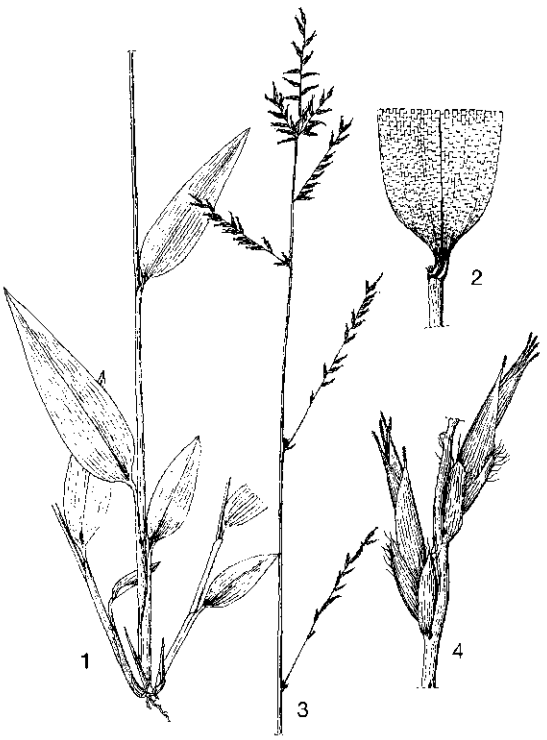
Vernacular names Indonesia: rumput bambu, tangkur gunung (Sundanese). Malaysia: rumput kelurut, rumput jarang, rumput bulu (Peninsular). Thailand: phai pen lek (Trang), yaa khui mai phai (Prachin Buri). Vietnam: d[aj]m tr[us]c di[eej]p, c[or] m[aa]y, c[or] l[as] tre.

Origin and geographic distribution *L. gracile* is widely distributed in tropical and subtropical Asia, from southern India, Sri Lanka, Burma (Myanmar), Indo-China, southern China and Thailand to Korea, Japan, the whole Malesian region and northern Australia.

Uses In Peninsular Malaysia, the tubers of *L. gracile* are eaten as a tonic and to treat chancre. In Vietnam, a decoction of the whole plant is considered diuretic and febrifuge and administered to treat dysuria, colds, sore throat and sunstroke. In China, the aerial parts of the plant are applied to sores in the mouth and against urinary problems, the roots and tubers as a cooling medicine to treat urinary problems, and during childbirth to hasten delivery. The use of *L. gracile* as a medicinal plant in China probably dates from the Ming Dynasty. *L. gracile* is a useful forage with apparently high nutritional value. In China, the fruits are an important feed for silver pheasants.

Properties The hot water extract of aerial parts of *L. gracile* is active against *Streptococcus mutans* strains that are the cause of dental caries. Some triterpenoids, arundoin, cylandrin, friedelin, taraxerol and steroids have been isolated.

Botany A perennial, tufted herb up to 120 cm tall, with short, branched rhizome, fibrous roots locally thickened to spindle-shaped tubers up to 4 cm long, and erect, compressed, hollow culms. Leaves distichously alternate, simple, ovate-lanceolate, 10–30 cm × 1–5.5 cm, contracted into 6–18 mm long pseudo-petiole at base, acuminate at apex, margins scabrid, glabrous to pubescent, distinctly cross-veined; sheath glabrous, but margins ciliate, ligule very short, truncate. Inflorescence a spike-like panicle up to 45 cm long, consisting of irregularly and distantly placed spiciform racemes up to 15 cm long, with spikelets in 2 rows. Spikelets ovate-lanceolate, 9–13 mm long, very shortly stalked, with 1 bisexual floret having lower glume 3.5–4.5 mm long and 5-veined, upper glume 5–6.5 mm long and 5–7-veined, lemma 6–7



Lophatherum gracile Brongn. – 1, lower part of plant; 2, basal part of leaf; 3, inflorescence; 4, part of inflorescence with 2 spikelets.

mm long and 7–9-veined, and palea 5–6 mm long and strongly 2-veined; spikelet on top with 5–13 sterile lemmas, gradually becoming smaller, all lemmas with short, retrorsely scaberulous awns up to 2 mm long; lodicules broadly cuneate; stamens 2, anthers linear; ovary with 2 long styles connate at base, stigmas long. Fruit an oblong-fusiform caryopsis c. 3.5 mm long.

The awns of the sterile lemmas function as a dispersal device. Whole spikelets adhere to the fur of animals by the awns, developing into a fan of recurved hooks at maturity.

Lophatherum comprises 2 species and is restricted to tropical and subtropical Asia and Australia. It belongs to the tribe *Centotheceae*, which comprises 10 genera of mostly forest grasses characterized by broad leaves with cross-veins.

Ecology *L. gracile* usually occurs in mixed forest, in shaded, not too dry localities up to 1500 m altitude. It is locally common.

Management In China the plants are harvested before they start flowering, tied into bundles and dried in the sun.

Genetic resources *L. gracile* is not in danger of genetic erosion because it is widely distributed.

Prospects Research on the phytochemistry and pharmacological properties of *L. gracile* is desirable as it has been regarded for centuries as a medicinal plant of considerable value in China and Indo-China.

Literature 121, 663, 671, 731.

Other selected sources 62, 334, 782.

Tahan Uji

Lophopyxis maingayi Hook.f.

Icon. pl. 18: t. 1714 (1887).

LOPHOPYXIDACEAE

$2n$ = unknown

Synonyms *Lophopyxis pierrei* Boerl. (1890), *Lophopyxis pentaptera* (K. Schumann) Engl. (1893).

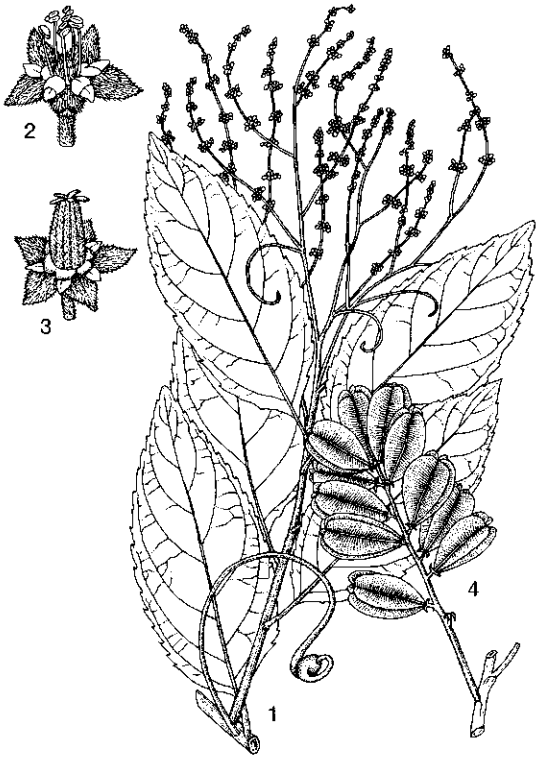
Vernacular names Brunei: akar belimbing hutan (Kinabatangan). Indonesia: simpuru (Sulawesi), tali sesawi (Ambon). Papua New Guinea: n'dralang (Manus Island).

Origin and geographic distribution *L. maingayi* occurs in Peninsular Malaysia, northern Borneo, Sulawesi, the Moluccas, New Guinea, the Solomon Islands and Palau Island (Micronesia).

Uses In the Moluccas the roots of *L. maingayi* are consumed as a poison antidote and externally applied to treat stings of poisonous fish. The finely ground leaves are externally applied on small wounds and boils. In Papua New Guinea (Manus Island) the stem is chewed and the juice swallowed to treat diarrhoea and stomach-ache.

The rather hard stem splits easily and is used for tying thatch in New Britain (Papua New Guinea).

Botany A climbing shrub or liana up to 8(–30) m long; stem up to 7 cm in diameter, bark whitish, axillary branchlets transformed into strong woody tendrils. Leaves arranged spirally, simple, ovate to oblong, 8–18(–24) cm × 4–8(–10) cm, base cuneate to obtuse, rarely subcordate, apex acuminate, serrulate to crenate, puberulous with caducous hairs persisting as domatia in the vein axils; petiole c. 1 cm long; stipules small, knoblike. Inflorescence an axillary or terminal spikelike, pendent raceme up to 25 cm long, a few together, bracts at the base often transformed into tendrils. Flowers unisexual, regular, 5(–6)-merous; sepals ovate, c. 1.5 mm long, greenish-white or yellowish, hairy on both sides; petals ovate, c. 1 mm long; disk yellowish; male flowers with free stamens opposite the sepals and rudimentary ovary; female flowers with superior, ovoid ovary, puberulent,



Lophopyxis maingayi Hook.f. – 1, flowering branch; 2, male flower; 3, female flower; 4, infructescence.

(4–)5-celled. Fruit an obovoid or ellipsoid 5-winged samara 2.2–3(–3.5) cm × 1.3–1.8 cm, green turning dark brown, 1-seeded, indehiscent. Seed subcylindrical, 12–15 mm × 5–6 mm, longitudinally grooved.

The position of the monotypic genus *Lophopyxis* is still disputed. It has been placed in *Icacinaceae, Celastraceae* and *Euphorbiaceae*, but is now considered to be a family of its own, as it does not fit easily in these families.

Ecology *L. maingayi* is found in primary and secondary forest, in swampy as well as well-drained sites, sometimes even in mangrove, from sea-level up to 300 m altitude.

Genetic resources *L. maingayi* occurs widely, although scattered, in both primary and secondary forest, and therefore does not appear to be threatened at present by genetic erosion.

Prospects Pharmacological and phytochemical research is needed to evaluate the potential of the traditional medicinal uses of *L. maingayi*.

Literature 247, 334, 347.

Other selected sources 144, 724, 857.

D.S. Alonzo

Luvunga Buch.-Ham. ex Wight & Arnott

Prodr. fl. Ind. orient. 1: 90 (1834).

RUTACEAE

x = unknown

Origin and geographic distribution *Luvunga* consists of some 12 species, and is found from India, Sri Lanka and Burma (Myanmar), throughout South-East Asia to New Guinea. Borneo is particularly rich with 7–8 species.

Uses *Luvunga* is only little used as a medicinal plant in South-East Asia, most often externally as an anodyne. In Thailand the roots are used as a diuretic. *L. scandens* is more esteemed as an ornamental.

Properties The essential oil of *L. scandens* fruits shows moderate to strong in-vitro antifungal activity against a range of plant-pathogenic (*Alternaria* and *Fusarium* species) and keratinophilic human-pathogenic (e.g. *Microsporum* and *Trichophyton* species) fungi, as well as *Aspergillus* and *Penicillium* species. The oil also has a strong repellent effect on the pulse beetle (*Callosobruchus chinensis*).

In tests with rats the oil showed central nervous system depressant effects, and lowered the blood pressure without alteration of rate or depth of respiration. It contains monoterpenes such as eugenol, farnesol, limonene and linalool.

Botany Lianas with hooklike or (in juvenile plants) straight axillary spines. Leaves alternate, 3-foliolate; petiole long, wingless; stipules absent; leaflets ovate to lanceolate, apex acute or acuminate, entire; petiolule pulvinate. Inflorescence a dense axillary panicle or raceme. Flowers bisexual, regular, (3–)4–5-merous, strongly scented; calyx cup-shaped; petals free, oblong-linear, thick; stamens (6–)8–10; ovary superior, shortly stalked, elongate-ovoid, 2–4-celled, style thick, gradually merging into the ovary, stigma capitate. Fruit an ellipsoid or globose berry, thick-walled, 1–3-seeded. Seeds embedded in a mucilagenous substance. *L. scandens* fruits ripen about 6 months after flowering.

Luvunga is badly in need of a critical revision; herbarium specimens are difficult to identify and species differ only very little. It resembles *Paramignya*, which is also a *Rutaceae* genus of lianas clinging to tree branches with their reflexed spines. *Luvunga* differs in its 3-foliolate leaves on long, stiff petioles.

Ecology *Luvunga* occurs in lowland and lower montane mixed forest.

Genetic resources Both *Luvunga* species treated here are widespread and do not seem to be in danger of genetic erosion, but locally populations may be threatened by habitat destruction, e.g. in India.

Prospects Little is known about the pharmacological properties of *Luvunga*, and research is needed to support its traditional medicinal uses. The antifungal activity of the essential oil deserves more attention.

Literature 877, 893, 907.

Selection of species

Luvunga sarmentosa (Blume) Kurz

Journ. As. Soc. Beng. 39(2): 69 (1870).

Vernacular names Indonesia: ki racun (Sundanese), tembesi (Javanese), akar keping. Vietnam: th[aaf]n x[aj] tr[uw][owf]n.

Distribution From Burma (Myanmar) to Peninsular Malaysia, Sumatra, Java and Borneo.

Uses In Java the sap flowing out of heated stems is applied to the gums to treat toothache. The bark and leaves are applied externally to painful limbs and rheumatism.

Observations A liana up to 25 m long; leaves with petiole 1.5–10 cm long, leaflets elliptical to

obovate, 7–25 cm × 2–10 cm, base acute or obtuse, apex acuminate; inflorescence consisting of many-flowered fascicled racemes; calyx obscurely lobed, petals 6–7 mm long, stamens free, finely pubescent; fruit ellipsoid, 2.5–3.5 cm × 1.5–2 cm, rough and pitted. In Java *L. sarmentosa* occurs in mixed forest from sea-level up to 1700 m altitude.

Selected sources 62, 121, 334, 731, 789.

Luvunga scandens (Roxb.) Buch.-Ham. ex Wight & Arnott

Prodr. fl. Ind. orient. 1: 90 (1834).

Vernacular names Malaysia: susoh ayam hutan, akar buah keping (Peninsular). Thailand: naam khue kai (northern), chaang ngaa dieo (Chanthaburi), naam khaa bai (Prachuap Khiri Khan). Vietnam: th[aaf]n x[aj] h[uw][ow]ng.

Distribution From India and Burma (Myanmar), throughout continental South-East Asia to Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia a root decoction is taken as a post-partum protective medicine. In India the dried mature fruits are used to prepare a perfumed medicinal oil that is an ingredient of various prescriptions.

Observations A liana up to 25 m long; leaves with petiole 5–13 cm long, leaflets elliptical-oblong or oblanceolate, 6–18 cm × 3–6 cm, base cuneate, apex acute or acuminate; inflorescence consisting of many-flowered panicled cymes; calyx with truncate lobes, petals 12–18 mm long, stamens united, glabrous; fruit oblong, c. 2.5 cm × 2 cm, rather smooth. In Peninsular Malaysia *L. scandens* is usually found in mixed forest on river banks and in the hills.

Selected sources 121, 213, 271, 629, 731, 789.

D. Mutiatikum

Macaranga Thouars

Gen. Nov. Madag.: 26 (1806).

EUPHORBIACEAE

$x = 11$; *M. denticulata*, *M. tanarius*: $n = 11$

Origin and geographic distribution *Macaranga* comprises some 250 species. About 30 of these occur in tropical Africa and Madagascar, the rest in tropical Asia, from India, Sri Lanka and Burma (Myanmar), through Indo-China, southern China, Taiwan, the Ryukyu Islands, Thailand and throughout the Malesian region, to northern Australia and the Pacific, east to Fiji. The main centre of diversity is found within Malesia where about 160 species occur, with an exceptionally high number of endemics in Borneo and New Guinea.

Uses Roots, bark and leaves of *Macaranga* are fairly commonly used internally in traditional medicine in South-East Asia, usually as a decoction, to treat stomach-ache, dysentery, haemoptysis, cough and fever. The leaves, and sometimes resin, are applied externally to wounds, ulcers, sores and boils.

In Brunei leaves of *M. beccariana* Merr. are used in a post-natal bath and as a repellent for ants. Some species are used in traditional medicine in Fiji, e.g. to treat convulsions, diarrhoea and as an abortifacient; an example is *M. vitiensis* Pax & Hoffm. Several *Macaranga* species are used medicinally in Africa. Bark and leaves of *M. barteri* Müll. Arg. are used as a vermifuge, febrifuge, aperient and anti-anaemic tonic, and to treat cough, bronchitis and gonorrhoea. A decoction of the roots of *M. heterophylla* (Müll. Arg.) Müll. Arg. is applied against amenorrhoea, and as an emmenagogue and abortifacient, a decoction of the bark to treat cough, and a decoction of the leaves to treat gonorrhoea. The bark of *M. hurifolia* Beille is used as a purgative and against cough, and a decoction of the roots to treat oedema. The bark and roots of *M. spinosa* Müll. Arg. are administered to treat asthma, cough, headache, rheumatism and for liver and stomach complaints, whereas a decoction of the bark is applied to toothache and thrush.

The wood is frequently used, especially for parts of houses not in contact with the ground, but also for e.g. light framing, interior trim, moulding, shingles, packing cases and match splints. It yields a high-quality pulp and produces excellent particle board, cement-bonded board and wood-wool board, and is suitable for the production of plywood. It provides good fuelwood.

The bark and pith or the fruit of several *Macaranga* species produce a resin or gum that can be used as glue. The bark of some species has been used to tan fishing nets. Bark, leaves and fruits of some species are applied in the Philippines in the preparation of a fermented drink called 'basi' made from sugar cane. Large leaves, as found in several species, are used to wrap food.

Properties Several tannins including corilagin, furosin, geraniin and macaranganin have been isolated from *Macaranga*, and many medicinal properties are probably due to these tannins. No less than 28 tannins have been demonstrated in *M. tanarius* leaves, and 10 in the bark. The results of tests with *M. tanarius* roots from Taiwan indicate that they may have immunopotentiating effect of humoral immune response in mice. An

aqueous ethanol extract exhibited antiviral activity against ranikhet and vaccinia virus.
The bark and leaves of *M. gigantea* and *M. triloba* showed moderate antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Saccharomyces cerevisiae* and *Fusarium oxysporum*. It is assumed that gallotannin is the substance in *M. grandifolia* fruits (which are added to 'basi') that inhibits the growth of lactic acid bacteria.
Four prenylated flavanones with antibacterial activity have been isolated from the dichloromethane extract of leaves of *M. pleiostemon* Pax & Hoffm., a species from New Guinea. An aqueous leaf extract of *M. peltata* (Roxb.) Müll. Arg. from India inhibited conidial germination of the fungus *Drechslera oryzae*.
A chloroform extract of *M. carolinensis* Volk. from the Caroline Islands showed in-vitro cytotoxic activity against P-388 and 9KB cell lines. Geranyl stilbenes with cytotoxic activity have been isolated from the African *M. schweinfurthii* Pax.

Botany Evergreen, dioecious, small to medium-sized trees up to 30(–40) m tall; bole straight, up to 50(–70) cm in diameter, occasionally with stilt roots, rarely with buttresses; bark surface smooth or rough with lenticels, hoop-marked, stripping off easily, greyish to pinkish, inner bark pink to reddish-brown; crown open, often bluish-green. Leaves arranged spirally, simple, often prominently lobed, palmately or pinnately veined, the main veins joined by parallel, concentric veinlets giving the effect of spider-webbing, often peltate; petiole often long and kneed; stipules often large and persistent. Inflorescence an axillary panicle, raceme or spike, consisting of small clusters. Flowers small, subtended by often glandular bracteoles, with 2–5-lobed perianth (petals absent); male flowers with 1–20 stamens having 3–4-celled anthers; female flowers with superior, (1–)2–3(–6)-celled ovary, styles usually free and unlobed. Fruit a leathery or woody, often shouldered capsule, smooth to variously spiny, splitting into 2-valved parts leaving the central column, few-seeded. Seeds black, often with a thin orange to red aril. Seedling with epigeal germination; cotyledons emergent, leafy; hypocotyl elongated; all leaves arranged spirally, conduplicate to involute.
Macaranga species are short-lived pioneers becoming 15–20 years old. Most species develop according to Rauh's architectural model, characterized by a monopodial trunk with rhythmic growth and so developing tiers of branches that are themselves morphogenetically identical with the trunk. Trees may flower when very young, and flowering and fruiting are fairly regular, several times a year. A few species are either facultative or obligate myrmecophytes. The latter group of species provides specific nesting space, mainly hollow twigs, for ants of the genus *Crematogaster*. The ants protect the plants from herbivores.
The dimorphism of sapling leaves and those of mature trees renders identification difficult. *Macaranga* is closely related to *Mallotus*, but differs in its 3–4-celled anthers and more conspicuously in its lateral inflorescences and the absence of stellate hairs.

Ecology Most *Macaranga* species are pioneers and form a characteristic of secondary forest especially along roadsides in western Malesia and New Guinea, but are less common in Sulawesi, the Moluccas and Java. They are often found gregariously and may locally form pure stands. A few species are found in primary forest. Most species thrive in a per-humid climate, some also under slightly seasonal conditions. The altitudinal range is large, with a few species occurring up to almost 3000 m altitude in New Guinea.

Management *Macaranga* can be propagated by seed. For *M. tanarius* there are about 54 500 dry seeds/kg. Seeds of *M. tanarius* show about 50% germination in 24–72(–265) days, whereas those of *M. triloba* have about 80% germination in 19–37 days. It is, however, difficult to get seedlings to grow.

Genetic resources Some *Macaranga* species are narrow endemics, but the genetic resources of most species are not endangered as trees are common and characteristic elements of secondary vegetation.

Prospects *Macaranga* is commonly used in traditional medicine throughout the large area of distribution of the genus, and often for similar purposes, e.g. internally to treat stomach-ache, dysentery, cough and fever, and externally to treat wounds and ulcers. However, surprisingly little is known about active compounds and pharmacological properties, and more research is worthwhile.
The fairly general occurrence of *Macaranga* and the long wood fibres make the exploitation for pulp and paper and the production of wood-based panels promising in the near future.

Literature 120, 121, 542, 883.

Selection of species

Macaranga aleuritoides F. v. Mueller

Descr. notes Papuan pl. 2: 21 (1876).

Synonyms *Macaranga riparia* Engl. (1886).

Vernacular names Papua New Guinea: kat (Taskul, New Ireland Province).

Distribution The Moluccas, New Guinea and the Solomon Islands.

Uses The fruits or seeds are chewed in Papua New Guinea to relieve abdominal pains.

Observations A small to medium-sized tree up to 20 m tall; leaves 3-lobed, c. 20 cm long, puberulous below, stipules single, up to 10 cm long; male flowers in panicles c. 20 cm long, with 7–9 stamens. *M. aleuritoides* can be very common in secondary forest and gaps in primary forest, up to 900 m altitude.

Selected sources 21, 883.

Macaranga bancana (Miq.) Müll. Arg.

DC., Prodr. 15(2): 990 (1866).

Synonyms *Macaranga triloba* auct. non (Thunberg) Müll. Arg.

Vernacular names Brunei: marakubong, sedaman. Malaysia: landas bukit, mahang merah, mahang tekukur (Peninsular), sedaman (Sarawak). Singapore: pahang merah. Thailand: low khao, lo ngaam (peninsular).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra, Bangka, Lingga and Borneo.

Uses In Peninsular Malaysia, the leaves are used externally to treat boils, and in Sarawak powdered young leaves are applied as a paste to the skin to relieve itch. The wood is used as firewood.

Observations A small to medium-sized tree up to 23 m tall, stems hollow; leaves 3-lobed, 16–32 cm × 12–25 cm, lobes broadly ovate, glandular-dentate, densely hairy but later glabrescent above, deeply peltate, stipules up to 8 mm long, broad, strongly convex-recurved, persistent; male flowers in slender, lax, branched panicles up to 20 cm long, with 1 stamen, female flowers with 4(–5)-celled ovary, styles connate into an ovoid, hollow body; fruit up to 7 mm long, with 4(–5) glandular patches on apex. *M. bancana* occurs in lowland forest, usually secondary or in edges, up to 700 m altitude; it is locally very common, e.g. in Peninsular Malaysia. It has been much confused with *M. triloba*.

Selected sources 121, 194, 990.

Macaranga bicolor Müll. Arg.

Linnaea 34: 199 (1865).

Vernacular names Philippines: hamindang (Filipino).

Distribution The Philippines.

Uses The sap from the bark and leaves is applied to fresh wounds; sap from the leaves also serves as an eye medicine. The root is used to treat headache. The wood is used for fuel.

Observations A small tree up to 10 m tall, with bole up to 30 cm in diameter; leaves ovate, c. 20 cm long, not lobed, usually glandular below, peltate; male flowers in branched panicles, female flowers with c. 6-celled ovary; fruit c. 1.3 cm in diameter, rugulose. *M. bicolor* occurs in secondary lowland, riverine or hill forest throughout the Philippines.

Selected sources 24, 197, 731, 883.

Macaranga conifera (Zoll.) Müll. Arg.

DC., Prodr. 15(2): 1005 (1866).

Synonyms *Macaranga populifolia* (Miq.) Müll. Arg. (1866).

Vernacular names Malaysia: memaya, ludai api, mesepat (Peninsular).

Distribution Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia, the roots and leaves are applied to treat malaria and dropsy. The wood is used for building local houses, and for implements.

Observations A small to medium-sized tree up to 30 m tall, with bole up to 50 cm in diameter; leaves ovate to elliptical, 7.5–10 cm × 3–7.5 cm, not lobed, glabrous, not peltate, stipules broad, persistent; male flowers in short panicles up to 7.5 cm long, with 1–2 stamens; fruit double-globose, smooth. *M. conifera* occurs in primary or secondary lowland forest, up to 750 m altitude.

Selected sources 20, 22, 121, 731, 883, 990.

Macaranga densiflora Warb.

Bot. Jahrb. 13: 350 (1891).

Vernacular names Papua New Guinea: wageva (Tukwaukwa, Milne Bay Province).

Distribution New Guinea and the Solomon Islands.

Uses In Papua New Guinea, crushed leaves are applied to wounds to arrest bleeding.

Observations A small tree up to 12 m tall; leaves ovate-lanceolate, 10–14 cm × 5–7 cm, not lobed, not peltate, stipules up to 2 mm long, caducous; male flowers in short panicles up to 8 cm long, with 3–4 stamens. *M. densiflora* occurs in

secondary lowland forest and along streams, rarely up to 1000 m altitude.

Selected sources 21.

Macaranga denticulata (Blume) Müll. Arg.

DC., Prodr. 15(2): 1000 (1866).

Vernacular names Malaysia: balik angin, mesepat (Peninsular). Burma (Myanmar): nwongkye, pet-waing. Laos: tong khôp, tong khôp 'hou sang[2], tong 'khao[2] 'san. Thailand: po khee haet, tong taep (northern), salo kliang (peninsular). Vietnam: ba soi.

Distribution Eastern India, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra and Java.

Uses In Peninsular Malaysia, a decoction of the plant has been applied to wounds and administered after childbirth. In China, a decoction of the wood is used to dispel tumours and to treat paralysis; it is also considered depurative and believed to prevent puerperal disorders.

Observations A small to medium-sized tree up to 20 m tall; leaves triangular-ovate, up to 13 cm × 10 cm, peltate, not lobed, with matted, felt-like indumentum below, hoary; male flowers in slender spikes or panicles, with 9–14 stamens, female flowers with 2-celled ovary and short, divergent-recurved stigmas; fruit small, double-globose, smooth. *M. denticulata* usually occurs in secondary forest, sometimes also in primary forest, up to 1100 m altitude.

Selected sources 19, 22, 62, 121, 731, 883, 990.

Macaranga gigantea (Reichenb.f. & Zoll.) Müll. Arg.

DC., Prodr. 15(2): 995 (1866).

Synonyms *Macaranga megalophylla* (Müll. Arg.) Müll. Arg. (1866), *Macaranga incisa* Gage (1922).

Vernacular names Brunei: merakubong. Indonesia: biruwak, kulit melabai (Sumatra), dahan kagurangen (Sulawesi). Malaysia: kubin, mahang gajah, telinga gajah (Peninsular). Singapore: mahang gajah. Thailand: huu chang (south-eastern), ma hang (peninsular), tao luang (northern).

Distribution Thailand, Peninsular Malaysia, Singapore, Sumatra, Borneo and Sulawesi.

Uses In Peninsular Malaysia, a decoction of the root bark is applied internally to treat dysentery. In Sumatra, a decoction of the bark and leaves is used to treat stomach-ache. Also in Indonesia, fresh sap is applied as an antidote to centipede bites. In Brunei a leaf decoction is also used as an antidote to poisoning of a general nature. The wood is used for building houses, and for implements. The bark has been used for tanning and dyeing. The resinous gum is applied as glue, and the leaves for wrapping up food.

Observations A small to medium-sized tree up to 30 m tall, with bole up to 40 cm in diameter; leaves orbicular-ovate, 20–60 cm across, shallowly 3-lobed, finely velvety, peltate, stipules up to 6 cm long; male flowers in large, branched panicles, with 2–3 stamens, female flowers with 2-celled ovary and short, reflexed stigmas; fruit double-globose, smooth. *M. gigantea* occurs in primary or secondary lowland, riverine or hill forest, particularly in gaps, up to 1000 m altitude.

Selected sources 19, 20, 22, 23, 121, 194, 195, 295, 296, 334, 731, 883, 990.

Macaranga glaberrima (Hassk.) Airy Shaw

Kew Bull. 19: 322 (1965).

Synonyms *Macaranga subfalcata* (Reichenb.f. & Zoll. ex Zoll.) Müll. Arg. (1866).

Vernacular names Indonesia: bataruwa, ki harepang prongpeng (Sundanese), tanglar (Javanese).

Distribution Java, the Lesser Sunda Islands (Flores) and New Guinea (Irian Jaya).

Uses Young leaves are applied to cuts. The wood is used to build houses.

Observations A small to medium-sized tree up to 20 m tall, with bole up to 30 cm in diameter; leaves elliptical, 4.5–18(–27) cm × 2–7(–9) cm, slightly 2-lobed at base, glabrous, not peltate, stipules linear to subulate, caducous; male flowers in sinuous spikes, often as a dense 'witches' broom', up to 6.5 cm long, with c. 12 stamens, female flowers with 2-celled ovary; fruit double-globose, c. 1.2 cm long, very shortly spiny. *M. glaberrima* seems restricted to primary forest, up to 1400 m altitude.

Selected sources 21, 62, 334, 731, 883.

Macaranga grandifolia (Blanco) Merr.

Philipp. Journ. Sci. 7, Bot.: 394 (1912).

Vernacular names Philippines: takip-asin (Filipino), binungang-malapad (Tagalog), ginabang (Iloko).

Distribution The Philippines (Luzon and Mindoro).

Uses In the Philippines, the resin is used as an astringent gargle to treat ulcers in the mouth. Bark, leaves and fruits are included in the Philippines in the preparation of a fermented drink

called 'basi' made from sugar cane.

Observations A small tree up to 10 m tall; leaves orbicular-ovate to ovate, 60–100 cm across, not lobed, not peltate, stipules 6–10 cm long; male flowers in large, branched panicles, female flowers with 2-celled ovary; fruit double-globose, c. 1 cm long, smooth, but each valve armed with 2 spine-like processes at apex. *M. grandifolia* occurs in secondary lowland forest, and is locally abundant.

Selected sources 24, 117, 197, 655, 731, 760.

Macaranga griffithiana Müll. Arg.

DC., Prodr. 15(2): 993 (1866).

Vernacular names Malaysia: mahang bulan, mahang tutup (Peninsular). Thailand: dok mai hu chang (south-eastern), ma hang (peninsular).

Distribution Laos, southern Vietnam, Thailand, Peninsular Malaysia, Singapore and Sumatra.

Uses In Peninsular Malaysia, a decoction of the roots is drunk to treat fever.

Observations A small tree up to 15(–20) m tall; leaves ovate, often slightly rhombic in outline, 10–25(–28) cm × (8–)10–23 cm, shortly and broadly 3-lobed, glabrous but veins with scattered, spreading, white whiskers, deeply peltate, stipules up to 6 mm long, usually caducous; male flowers in sparsely branched panicles up to 25 cm long, with 2–3 stamens, female flowers with 4(–5)-celled ovary; fruit smooth, with a conspicuous glandular patch on each cell. *M. griffithiana* is locally very common, often in open, often seasonally swampy locations, and in secondary forest, rarely in primary forest.

Selected sources 121, 194.

Macaranga hullettii King ex Hook.f.

Fl. Brit. Ind. 5: 452 (1887).

Vernacular names Malaysia: mahang bulan, mahang serindit (Peninsular).

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia a decoction is applied internally to treat stomach-ache. The wood is used as firewood.

Observations A small tree up to 18 m tall, twigs hollow, ant-inhabited; leaves narrowly ovate to ovate, 14–32 cm × 6–16(–22) cm, usually not lobed, sometimes with tiny lateral lobes, glabrous, peltate, stipules persistent, up to 1 cm long, broad and recurved; male flowers in sparsely branched panicles up to 30 cm long, with 1 stamen, female flowers with 5 styles fused at base; fruits crowded, strongly shouldered or horned. *M. hullettii* occurs mainly in lowland primary forest, often in riverine forest, but also in lower montane forest, up to 1350 m altitude.

Selected sources 20, 22, 121, 194, 731, 990.

Macaranga hypoleuca (Reichenb.f. & Zoll.) Müll. Arg.

DC., Prodr. 15(2): 992 (1866).

Vernacular names Indonesia: mahang kapur (general). Malaysia: mahang puteh (Peninsular), sedaman, sedaman puteh (Sabah). Thailand: law.

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia, a decoction is used as a febrifuge, expectorant and anti-spasmodic. The wood is sometimes used for implements.

Observations A small to medium-sized tree up to 30 m tall, bole up to 40 cm in diameter, young branches white; leaves deeply 3-lobed, lobes c. 15 cm × 7.5 cm, usually brilliantly white-waxy below, peltate; male flowers in elongate, lax panicles up to 30 cm long, with 1 stamen, female flowers usually with 3-celled ovary, styles very short, reflexed; fruit smooth, usually 3-lobed, with 2 raised glandular patches at the apex of each cell. *M. hypoleuca* is locally common in evergreen, usually secondary forest up to 1000 m altitude, rarely as high as 2400 m.

Selected sources 19, 20, 22, 121, 194, 731, 883, 990.

Macaranga involucrata (Roxb.) Baillon

Etud. Gén. Euph.: 432 (1858).

Vernacular names Indonesia: haleki daun kecil (Ambon), liwini (Halmahera), lowui (Ternate).

Distribution The Sula Islands, the Moluccas, New Guinea, the Bismarck Archipelago and Australia (Queensland).

Uses In the Moluccas, a decoction of the bark mixed with *Citrus hystrix* DC. fruits is applied internally to treat leucorrhoea, gonorrhoea and gravel; it is also used in a gargle against swollen tonsils and palate, and the sap of young leaves is used to treat dysentery and thrush. The wood is used in house building.

Observations A small tree up to 10 m tall; leaves ovate-deltoid, 8–20 cm × 4–8 cm, 3-lobed or not lobed, glabrous or softly velvety, not peltate, stipules linear to subulate, up to 1 cm long, caducous; male flowers in lax, few-branched panicles up to 25 cm long, with 1 stamen, female flowers with 2 plumose and caducous styles up to 1 cm long; fruit usually 2-celled, smooth and warty or

with short processes. *M. involucrata* is locally common in secondary forest at low altitudes, up to 600(–1200) m.

Selected sources 21, 23, 334, 731, 883.

Macaranga pleioneura Airy Shaw

Kew Bull. 23: 110 (1969).

Vernacular names Papua New Guinea: dinalpa (Duman, Simbu Province).

Distribution New Guinea.

Uses In Papua New Guinea, young leaves are applied to sores and cuts.

Observations A shrub or small tree up to 9 m tall; leaves broadly elliptical to broadly lanceolate, (5–)8–15(–20) cm × (2.5–)4–6(–10) cm, not lobed, not peltate, stipules c. 3 mm long, caducous; male flowers in simple or branched inflorescences up to 8 cm long, with 30–40 stamens, female flowers with 1(–2)-celled ovary; fruit with 1–2(–8) processes. *M. pleioneura* occurs in secondary montane rain forest, at 1400–2400 m altitude.

Selected sources 21.

Macaranga similis Pax & Hoffm.

Engl., Pflanzenr. IV.147.XIV: 29 (1919).

Vernacular names Papua New Guinea: adui (New Britain).

Distribution *M. similis* is endemic to New Guinea, the Bismarck Archipelago and rare on the Solomon Islands.

Uses In New Britain, the leaves are applied externally to sores. In the Solomon Islands, the wood is used in house building and as firewood, and the leaves to seal traditional stone ovens and for cleansing the body.

Observations A small tree up to 10 m tall; leaves triangular-ovate, 12–13.5 cm × 8–11.5 cm, not lobed, softly velvety below, not peltate, stipules up to 15 mm long; male flowers in up to 6 cm long, branched panicles, with c. 9 stamens, female flowers with threadlike, lateral styles; fruits clustered within persistent leafy bracts, at first with soft hairy apical spines, maturing glabrous. *M. similis* occurs in lowland secondary forest up to 500 m altitude; it is locally very common, particularly in the Milne Bay District of Papua New Guinea.

Selected sources 21, 332, 347.

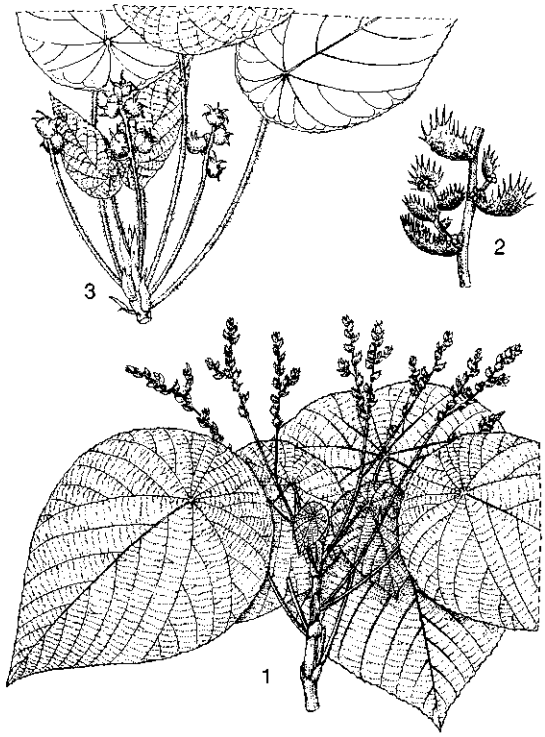
Macaranga tanarius (L.) Müll. Arg.

DC., Prodr. 15(2): 997 (1866).

Vernacular names Brunei: sedaman buta buta. Indonesia: tutup ancur (Javanese), mara (Sundanese), mapu (Batak). Malaysia: kundoh, mahang puteh, tampu (Peninsular). Papua New Guinea: tabi, tabu (New Britain). Philippines: binunga (Filipino), himindang (Bikol), biluan (Tagalog). Thailand: hu chang lek (south-eastern), lo khao, mek (peninsular). Vietnam: m[ax] r[aj]ng.

Distribution From the Andaman and Nicobar Islands, Indo-China, southern China, Taiwan and the Ryukyu Islands, through Thailand and the whole of the Malesian region, to northern Australia and Melanesia.

Uses In the Philippines, the powdered root is used as an emetic to treat fever, and a decoction of the root against haemoptysis. In the Moluccas (Indonesia) and New Britain (Papua New Guinea), the leaves have been used internally to treat dysentery and as an abortifacient. In Peninsular Malaysia, pounded leaves are applied to wounds, and an infusion of the root internally to treat fever. In Brunei smoke from burning leaves is considered a general ailment of the body. The bark is used for toughening fishing nets. In Indonesia, the leaves dye matting black. Bark and leaves are widely utilized in the Philippines in the preparation of a fermented drink called 'basi' made from



Macaranga tanarius (L.) Müll. Arg. – 1, branch with male inflorescences; 2, part of male inflorescence; 3, fruiting branch.

sugar cane. In Sumatra, fruits are added to palm juice as it is boiled down, to improve the quality of the sugar produced. In Indonesia and the Philippines, the bark exudate is used as a glue. The wood is applied in house building and for implements.

Observations A small to medium-sized tree up to 20(–27) m tall; leaves orbicular-ovate, 8–32 cm × 5–28 cm, usually not lobed, hairy when young, deeply peltate, stipules large, caducous; male flowers in branched panicles up to 34 cm long, with (3–)5–6(–10) stamens, female flowers with 2-celled ovary and 2 large styles; fruit about 1 cm in diameter, with long, soft prickles on apex, yellowish-glandular outside. *M. tanarius* is often very common in secondary forest, especially in logged areas, but occurs also in thickets, brushwood, village groves and beach vegetation, up to 2100 m altitude.

Selected sources 19, 20, 21, 22, 23, 24, 62, 87, 117, 121, 195, 197, 334, 347, 542, 577, 731, 760, 883, 990.

Macaranga triloba (Thunberg) Müll. Arg.

DC., Prodr. 15(2): 989 (1866).

Vernacular names Indonesia: mahang abu (Sumatra), mara bodas (Sundanese), tutup ancur (Javanese). Philippines: bula-bula (Tagbanua).

Distribution Peninsular Thailand, Peninsular Malaysia, Sumatra, Bangka, Java and the Philippines.

Uses In Java and Sumatra, a decoction of bark, leaves and fruits is used internally to treat stomach-ache. The wood is used as firewood.

Observations A small to medium-sized tree up to 20 m tall, stems solid; leaves 3(–5)-lobed, 15–35 cm × 12–24(–30) cm, lobes broadly ovate, glandular-dentate, densely hairy but later glabrescent above, deeply peltate, stipules up to 15 mm long, spreading, persistent; male flowers in slender, lax, branched panicles up to 22 cm long, with 1 stamen, female flowers with 4–5-celled ovary, styles connate into an ovoid, hollow body; fruit up to 8 mm long, with 4–5 hornlike processes. *M. triloba* occurs in a wide range of habitats, including dryland dipterocarp forest and edges of swampy forest, up to 1400 m altitude; it is locally very common, e.g. in Java.

Selected sources 62, 194, 295, 296, 334, 731, 883.

S. Aggarwal

Macrosolen Blume

Syst. Veg. 7, 2: 1731 (1830).

LORANTHACEAE

$x = 12$; *M. cochinchinensis*: $2n = 24$

Origin and geographic distribution *Macrosolen* consists of some 30 species, and is distributed in southern Asia, from India to New Guinea. In Malesia 24 species occur, with a centre of diversity in the north-western part, especially in Borneo.

Uses Various parts of *Macrosolen* are employed internally and externally for a range of applications. In Java dried stems of stem-parasitic *Loranthaceae* (including *Macrosolen*, but also *Dendrophthoe* and *Scurrula*) enter into traditional prescriptions for the treatment of smallpox, and as a vermifuge for children. Specific applications are often linked with the host plant. More recently *Macrosolen* has been mentioned as a traditional medicine for cancer and liver afflictions. In Vietnam *M. tricolor* (Lecomte) Danser is used for the preparation of a purgative tea.

Properties Leaves and stems of *M. cochinchinensis* contain considerable amounts of L-asparaginase. In complementary and alternative medicine (CAM) therapy, L-asparaginase is indicated for lymphoblastic leukaemia when resistance against conventional cytostatics has developed. Tumours of acute leukaemia require exogenous L-asparagine as an essential nutrient for their growth. L-asparaginase catalyses the hydrolysis of L-asparagine to aspartic acid and ammonia, thus interfering with the metabolism of malignant cells. In phytochemical studies gallic acid and several flavonoids including orientin, quercetin, rutin and vicemin have been isolated from *M. cochinchinensis*.

Botany Stem-parasitic shrubs, often robust, usually with runners on the bark of the host, bearing secondary haustoria. Leaves usually opposite, simple and entire, petiolate; stipules absent. Inflorescence a raceme or spike of decussate pairs of flowers, sometimes few-flowered and umbellate, axillary or inserted on the runners; bracts 3 under each flower, free or variously connate. Flowers bisexual, 6-merous; calyx reduced to a limb; corolla gamopetalous, usually weakly zygomorphic, in mature buds with 6 keels or wings at the point of reflexion of the lobes; stamens inserted on the corolla opposite the lobes; ovary inferior, style simple, usually with a knoblike stigma. Fruit berrylike, ellipsoid to nearly globose, 1-seeded. Seed covered by a sticky layer.

After germination of the seeds, it takes 1.5–3 years before plants start flowering and fruiting. Pollination in *Macrosolen* is by birds or insects and effective seed dispersal is by fruit-eating birds. Fruits may be either swallowed whole and the seeds excreted, or the seeds are rubbed to branches after feeding on the surrounding fruit pulp.

Macrosolen is very closely related to *Elythranthe*, the differences being the extent of development of the involucral bracts at the base of the inflorescence and subtending the flowers, and the structure of the inflorescence axis.

Ecology *Macrosolen* occurs in habitats ranging from humid to open forests, as well as in disturbed sites. Although more common in the lowlands, it can be found from sea-level up to over 3000 m altitude. In Malesia, many *Macrosolen* species are aggressive, also attacking cultivated trees.

Management Seeds of *M. cochinchinensis* have no dormant period, and can germinate within the fruit, although this affects vigour. Germination takes 2–8 days at 18–32°C with over 90% success rate. Germination can occur on any natural substrate, and artificial propagation is possible. However, best results are obtained with seeds from fresh fruits sown on the small branches of a host.

Genetic resources *Macrosolen* comprises a mixture of widespread species and narrow endemics, and with respect to their hosts, both generalists and apparent specialists are represented. The degree of potential risks of genetic erosion is linked to these attributes. *M. cochinchinensis* is widely distributed and occurs on a wide range of host plants, and therefore it does not appear to be threatened by genetic erosion.

Prospects Little is known on the pharmacology of *Macrosolen*. More research is needed to evaluate its potential in complementary and alternative medicine.

Literature 74, 247, 384, 731, 732, 1018.

Selection of species

Macrosolen cochinchinensis (Lour.) v. Tiegh.

Bull. Soc. Bot. France 41: 122 (1894).

Synonyms *Loranthus globosus* Roxb. (1824), *Elytranthe cochinchinensis* (Lour.) G. Don (1834), *Elytranthe globosus* (Roxb.) G. Don (1834).

Vernacular names Indonesia: benalu (general), kamaduhan (Javanese), mangendeuh (Sundanese). Malaysia: dedalu api jantan, api-api jantan (Peninsular). Thailand: pa, prathat nuan (peninsular). Vietnam: d[aj]i c[as]n nam.

Distribution From the Himalayas to Indo-China, southern China, Thailand and throughout the Malesian region east to Irian Jaya (Bird's Head Peninsula).

Uses In Peninsular Malaysia pounded leaves are used as a poultice to treat headache. The stem juice is drunk to expel the afterbirth. In Indo-China fruits are employed as a cough medicine, and the leaves as a substitute for tea.

Observations A hemiparasitic shrub, glabrous or rarely the inflorescence shortly pale-tomentose; leaves opposite or alternate, narrowly to broadly elliptical or ovate, 4–16 cm × 2–7 cm, base cuneate to truncate, apex acuminate, petiole (0.1–)0.3–1 cm long; inflorescence a spicate, sometimes subumbellate raceme of 2–7 pairs of flowers, axis 0.5–2(–4) cm long; corolla in mature bud 8–18(–23) mm long, mostly yellow or green or rarely pink or red below, tube in open flower 5–10(–14) mm long. *M. cochinchinensis* occurs in humid and open forests, as well as in disturbed sites; it is common in the lowlands, but can be found up to 2300 m altitude.

Selected sources 121, 247, 731, 732.

Macrosolen robinsonii (Gamble) Danser

Bull. Jard. Bot. Buitenzorg, sér. 3, 10: 345 (1929).

Synonyms *Elytranthe robinsonii* Gamble (1913).

Vernacular names Vietnam: d[aj]i c[as]n robinson.

Distribution Vietnam and Peninsular Malaysia.

Uses In Vietnam, the leaves of *M. robinsonii* are employed to prepare a diuretic tea, specifically to remedy an enlarged abdomen.

Observations A hemiparasitic shrub, glabrous; leaves opposite, narrowly ovate to ovate, 5–8(–12) cm × (1–)2–3.5 cm, base cuneate, apex acuminate, petiole 0.1–0.5(–1) cm long; inflorescence an umbellate raceme of 1–2 opposite pairs of flowers, axis 0.1–0.5 cm long; corolla in mature bud 15–25(–30) mm long, pink or red, tube in open flower 10–16 mm long. *M. robinsonii* is found at 500–1500 m altitude.

Selected sources 247, 731, 732.

Slamet Sutanti Budi Rahayu

Maesa Forssk.

Fl. aegypt.-arab.: 66 (1775).
MAESACEAE
$x = 10$

Origin and geographic distribution *Maesa* comprises some 150 species and is widely distributed in the Old World tropics.

Uses In South-East Asia *Maesa* leaves are mainly used externally to treat itch and skin diseases. Numerous *Maesa* species are used as a fish poison. Sometimes only the fruits are used, but in general all aboveground parts of the plantare used, apparently for their saponin content. In the Philippines the widespread *M. denticulata* Mez and *M. laxa* Mez are used for this purpose. *M. tetrandra* (Roxb.) A.DC., a widespread species from Java, the Moluccas and New Guinea, is mentioned in old literature as a remedy for fever and measles in Ternate (the Moluccas). *M. haplobotrys* F. v. Mueller (synonym: *M. edulis* C.T. White), from Timor, the Moluccas, New Guinea and the Solomon Islands, is an ingredient of mixtures with *Ficus* as a poison-antidote, and for birth control. In Nepal a decoction of the bark of *M. macrophylla* (Wallich) A.DC. is taken as a gargle to treat tonsilitis, ulcers and fever, and as an ecbolic. *M. lanceolata* Forssk. is widely used in traditional medicine in Africa and Madagascar, e.g. as an ecbolic, purgative and fish poison, and for fertility control.

Properties Based on dried leaves of *M. ramentacea* a commercial natural piscicide called 'Swimtop' has been developed in Thailand. It can be used in both freshwater and brackish water ponds, and breaks down quickly, leaving no toxic residues in the fish or the water. The saponins in the leaves stupefy or kill fish dose-dependently but are nontoxic to mammals or shellfish (shrimps and prawns), and do not render fish inedible.
A crude aqueous extract of *M. ramentacea* leaves showed antifungal activity against numerous plant pathogenic fungi. A crude extract of *M. indica* seeds showed strong inhibition of 2-aminoanthracene-induced mutants of *Salmonella typhimurium* (T-98), indicating a possible antimutagenic activity.
A methanol extract of *M. macrophylla* bark showed strong antiviral activity against human poliovirus-1, Sindbis virus and Herpes simplex virus-1 at a concentration of 100 µg/ml. A methanol extract from leaves of the African *M. lanceolata* showed strong molluscicidal, haemolytic and antiviral activities, with saponins as active compounds. The antiviral activity included activities against Herpes simplex types 1 and 2, and vesicular stomatitis viruses.

Botany Dioecious and possibly polygamous shrubs and small trees, or lianas. Leaves alternate, simple, entire or variously serrulate-crenate, petiolate; stipules absent. Inflorescence axillary, sometimes appearing terminal, paniculate or racemose. Flowers unisexual, 4–5-merous; pedicel with 2 bracteoles; calyx lobes mostly broadly ovate, persistent; corolla campanulate or urceolate; stamens inserted on the corolla tube; ovary semi-inferior. Fruit berrylike with a somewhat woody endocarp, indehiscent, many-seeded.
Based on morphology and molecular sequence data, *Maesa* has been removed from the family *Myrsinaceae* and upgraded to a family of its own: *Maesaceae*.

Ecology *Maesa* is found in the understorey or edges of primary and secondary forest, from sea-level up to 2800 m altitude.

Management *M. ramentacea* is easily propagated by cuttings.

Genetic resources *Maesa* species are commonly found in areas of forest regeneration, and are usually common and cannot be considered threatened. However, some species are restricted in their distribution. The Philippines and New Guinea, for example, both have several endemic species, which may be threatened with continued habitat degradation.

Prospects A commercial pesticide based on *M. ramentacea* leaves was patented in 1995. Other species may have potential as natural pesticides as well. The antifungal and antiviral activities deserve more attention.

Literature 37, 43, 161, 917, 948, 975.

Selection of species

Maesa indica (Roxb.) A.DC.

Trans. Linn. Soc. 17: 134 (1834).

Synonyms *Baeobotrys indica* Roxb. (1824).

Vernacular names Malaysia: bunga kasi hutan (Peninsular). Laos: dok ton, kok tap. Thailand: khaao saan noi, ma phap (northern). Vietnam: d[ow]n r[aw]ng c[uw]a, d[ow]n [aas]n d[ooj].

Distribution From India to Indo-China, Thailand and Peninsular Malaysia.

Uses In Indo-China crushed leaves are used externally to treat urticaria and itch caused by allergy. The leaves are used as a fish poison in India. Sometimes they are eaten in curries or as a vegetable.

Observations A shrub up to 5 m tall; leaves elliptical to ovate-elliptical, (6–)8–17 cm × 4–8(–15) cm, base cuneate to rounded, apex acuminate; inflorescence a condensed panicle or raceme 2–8 cm long, glabrous or slightly glandular; pedicel up to 2 mm long. *M. indica* occurs in evergreen forest, up to 2300 m altitude.

Selected sources 121, 249, 622, 789, 990.

Maesa ramentacea (Roxb.) A.DC.

Trans. Linn. Soc. 17: 133 (1834).

Synonyms *Baeobotrys ramentacea* Roxb. (1824).

Vernacular names Malaysia: gambir hutan, gambir-gambir (Peninsular). Thailand: khaao saan luang (northern), khrai yoi (Chiang Mai), luai (Trang). Vietnam: d[ow]n h[oof]ng.

Distribution Eastern India, Burma (Myanmar), Indo-China, southern China, Thailand and throughout the Malesian region.

Uses In Peninsular Malaysia pounded leaves are applied externally to treat itch and other skin diseases. Mention is made of the leaves eaten with rice as a remedy for heart pain. Dried leaves are used as a fish poison.

Observations A shrub or small tree up to 15 m tall; leaves ovate or elliptical, 6–18 cm × 2–11 cm, base cuneate, rounded or subcordate, apex acuminate; inflorescence axillary, panicle-like, 4–18 cm long, with widely patent branches, glabrous; pedicels up to 3 mm long. *M. ramentacea* is commonly found in secondary forest, from sea-level up to 1200 m altitude.

Selected sources 121, 249, 622, 746, 789, 888, 938, 990.

T.M.A. Utteridge & J.L.C.H. van Valkenburg

Mallotus Lour.

Fl. cochinch.: 635 (1790).

EUPHORBIACEAE

$x = 11$; *M. philippensis*, *M. repandus*: $n = 11$

Origin and geographic distribution *Mallotus* comprises about 140 species. Only 2 of these occur in Africa and Madagascar, the others being found from India and Sri Lanka to Indo-China, China, Taiwan, Korea, Japan, Thailand, throughout the Malesian region, northern and eastern Australia and the Pacific (east to Fiji). Some 75 species occur within Malesia.

Uses Bark, leaves, fruits and seeds of *Mallotus* are commonly used in traditional medicine in South-East Asia. The most common internal applications are for treating stomach complaints and intestinal problems. Externally they are used to treat boils, wounds, skin diseases and fever. The fruit granules of *M. philippensis* were previously important as an anthelmintic and purgative, but these uses have declined. The powder from the fruits is still used for the treatment of tapeworm infestation in livestock, particularly in poultry.

M. japonicus (Thunberg) Müll. Arg. is applied in Chinese traditional medicine, particularly to regulate the functions of the digestive system, e.g. to treat gastric and duodenal ulcers.

The red granules on the fruits of *M. philippensis* were formerly much used as a dye. The wood of several *Mallotus* species is used for small objects and as fuelwood.

Properties The leaves of *M. mollissimus* showed activity against *Staphylococcus aureus*. The bark of *M. philippensis* is active against gram-positive as well as gram-negative bacteria. Kamala powder is a dull reddish-brown substance from *M. philippensis* fruits used for medicinal purposes, and formerly also for dyeing. Under the microscope it is seen to consist of very characteristic globular glands containing red resin and radiating groups of unicellular curved trichomes. In-vitro and in-vivo research showed that a fruit extract of *M. philippensis* displays activity against tapeworm. The resin caused a significant purgative effect after an oral dose (120 mg/kg) in rats, and killed 36% and 78% of tapeworms in the small intestine at doses of 60 mg/kg and 120 mg/kg, respectively. The anthelmintic activity is mainly attributed to the phloroglucinol derivatives rottlerin and isorottlerin. Rottlerin exhibited antifertility activity in rats and guinea-pigs, whereas isorottlerin was inactive. Rottlerin is a protein kinase inhibitor. Rottlerin and isorottlerin together constitute about 11% of the weight of the powder from ripe *M. philippensis* fruits. Leaf extracts showed antifilarial activity on *Setaria cervi* in vitro. The alcoholic extract of *M. philippensis* fruits exhibited in-vitro anticancer activity against human epidermoid carcinoma of the nasopharynx and sarcoma of mice.

Stem and root extracts of *M. repandus* showed radical scavenger activity. An aqueous extract of *M. repandus* stems exhibited anti-inflammatory activity against carrageenan-induced paw oedema. *M. repandus* showed significant antihepatotoxic activity in cultured hepatocytes. A methanol extract had anti-ulcer activity in stress-induced gastric ulcers and radio protective effect against bone marrow and skin injury.

Bergenin (an isocoumarin), the major constituent

of *M. japonicus*, showed antihepatotoxic activity on carbon tetrachloride-intoxicated hepatocytes of rats. Bergenin has also been isolated from wood, bark and leaves of *M. philippensis* and from aerial parts of *M. repandus*. Several phloroglucinol derivatives isolated from *M. japonicus* (e.g. mallophenone, mallotojaponin (a major constituent of the fruit), isomallotolerin, isomallotochromene, mallotochroman and isomallotochroman) distinctly inhibited the replication of herpes simplex virus type 1. They also demonstrated cytotoxicity against human larynx and lung carcinoma cells as well as mouse melanoma and leukaemia cells, and caused a marked prolongation of the life-span of mice bearing L5178Y leukaemia. A methanol extract of *M. japonicus* stems showed significant inhibitory activity on human immunodeficiency virus type 1 (HIV-1) reverse transcriptase.

The presence of cardenolides has been demonstrated in the seeds of several *Mallotus* species. The seed-oil of *M. philippensis* is unstable; it polymerizes rapidly. Seeds contain up to 20% oil. The principle fatty acid is kamlolenic acid. The bark contains up to 10% tannin. Several hydrolyzable tannins have been isolated including colilagin, eugenin, furosin, geraniin, mallotinic acid, mallotinin and ropondusinic acids A and B.

Botany Dioecious, sometimes monoecious shrubs or small to medium sized trees up to 25(–35) m tall, sometimes lianas; indumentum often consisting of stellate hairs. Leaves arranged spirally or opposite, simple and entire, sometimes sinuate or dentate, rarely lobed, sometimes peltate, often whitish and with glandular granules below, venation pinnate or palmate; stipules small. Inflorescence a terminal or axillary raceme or spike, sometimes paniculate, generally unisexual. Flowers unisexual, calyx 2–4(–5)-lobed, petals absent; male flowers with numerous stamens, disk present or absent; female flowers with superior, 2–4-lobed ovary, styles simple to plumose, disk absent. Fruit a more or less distinctly lobed capsule, smooth to echinate, splitting into 2-valved, 1-seeded parts leaving a persistent central column. Seeds globose to ovoid, smooth, shiny black. Seedling with epigeal germination; cotyledons emergent, leafy; hypocotyl elongated; first few leaves arranged spirally, decussate higher up in species with opposite leaves.

Mallotus can grow quickly; a mean annual diameter increment of 1.4 cm has been recorded for *M. philippensis*, 1.7–3.6 cm for *M. mollissimus*. The seeds of many *Mallotus* species are dispersed by birds.

Mallotus is closely related to *Macaranga*, the latter differing by its 3–4-celled anthers and more conspicuously by its lateral inflorescences and absence of stellate hairs.

Ecology Most *Mallotus* species occur in primary evergreen rain forest, but a few are abundant in secondary forest and in more open locations including savanna woodland, up to 2000 m altitude. They occur in dipterocarp, riverine and swamp forest. A few species (e.g. *M. philippensis*) are pioneers characteristic of secondary vegetation and may be gregarious elements in regenerated forest. They are among the first species to appear after fields are abandoned.

Management *Mallotus* can be propagated by seed, but the germination rate may be poor, e.g. in *M. philippensis*. Trees may also reproduce from root suckers. Most species are light-demanding, but some need shade during establishment. In India, *M. philippensis* is resistant to drought, it coppices well and is capable of producing root suckers; it is not resistant to fire.

The red granules of *M. philippensis* fruits are usually separated by beating and shaking, or by stirring the fruits vigorously in water. The yield of the powder is only 1.5–4% of the fruit weight.

Genetic resources The light-demanding *Mallotus* species exhibiting pioneer characteristics are at little risk of genetic erosion by deforestation. However, more research on taxonomy, geographic distribution and ecological requirements is needed to determine the risks for all the species of this large genus. Ex-situ germplasm collections are not known to exist.

Prospects Many pharmacological properties demonstrated in *Mallotus* material outside South-East Asia deserve more attention in material from the region, especially the antitumour, antihepatotoxic, antibacterial and antiviral activities. The dye from *M. philippensis* is much too expensive to compete with synthetic dyes, but might have prospects in the food industry as an antioxidant.

Literature 49, 50, 476, 542, 627, 883.

Selection of species

Mallotus barbatus Müll. Arg.

Linnaea 34: 184 (1865).

Vernacular names Malaysia: balek angin, tampin (Peninsular). Thailand: kheethao (northern), salapaang bai yai (Chanthaburi), kalo yaai thaai (peninsular). Vietnam: b[uf]ng b[uj]c.

Distribution India, Burma (Myanmar), Indo-

China, southern China, Thailand, Peninsular Malaysia, Java and the Moluccas (Halmahera).

Uses In Peninsular Malaysia, it has been recorded that a poultice is made from the plant by pounding it with pepper, ginger and rice; it is used to treat colic. In Vietnam, *M. barbatus* is used to treat boils and headache. In Indo-China, a tallow is made from the seeds for illumination.

Observations A shrub or small tree up to 6 m tall, branches, petioles and inflorescences densely floccose-tomentose; leaves arranged spirally, suborbicular in outline, often tricuspidate or shortly and acutely 3-lobed, peltate; fruit subglobose, densely covered with soft stellate-tomentose processes forming a continuous uniform layer. *M. barbatus* occurs in evergreen forest, often in clearings and near streams, up to 1200 m altitude.

Selected sources 19, 23, 62, 121, 990.

Mallotus blumeanus Müll. Arg.

Linnaea 34: 195 (1865).

Vernacular names Indonesia: bungbulang peucang, calik angin (Sundanese), katimuru (Javanese).

Distribution Sumatra, Java, the Lesser Sunda Islands (Flores) and Sulawesi.

Uses In Indonesia the leaves are used during childbirth.

Observations A medium-sized tree up to 30 m tall, almost completely glabrous; leaves decussately opposite, ovate-oblong, not peltate; fruit ellipsoid, verrucose. *M. blumeanus* occurs in primary forest up to 1000 m altitude.

Selected sources 22, 23, 62, 334, 883.

Mallotus eriocarpus (Thwaites) Müll. Arg.

Linnaea 34: 194 (1865).

Synonyms *Coelodiscus montanus* Müll. Arg. (1866).

Vernacular names Malaysia: ramin bukit, kayu berkuching (Peninsular).

Distribution Sri Lanka and Peninsular Malaysia.

Uses In Peninsular Malaysia, *M. eriocarpus* is applied as a poultice to treat eczema.

Observations A shrub or small tree up to 8 m tall, softly tomentose all over; leaves opposite, ovate-cordate to oblong lanceolate, rounded or cordate at base, dentate, not peltate; fruit smooth, completely devoid of processes. *M. eriocarpus* occurs in lowland forest.

Selected sources 121, 990.

Mallotus floribundus (Blume) Müll. Arg.

Linnaea 34: 187 (1865).

Vernacular names Blue blade (En). Indonesia: nakau (Palembang), tapen (Java). Malaysia: mallotus marambokan (Sabah), maya-maya, pasu-pasu (Peninsular). Philippines: tula-tula (Filipino). Burma (Myanmar): taung-kado. Thailand: lo khon, pik (peninsular), prik (peninsular, southwestern). Vietnam: b[aj]ch dan, ba b[es]t hoa nhi[eef]u.

Distribution Burma (Myanmar), Indo-China, Thailand, throughout Malesia and the Solomon Islands.

Uses In Peninsular Malaysia, a decoction of the root is used to treat fever, stomach-ache and cholera, and is given after childbirth; a decoction of the plant is also applied as a lotion to treat yaws. The wood is used for small objects.

Observations A shrub or small tree up to 18(–25) m tall, mostly with straight bole up to 30 cm in diameter; leaves arranged spirally (upper ones sometimes opposite), broadly ovate to orbicular, often glaucous below with conspicuous tufts of fulvous hairs in the basal vein-axils, peltate, petiole long and slender; fruit sparsely and softly echinate. *M. floribundus* is locally common in primary and secondary forest, mainly in open locations, or scrub vegetation, especially along streams, up to 500(–1000) m altitude.

Selected sources 19, 21, 22, 23, 62, 121, 334, 760, 872, 883, 990.

Mallotus macrostachyus (Miq.) Müll. Arg.

DC., Prodr. 15(2): 963 (1866).

Vernacular names Common pom-pom tree (En). Malaysia: balek angin, berumbing (Peninsular), dau (Sabah). Thailand: famee, lo, plao yai (peninsular). Vietnam: b[uj]c ch[uf]m to, ba b[es]t ch[uf]m to.

Distribution Peninsular Thailand, Peninsular Malaysia, Singapore, Bangka and Borneo.

Uses In Peninsular Malaysia, the hairs rubbed from the young leaves are applied to wounds as a styptic, the leaves as a poultice to treat boils and fever, and a decoction of the leaves for cleansing wounds. The wood is occasionally used, e.g. for rafters.

Observations A shrub or small to medium-sized tree up to 18 m tall, with robust, shortly rufous-tomentellous branches; leaves arranged spirally, triangular-ovate, narrowly peltate, very long-petiolate; inflorescence frequently leaf-op-

posed; fruit globose, with a dense covering of tomentose processes forming a thick uniform layer. *M. macrostachyus* occurs in and at the margins of evergreen forest, primary as well as secondary, up to 1200 m altitude.

Selected sources 19, 121, 883, 990.

Mallotus miquelianus (Scheffer) Boerl.

Handl. fl. Ned. Ind. 3: 290 (1900).

Synonyms *Mallotus anisophyllus* Hook.f. (1887).

Vernacular names Malaysia: kayu kering (Peninsular). Philippines: pikal (Filipino).

Distribution Peninsular Thailand, Peninsular Malaysia, Sumatra, Borneo and the Philippines.

Uses In Peninsular Malaysia, the leaf juice is used to treat earache. The stems are used for making walking sticks.

Observations A shrub up to 3(–10) m tall; leaves opposite, one leaf of each pair being reduced, cordate and up to 5 cm in diameter, not peltate, petiole of normal leaves very short, up to 7 mm long; fruit with short blackish processes, puberulous. *M. miquelianus* occurs in primary or secondary forest, usually in more open locations, up to 700(–1400) m altitude.

Selected sources 19, 22, 23, 121, 872, 990.

Mallotus mollissimus (Geiseler) Airy Shaw

Kew Bull. 26: 297 (1972).

Synonyms *Croton mollissimus* Geiseler (1807), *Mallotus ricinoides* (Pers.) Müll. Arg. (1865).

Vernacular names Papua New Guinea: di (Lossu, New Ireland Province). Philippines: hinlaumo (Filipino). Vietnam: b[uj]c n[aa]u, b[uj]c qu[ar] th[aaf]u d[aaf]u, ba b[es]t n[aa]u.

Distribution Indo-China, throughout the Malesian region except Peninsular Malaysia, northeastern Australia and Melanesia; possibly also in southern Burma (Myanmar), southern China and Thailand.

Uses In Sumatra, the leaves are used to treat stomach-ache. In Papua New Guinea, the sap is used externally to treat sore eyes, and internally against dysentery. Leaves are chewed and sap swallowed as a contraceptive.

Observations A shrub or small to medium-sized tree up to 15 m tall; leaves arranged spirally, ovate-suborbicular to deltoid-rhomboid, usually sinuate or dentate towards the apex, peltate; fruit subglobose, with densely crowded, pubescent processes forming a continuous woolly layer. *M. mollissimus* is common in secondary forest and in grassland on loamy or clayey soils, up to 1300 m altitude.

Selected sources 19, 21, 22, 23, 62, 256, 296, 347, 883, 990.

Mallotus paniculatus (Lamk) Müll. Arg.

Linnaea 34: 189 (1865).

Synonyms *Croton paniculatus* Lamk (1786), *Mallotus cochinchinensis* Lour. (1790).

Vernacular names Turn-in-the-wind (En). Indonesia: calik angin (Sundanese), tutup awu, tutup kancil (Javanese). Malaysia: balek angin (Peninsular), mallotus balabakan (Sabah). Philippines: anaplan (Bukidnon). Laos: 'khi^{2} thao^{1}, lat koua, luat ma^{2}. Thailand: saet (peninsular), sateton (north-eastern), soi daao (south-eastern). Vietnam: b[uj]c b[aj]c, ba b[es]t nam b[ooj], bai b[as]i.

Distribution India, Burma (Myanmar), Indo-China, southern China, Taiwan, Thailand, throughout Malesia except the Lesser Sunda Islands, and north-eastern Australia.

Uses In Peninsular Malaysia, a decoction of the plant is used for cleansing wounds, a poultice in combination with other plants to treat headache, and a lotion externally to treat fever in children. A decoction of the root is administered after childbirth. The wood is used for matches and boxes, and as fuelwood. The bark is occasionally used for binding purposes.

Observations A shrub or small to medium-sized tree up to 20 m tall; leaves arranged spirally, rhombic or ovate, often tricuspidate or 3-lobed, whitish-felted below, usually not peltate; fruit subglobose, whitish-felted, with scattered processes. *M. paniculatus* is common in evergreen forest and in scrub vegetation, up to 1500 m altitude.

Selected sources 19, 21, 22, 23, 62, 121, 256, 334, 883, 990.

Mallotus philippensis (Lamk) Müll. Arg.

Linnaea 34: 196 (1865; '*philippinensis*').

Synonyms *Croton philippense* Lamk (1786).

Vernacular names Kamala tree, monkey face tree, red berry (En). Croton tinctorial, rottlière des teinturiers (Fr). Indonesia: galuga furu (Ternate), kapasan (Javanese), ki meyong (Sundanese). Malaysia: rambai kuching (general), kasirau, minyak madja (Peninsular). Papua New Guinea: tore (Vanapa Bridge, Central Province). Philippines: banato (Tagalog), pangaplasin (Ilokano), tagusala (Bisaya). Burma (Myanmar): hpawng-awn. Cambodia: 'ân-nadaa. Laos: kh'aay paax, khiiz moon, tangx thôôm. Thailand: kai khat hin, khee nuea (north-eastern), kham saet (central). Vietnam:

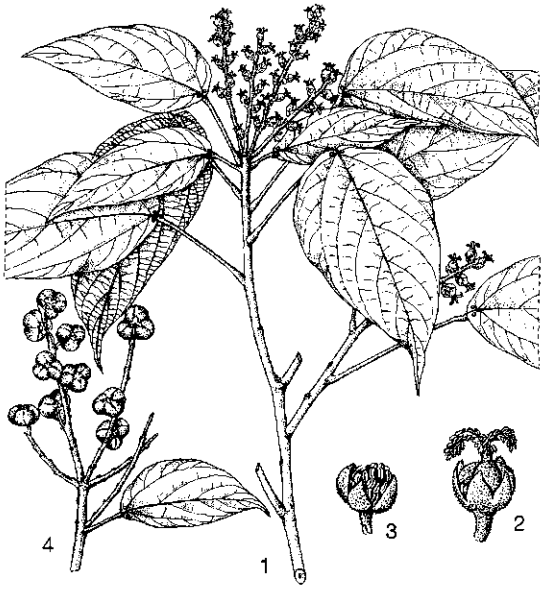
r[uf]m nao, c[as]nh ki[ees]n, m[oj]t.

Distribution From India and Sri Lanka to Burma (Myanmar), Indo-China, Taiwan, the Ryukyu Islands, Thailand, throughout the Malesian region, northern Australia and Melanesia.

Uses The granules on the fruit have been widely used as an anthelmintic and to treat skin complaints, e.g. herpes. They have been applied as a drastic purgative. The leaves and bark are also used to treat skin diseases, and pounded seeds are applied to wounds. The seeds are administered in traditional medicine in Thailand to treat vertigo and loss of appetite; a decoction of the wood is used to treat muscular inflammation and kidney diseases. The leaves are used as diuretic and anti-amoebic. In Papua New Guinea, a decoction of the leaves is applied against diarrhoea, but also to treat constipation; the sap is applied to wounds. The granules which cover the ripe fruit are used in India as a dye ('kamala') for dyeing silk and wool bright orange, and as a preservative for vegetable oils and dairy products. The seed oil is sometimes used in the production of rapid-drying paints and varnishes, as a substitute for tung oil from *Aleurites*. The wood is useful as a fuelwood and is sometimes used for implements and rafters. The leaves are used as a fodder.

Observations A small to medium-sized tree up to 25 m tall; leaves arranged spirally, elliptical to lanceolate-ovate or obovate, with red glandular granules below, not peltate; fruit subglobose, with a dense layer of red granules. *M. philippensis* occurs in many different habitats, in primary and secondary forest, edges of mangroves and scrub vegetation in grassland, up to 1600 m altitude.

Selected sources 19, 21, 22, 23, 62, 121, 173, 256, 303, 334, 347, 542, 671, 760, 883, 990.



Mallotus philippensis (Lamk) Müll. Arg. – 1, branch with female inflorescences; 2, female flower; 3, male flower; 4, fruiting branch.

Mallotus repandus (Willd.) Müll. Arg.

Linnaea 34: 197 (1865).

Vernacular names Malaysia: akar charek puteh (Peninsular). Thailand: ma pop khruea (northern), kurapia (Pattani), yieo maeo (peninsular). Vietnam: b[uj]c b[uj]c leo, nkung di[eej]n b[af]i.

Distribution India, Sri Lanka, Indo-China, Taiwan, Thailand, throughout Malesia except Borneo, north-eastern Australia and New Caledonia.

Uses In Peninsular Malaysia, a decoction of the roots is used to cure colds. In Taiwan, the stems and roots are applied as anti-inflammatory and liver-protective drugs. The roots are also used to treat itch, snakebites, fever and hepatitis.

Observations A climbing or scrambling shrub or liana up to 20 m long; leaves arranged spirally, triangular to elliptical or rhombic-ovate, not peltate; fruit 2(–3)-celled, without echinate processes, densely yellow-tomentose. *M. repandus* occurs scattered in primary or secondary rain forest, up to 900 m altitude.

Selected sources 19, 21, 22, 23, 62, 121, 256, 554, 562, 990.

Ch.B. Lugt

Mapania cuspidata (Miq.) Uittien

Journ. Arn. Arb. 20: 213 (1939).

CYPERACEAE

$2n$ = unknown

Synonyms *Mapania humilis* Fern.-Vill. (1882), *Mapania petiolata* C.B. Clarke (1908).

Vernacular names Indonesia: sohlenat (Sundanese), selingsingan (Sumatra), kihadio (Seram). Malaysia: siak-siak rimba, sempit (Peninsular), penawar Fatimah (Sarawak). Philippines: malalubigan (Tagalog), lubigan (Panay Bisaya), maribari (Samar-Leyte Bisaya).

Origin and geographic distribution *M. cuspidata* is widespread in the Nicobar Islands, Thailand, throughout the Malesian region, the Solomon Islands and the New Hebrides.

Uses In Peninsular Malaysia the leaves of *M. cuspidata* are used to treat fever, whereas a decoc-

tion of whole plants is administered as a tonic after childbirth. In Sarawak a root decoction is drunk as a poison antidote. *M. cuspidata* has potential ornamental value. Some *Mapania* species, e.g. *M. palustris* (Hassk. ex Steudel) Fern.-Vill. and *M. sumatrana* (Miq.) Benth., are used for making mats and baskets. *M. kurzii* C.B. Clarke is browsed by cattle.

Botany A robust, glabrous, perennial herb up to 90 cm tall, with rhizome up to 11 mm in diameter. Leaves 3-ranked, in a rosette, simple, linear, linear-oblong to oblong, (16–)20–98 cm × 2–6.5 cm, narrowed into a pseudopetiole up to 39 cm long at base, cuspidate at apex, margins entire to scabrid near apex, leathery, 3-veined, young leaves pinkish to reddish on lower side; sheath present at base of pseudopetiole. Inflorescence a terminal, ellipsoid to hemi-spherical spike up to 3 cm long, on a lateral scape up to 29 cm long; spike with several involucral bracts. Flowers unisexual, sessile, arranged in axils of bracts along an axis ('spicoid'), lower 3 flowers of spicoid male, with 1 stamen, terminal flower female, with elongate style ending in 3 stigma branches; each spicoid with 6 bracts (so 2 without flowers). Fruit nutlike, ellipsoid to obovoid-ellipsoid, dull pale green to medium-brown, with succulent exocarp and stony endocarp.

Mapania comprises about 75 species and is pantropical. In the Malesian region about 30 species occur, Borneo being richest (25 species), followed by Peninsular Malaysia (16). *M. cuspidata* is a variable species. Three varieties are distinguished, differing in leaf shape and size.

Ecology *M. cuspidata* occurs in the undergrowth of rain forest up to 900 m altitude, usually in damp, peaty localities, also in riverine forest and freshwater swamp forest.

Genetic resources Although *M. cuspidata* is widespread and in many regions not uncommon, *Mapania* is in general liable to genetic erosion because it is largely confined to lowland rain forest, a habitat under increasing pressure.

Prospects Nothing is known about the pharmacological activities of *Mapania*. The use in traditional medicine is similar to that of other, more common *Cyperaceae*, e.g. *Cyperus* and *Fimbristylis*, and it is not expected to increase. The ornamental value of some species, e.g. *M. cuspidata*, deserves more attention, especially for use as an indoor foliage plant.

Literature 11, 12, 121, 859.

Other selected sources 247, 760.

R.H.M.J. Lemmens

Matthaea Blume

Mus. Bot. Lugd.-Bat. 2: 89 (1856).

MONIMIACEAE

x = unknown

Origin and geographic distribution *Matthaea* consists of 6 species, 4 of which are endemic to the Philippines. The widespread *M. sancta* occurs throughout western Malesia.

Uses *Matthaea* stems and leaves are used to relieve headache. The wood is sometimes used in house construction.

Botany Monoecious shrubs or small, evergreen trees. Leaves opposite, simple, entire or dentate distally, pubescent or glabrous at maturity, pinnately veined, with fine pellucid dots; stipules absent. Inflorescence axillary or terminal, cymose, shorter than the leaves. Flowers unisexual, 4-merous; male flowers with subglobose receptacle, surrounded by small rounded tepals, stamens 4, free, opening by 2 longitudinal slits; female flowers with more flattened receptacle, upper half of tepals abscising as a calyptra at anthesis to reveal numerous carpels. Fruit consisting of numerous long-stipitate, verruculose drupes situated on the receptacle.

Matthaea is closely related to *Steganthera*, which differs in the anthers opening by a single horizontal slit. However, the two genera are geographically separate, *Steganthera* being centred in New Guinea, with outliers to Sulawesi.

Ecology *Matthaea* is primarily found in rain forest, from sea-level up to 1700 m altitude.

Genetic resources *M. sancta* is relatively widespread, and occurs in both primary and secondary forest. Therefore the risk of genetic erosion appears to be limited. However, the other species have a very limited distribution and a narrow altitudinal range, often with a preference for dense forest and are prone to habitat destruction.

Prospects Nothing is known about the pharmacological properties of *Matthaea*. Research is needed to evaluate its value as a remedy for headache. However, the utilization as a medicinal plant is unlikely to increase.

Literature 121, 247.

Selection of species

Matthaea chartacea Merr.

Publ. Govt. Lab. Philipp. 35: 14 (1905).

Synonyms *Matthaea williamsii* Perkins (1911), *Matthaea pinchotiana* Perkins (1911).

Vernacular names Indonesia: laba (Talaud Islands). Philippines: alukba (Mangyan), molikotlang (Mindoro), matagusa (Mindanao).

Distribution The Philippines and the northern Moluccas (Talaud Islands).

Uses Scraped stems are used to treat headache.

Observations A shrub or small tree up to 10 m tall; leaves oblong-ovate, (13–)15–20(–25) cm × 6–9.5(–12) cm; inflorescence axillary, solitary or few together, rachis of male inflorescence strigose, up to 2 cm long; receptacle of female flowers turbinate, at anthesis c. 1 cm in diameter, ovary densely strigose; dried drupes c. 20 mm × 15 mm, glabrous, black, wrinkled. *M. chartacea* occurs in both primary and secondary forest from sea-level up to 700 m altitude.

Selected sources 121, 247, 621.

Matthaea sancta Blume

Mus. Bot. Lugd.-Bat. 2: 90, t. 10 (1856).

Vernacular names Malaysia: cherum, poko churow, poko lumsoo (Peninsular). Philippines: babang-di-putukan (Ifugao), colog-colog (Negros), bago-bago (Cebu Bisaya).

Distribution Peninsular Malaysia, Singapore, Sumatra, Borneo, the Philippines and Sulawesi.

Uses In Peninsular Malaysia leaves are mixed with tobacco and smoked to relieve headache. The heavy wood is used locally for construction purposes.

Observations A shrub or small tree up to 15 m tall; leaves lanceolate-oblong to oblong, 15.5–31 cm × 3.5–9.5 cm; inflorescence axillary, solitary or fascicled, rachis of male inflorescence pubescent, 2–3 cm long; receptacle of female flowers turbinate, at anthesis c. 1.2 cm in diameter, ovary densely pilose; dried drupes c. 18 mm × 11 mm, glabrous, blue-black. *M. sancta* occurs in both primary and secondary forest from sea-level up to 1200 m altitude.

Selected sources 121, 247, 621.

D.S. Alonzo

Mazus pumilus (Burm.f.) van Steenis

Nova Guinea, n.s. 9: 31 (1958).

SCROPHULARIACEAE

$2n$ = usually 40, but also: $n = 8, 26$, $2n = 24, 38$

Synonyms *Mazus rugosus* Lour. (1790), *Mazus japonicus* (Thunberg) O. Kuntze (1891).

Vernacular names Indonesia: jukut mata keuyeup (Sundanese), anruda borong (Makassar). Philippines: banauan (Bagobo). Cambodia: pramat det. Vietnam: rau d[aws]ng.

Origin and geographic distribution *M. pumilus* is extremely widely distributed in tropical, subtropical and temperate regions of eastern Asia, from India to China, Korea and Japan, and in Burma (Myanmar), Indo-China, Thailand, and the Malesian region (recorded for Singapore, Java and the Philippines, but probably also elsewhere); it is also found in Australia. It has been introduced and is more or less naturalized in several other regions, e.g. locally in southern Europe, Argentina and the United States.

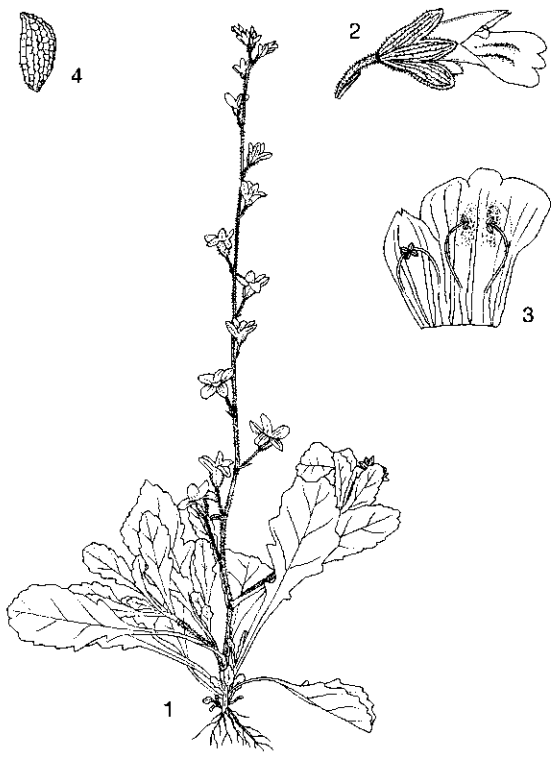
Uses Whole plants are applied to snakebites in Java. In Cambodia, an infusion of whole *M. pumilus* plants is used as a tonic, aperient and febrifuge. In China, the plant is considered to have emmenagogic activity.

Properties There is no information on the chemistry or pharmacological properties of *M. pumilus*. Five saponins (mazusaponins I–IV, and ilexoside VIII) have been isolated from the Japanese *M. miquelii* Makino.

Botany An annual herb often branched from the base, with erect or ascending stems up to 40 cm tall. Leaves opposite, mostly clustered towards the base (rosulate), simple, obovate-spatulate, 1.5–7 cm × 1–2 cm, coarsely crenate-dentate, glabrous, blade attenuate into an obscure petiole; stipules absent. Inflorescence a terminal raceme up to 35 cm tall, often flexuous, 5–25-flowered; bracts linear, up to 4 mm long. Flowers bisexual, 5-merous, pedicellate; calyx broadly campanulate, lobed nearly to the middle, 3–5 mm long in flower, 5–8 mm long in fruit; corolla tubular, 7–8 mm long, distinctly 2-lipped with upper lip 2-lobed and lower lip longer, 3-lobed and provided with 2 tubercles at base, pale purple with yellow spots on lower lip; stamens 4, inserted on lower part of corolla tube, didynamous; ovary superior, ovoid, 2-celled, style filiform, stigma 2-lamellate. Fruit a subglobose capsule 2–3 mm long, included in the persistent calyx, loculicidally 2-valved, many-seeded. Seeds ellipsoid, c. 0.5 mm long, with thin reticulate testa.

In Java, *M. pumilus* can be found flowering throughout the year. In Japan, it is predominantly self-pollinated, and plants die after flowering and fruiting, behaving as a real annual.

Mazus comprises about 20 species, and occurs in tropical to temperate regions of eastern Asia, Australia, New Zealand and Micronesia. *M. pumilus* is a variable species both morphologically and cytologically. The morphological variation has re-



Mazus pumilus (Burm.f.) van Steenis – 1, plant habit; 2, flower; 3, corolla opened, showing stamens; 4, seed.

sulted in the description of several botanical varieties, particularly for China.

Ecology *M. pumilus* occurs along roadsides, in the grounds of buildings and fields, and along streams, in open, not too dry, sunny or slightly shaded localities, in Java up to 1400 m altitude, in the Philippines up to 2200 m. It is common and considered a weed in many places, e.g. in rice fields.

Management The seeds need much light to germinate; they hardly germinate at all in the shade of other plants. As a weed, *M. pumilus* prefers abandoned fields.

Genetic resources With its wide distribution and preference for secondary habitats, *M. pumilus* is not liable to genetic erosion. Its morphological and cytological variability deserves more attention.

Prospects *M. pumilus* is used in traditional medicine in several regions of its distribution area. Research on phytochemistry and pharmacological properties is needed to confirm its uses.

Literature 249, 334, 732, 1025.

Other selected sources 62, 121, 250.

S. Brotonegoro

Medinilla radicans (Blume) Blume

Flora 14: 509 (1831).

MELASTOMATACEAE

$2n$ = unknown

Vernacular names Indonesia: areuy manjel (Sundanese).

Origin and geographic distribution *M. radicans* appears to be restricted to western and eastern Java, Bali and Sumbawa.

Uses In western Java the leaves of *M. radicans* are eaten to treat dysentery. Pounded bark is used to dye bamboo baskets purplish. There is an old record from the Moluccas of the adventitious roots of *M. crispata* (L.) Blume being applied as a poultice to wounds and young leaves to skin disorders. Some *Medinilla* species have considerable ornamental value, especially *M. magnifica* Lindley (from the Philippines) and *M. speciosa* (Reinw. ex Blume) Blume (found throughout Malesia except the Philippines and New Guinea).

Properties The use of *Melastomataceae* in traditional medicine as an astringent, antidiarrhoeal and haemostatic is often ascribed to the presence of tannins. The leaves of *M. magnifica* are rich in tannins. The ellagitannin oligomers medinillin A and B have been isolated. Gallic acid is by far the most abundant phenolic component.

Botany A scandent, often epiphytic shrub up to 2 m tall. Leaves in whorls of 3–7, simple and entire, obovate, 7–12 cm × 2–6 cm, shortly acuminate, 1–3-veined from the base; petiole 1.5–3.5 cm long; stipules absent. Inflorescence umbelliform, up to 3 cm long, 4–8-flowered. Flowers bisexual, 4-merous, pedicelled; hypanthium (calyx tube) narrowly campanulate, 7–11 mm long; petals free, 5–12 mm long, fleshy, whitish to pink; stamens 8, alternately longer and shorter; ovary semi-inferior, 4-celled, style c. 12 mm long, glabrous. Fruit a berry 7–9 mm long, apically prolonged into a cylindrical neck, many-seeded. Seeds semi-ovoid.

Medinilla comprises about 400 species and occurs in the tropics of the Old World. The Malesian region is the centre of diversity, Borneo, the Philippines and New Guinea being richest in species. Madagascar is also rich. The genus belongs to the tribe *Dissochaeteae*, together with e.g. *Dissochaeta*.

M. radicans has been confused with *M. quadrifolia* (Blume) Blume, which is more widely distrib-

uted (Peninsular Malaysia, Sumatra, western Java and Borneo), and differs in its broadly campanulate to ovoid hypanthium (calyx tube) and 4–5-merous flowers.

Ecology *M. radicans* occurs in forest up to 1000 m altitude, usually epiphytic on trees.

Genetic resources Like many other *Medinilla* species, *M. radicans* appears to have a limited area of distribution, and may be liable to genetic erosion.

Prospects It seems unlikely that the medicinal use of *M. radicans* or other *Medinilla* species will increase. Methods developed for in-vitro propagation have opened the gate for mass production of ornamental *Medinilla*.

Literature 62, 334.

Other selected sources 779, 780, 1035.

R.H.M.J. Lemmens

Melicope J.R. Forster & J.G. Forster

Charact. gen. pl.: 55 (1775).

RUTACEAE

$x = 18$; *M. bonwickii*, *M. lunu-ankenda*: $2n = 36$

Origin and geographic distribution *Melicope* comprises about 230 species, and occurs in Madagascar, India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand, throughout Malesia, east to the Hawaiian and Marquesas Islands, south to Australia and New Zealand. Some 30 species are found within Malesia.

Uses *Melicope* is sometimes used in South-East Asian folk medicine. Some species are used as a febrifuge, the leaves of others, in decoction or crushed, are applied to sores, boils, scabies and other skin affections.

In the Philippines the bark of *M. confusa* (Merr.) P.S. Liu or *M. semecarpifolia* (Merr.) T.G. Hartley is used for treating an enlarged spleen. In Taiwan the roots of *M. semecarpifolia* are used as a carminative in folk medicine, and a decoction of the roots or leafy shoots mixed with liquour is ingested to treat urticaria. Leaves of *M. latifolia* (DC.) T.G. Hartley (synonym: *Euodia peekelii* Lauterb.) have been externally applied for treating fever and cramps. In Vietnamese folk medicine the roots of *M. pteleifolia* (Champ. ex Benth.) T.G. Hartley (synonym: *Euodia lepta* (Sprengel) Merr.), a species found from Burma (Myanmar) eastward through Thailand and Indo-China to Taiwan, are used as a tonic, stomachic and emmenagogue. An infusion of the leaves is used as a wash for wounds, ulcers, boils and scabies. In the Solomon Islands the bark of *M. burttiana* B.C. Stone is macerated in water and applied to sore legs.

Melicope wood is used for both indoor and outdoor applications of varying quality and durability. It also produces good-quality veneer. The fruits of some species have been used as a spice or condiment, whereas others, e.g. *M. denhamii*, are cultivated as an ornamental.

Properties Several *Melicope* species contain quinoline alkaloids, terpenes and coumarins. Numerous chromenes, including 2,2-dimethylchromenes and dichromenes, have been isolated from the aerial parts of *M. pteleifolia*.

In a general screening experiment, an extract of *M. lunu-ankenda* showed in-vitro anti-human immunodeficiency virus (HIV) activity. In an XTT-tetrazolium assay two quinoline alkaloids isolated from the extract exhibited modest anti-HIV-1 activity in cultured human lymphoblastoid CEM-SS cells.

The methanol extract of *M. semecarpifolia* root bark showed strong antiplatelet activity in vitro using the turbidimetric method. Especially the furoquinoline alkaloids showed significant activity. Furoquinoline-type alkaloids isolated from the leaves of *M. confusa* also showed significant antiplatelet aggregation activity.

In a screening experiment using the disk diffusion method, extracts of leaves, stem and bark of *M. elleryana* (F. v. Mueller) T.G. Hartley, collected in Papua New Guinea, showed antimicrobial activity. Light petroleum, dichloromethane and ethyl acetate fractions of the various methanol extracts showed a broad spectrum antibacterial activity but no antifungal activity.

Botany Evergreen or deciduous shrubs or small to medium-sized, rarely large trees. Leaves opposite or whorled, 3-foliolate or 1-foliolate, aromatic; stipules absent; leaflets with pellucid dots. Inflorescence axillary or on branches, paniculate. Flowers bisexual or unisexual (and then trees dioecious), 4-merous; sepals fused at base; petals free, white; stamens 4 or 8; disk present; ovary superior, 4-carpellate, carpels fused completely or only at base, styles united. Fruit with 1–4 follicles or a 4-celled capsule, with shiny, black seeds remaining attached in the fruit. Seedling with epigeal germination; cotyledons emergent; hypocotyl elongated; all leaves opposite, early leaves toothed, later ones entire.

Most *Melicope* species seem to flower almost throughout the year. The shiny seeds are likely to

be eaten and dispersed by birds. Dispersal by bats is also stated.

Melicope and *Euodia* are very closely related genera and much confusion exists with respect to the proper identity of the hundreds of names in use. The most important differences between the two genera are the dull and roughened seeds that are discharged upon dehiscence of *Euodia* fruit versus the shiny and smooth seeds remaining attached in the dehisced fruit of *Melicope*. In addition flowers in *Melicope* can be bisexual or unisexual with 4 or 8 stamens, whereas in *Euodia*, they are bisexual with 4 stamens.

Ecology *Melicope* usually occurs scattered in primary or secondary rain forest, occasionally also in semi-deciduous or deciduous forest, up to 1600(–2400) m altitude. Some species are also found along forest edges or in more open locations. Several species, notably *M. lunu-ankenda*, are recorded from swamp forest.

Management *Melicope* can be propagated by seed. For *M. lunu-ankenda*, there are about 267 000 dry seeds/kg. *Melicope* coppices well and grows rapidly and may therefore be recommended for plantations. It is not resistant to fire.

Genetic resources The *Melicope* species treated here are all relatively widespread and apparently well adapted to disturbance. The risk of genetic erosion appears to be limited.

Prospects The alkaloids found in several *Melicope* species show interesting antimicrobial, antifungal and even modest anti-HIV activity. The traditional medicinal uses as skin wash or poultice and tonic deserve further attention in view of these findings.

Literature 148, 149, 320, 462, 543, 615, 731.

Selection of species

Melicope bonwickii (F. v. Mueller) T.G. Hartley

Sandakania 4: 56 (1994).

Synonyms *Euodia bonwickii* F. v. Mueller (1865), *Euodia speciosa* Reichenb.f. & Zoll. ex Teijsm. & Binnend. (1867), *Euodia villamilii* Merr. (1914).

Vernacular names Indonesia: abal (Madurese), awal (Javanese). Philippines: kamal (Tagalog).

Distribution Java, the Lesser Sunda Islands, Borneo, the Philippines, Sulawesi, the Moluccas, New Guinea and north-eastern Australia.

Uses In Java the bark is used as a leech repellent. In the Tanimbar Islands the plant is said to be used to treat dysentery.

Observations A tree up to 40 m tall, young branchlets glabrous to rarely sparsely hairy, terminal bud appressed hairy; leaves opposite, 3-foliolate, 14–40 cm long, leaflets elliptical to obovate, 10–30 cm × 5–15 cm, glabrous or sparsely hairy on veins below; inflorescence on branchlets below the leaves, rarely axillary, glabrous to sparsely hairy, 3.5–10 cm long; flowers bisexual, stamens 4, filaments glabrous; fruit sparsely hairy to almost glabrous, follicles nearly round to obovoid, 4–6 mm long, exocarp dry; seeds nearly round to ellipsoid or hemispherical, 3–4.5 mm long. *M. bonwickii* occurs in primary and secondary forest on well-drained and alluvial soils from sea-level up to 900 m altitude.

Selected sources 320, 334, 731, 877, 883.

Melicope denhamii (Seem.) T.G. Hartley

Sandakania 4: 57 (1994).

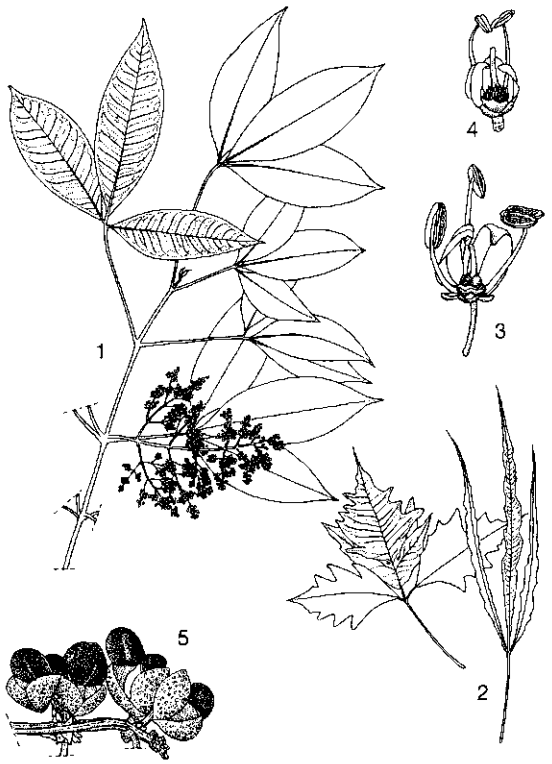
Synonyms *Euodia schullei* Warb. (1891), *Euodia radlkoferiana* Lauterb. (1905), *Euodia ridleyi* Hochr. (1905).

Distribution Borneo, the southern Philippines, Sulawesi, the Moluccas, New Guinea, the Solomon Islands and islands of the Pacific to Fiji; cultivated since ancient times in Borneo and various parts of eastern Malesia.

Uses In the Solomon Islands heated *M. denhamii* leaves are used to poultice boils, and a decoction of the leaves and bark is used as a lotion to treat skin diseases. *M. denhamii* is planted as an ornamental.

Observations A shrub or tree up to 25 m tall, young branchlets glabrous to velvety, terminal bud nearly glabrous to velvety; leaves opposite, mostly 3-foliolate, 3–38 cm long, leaflets broadly ovate or broadly elliptical to linear, 2–27 cm × 0.2–15 cm, glabrous to pubescent; inflorescence axillary and/or on branchlets below the leaves, glabrous to velutinous, up to 17 cm long; flowers usually bisexual, stamens 4, filaments glabrous; fruit glabrous to sparsely hairy, follicles subglobose, 2–3 mm long, exocarp dry or subfleshy; seeds subglobose or hemispherical, 1.5–2.5 mm long. *M. denhamii* occurs in primary and secondary forest, on both well-drained and swampy soils, in grassland and along roadsides, from sea-level up to 1000 m in Borneo, up to 2400 m in New Guinea.

Selected sources 320, 731.



Melicope denhamii (Seem.) T.G. Hartley – 1, flowering twig; 2, leaf variability of putative cultigens; 3, bisexual flower, petals and stamens partially removed; 4, functionally female flower, petals and stamens partially removed; 5, detail of infructescence.

Melicope lunu-ankenda (Gaertner) T.G. Hartley

Sandakania 4: 61 (1994).

Synonyms *Euodia aromatica* Blume (1825), *Euodia roxburghiana* (Cham.) Benth. (1861), *Euodia lunu-ankenda* (Gaertner) Merr. (1912).

Vernacular names Indonesia: sempayang (Javanese), sipungul janten (Sumatra). Malaysia: pauh-pauh paya, tapak itek, tenggek burong (Peninsular). Thailand: saam ngaam (central, south-eastern), uam (peninsular).

Distribution India, Sri Lanka, Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the south-western Philippines and Sulawesi.

Uses In Sumatra sap from the bark mixed with salt is drunk to treat the cold stage of malarial fever. In Peninsular Malaysia an infusion of the leaves and flowers is used as a tonic and emmenagogue. The plant is further used to treat remittent fever. In Taiwan a decoction of the roots mixed with liquour is used against colds and rheumatism. The young leaves are consumed as a condiment with rice or used to flavour food.

Observations A shrub or tree up to 30 m tall, young branchlets glabrous to velvety, terminal bud sparsely hairy to velvety; leaves opposite, mostly 3-foliolate, 6–37 cm long, leaflets elliptical to obovate, 3.5–23 cm × 2–9 cm, glabrous or nearly so; inflorescence axillary, glabrous to velvety, up to 32 cm long, with main branches ascending; flowers unisexual, rarely bisexual, stamens 4, filaments hairy at base or glabrous; fruit glabrous, follicles ellipsoid to obovoid, 4–10(–12) mm long, exocarp subfleshy; seeds round to ovoid or ellipsoid, sometimes compressed, 3–6 mm long. *M. lunu-ankenda* occurs in primary and secondary forest, on both well-drained and swampy soils, and in montane shrubbery up to 2200 m altitude.

Selected sources 121, 334, 731, 877, 883.

Melicope triphylla (Lamk) Merr.

Philipp. Journ. Sci., Bot. 7: 375 (1913).

Synonyms *Euodia anisodora* K. Schumann & Lauterb. (1900).

Vernacular names Papua New Guinea: wajo (Nyamikum, Sepik).

Distribution Taiwan, the Ryukyu Islands, southward to Borneo, and eastward to Papua New Guinea.

Uses In the Sepik region, Papua New Guinea, the leaves are an ingredient of a complex prescription, taken in decoction to treat stomach-ache, constipation and diarrhoea, and to remove intestinal worms.

Observations A shrub or tree up to 15 m tall, young branchlets glabrous to hairy, sometimes glaucous, terminal bud glabrous to velvety hairy; leaves opposite, mostly 3-foliolate, 4.5–42(–51) cm long, leaflets elliptical to oblanceolate, 3–28(–33) cm × 1–10.5(–14) cm, glabrous; inflorescence axillary and/or on branchlets below the leaves, glabrous to hairy, up to 13 cm long; flowers unisexual or sometimes bisexual, stamens 8 or sometimes 4, filaments sparsely hairy or glabrous; fruit glabrous, follicles ellipsoid or nearly round, 2.5–5 mm long, exocarp subfleshy; seeds nearly round or ellipsoid, 2.4–4.5 mm long. *M. triphylla* occurs in primary and secondary forest from sea-level up to 2500 m altitude.

Selected sources 320, 347, 877.

Melicope xanthoxyloides (F. v. Mueller) T.G. Hartley

Allertonia 8(1): 119 (2001).

Synonyms *Euodia alata* F. v. Mueller (1871).

Vernacular names Papua New Guinea: gadembo (Kurerada, Northern Province).

Distribution The Aru Islands, New Guinea, the Bismarck Archipelago, and north-eastern Australia.

Uses In Papua New Guinea the inner bark is soaked in water, and the resulting drink taken to sooth a bad cough. A concoction of the leaves in water is drunk to treat stomach-ache.

Observations A tree up to 21 m tall, young branchlets puberulent to pubescent, terminal bud pubescent; leaves opposite, mostly 3-foliolate, 22–60 cm long, leaflets elliptical to obovate, 11–37 cm × 4.5–18 cm, nearly glabrous to pubescent; inflorescence axillary, pubescent, up to 24 cm long; flowers unisexual, rarely bisexual, stamens 4, filaments glabrous; fruit glabrous to puberulent or tomentulose, follicles subglobose to ellipsoid, 3–4(–4.5) mm long, exocarp dry; seeds subglobose to ellipsoid, 2.5–3.5(–4) mm long. *M. xanthoxyloides* occurs in primary and secondary forest, in lowlands also in secondary coastal forest, swamp forest, and monsoonal gallery forest, from sea-level up to 1900 m altitude.

Selected sources 320, 347.

Juliasri Djamal & J.L.C.H. van Valkenburg

Melissa axillaris (Benth.) Bakh.f.

Back. & Bakh.f., Fl. Java 2: 629 (1965).

LABIATAE

$n = 8, 17$

Synonyms *Melissa parviflora* Benth. (1830) non Salisb.

Vernacular names Indonesia: jawer kotok (Sundanese), sangketan (Javanese). Vietnam: hoa m[aaj]t, ti[as] t[oo] d[aas]t.

Origin and geographic distribution *M. axillaris* is widely distributed from Nepal, Bhutan and India, through Burma (Myanmar), Indo-China, southern China and Thailand, to the Malesian region, where it is recorded from northern and central Sumatra, and western and central Java.

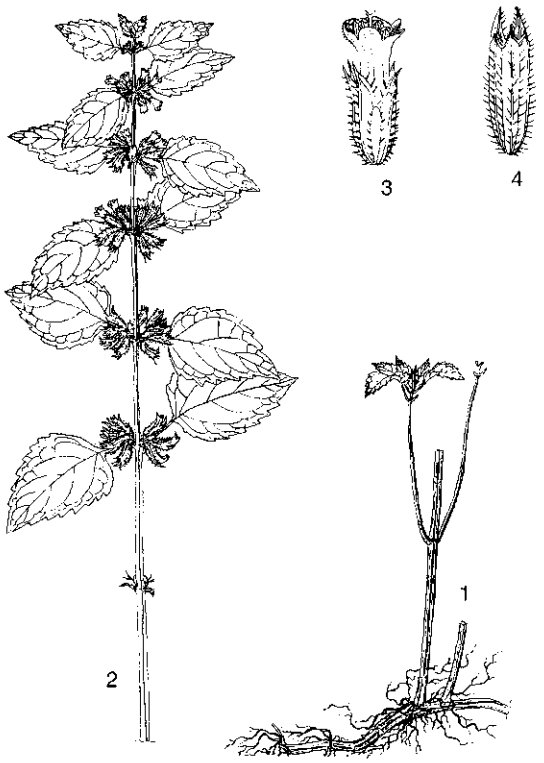
Uses There is only a single record of medicinal uses of *M. axillaris* in Malesia: the leaves are used externally in central Java to treat headache. This plant is also used in traditional medicine in China, to treat dysentery and snake bites, and it is also an ingredient of hair oil.

The southern European to central Asian *M. officinalis* L. (lemon balm) is much better known for its medicinal applications. The dried leaves are used traditionally to treat neurotonic disorders, especially cases of minor sleeplessness. They are also used against functional dyspepsia. In Iran, an infusion of branchlets is used as a tonic, antispasmodic, anti-emetic, diaphoretic and to treat migraine. *M. officinalis* is occasionally planted in gardens in the mountains of Java, and on several farms in Cavite Province, the Philippines, mainly as culinary herb for flavouring salads, soups, vinegars and liqueurs. It has also been introduced and is locally naturalized in the United States and Central American countries, where it is also used in local medicine, mainly to promote digestion, as antispasmodic and sedative, and to treat wounds, bruises and ulcers.

Properties The essential oil present in *M. officinalis* leaves (about 0.05%) is characterized by the presence of monoterpenoid aldehydes: citrals, citronellal, methylheptenone, geranyl acetate, β-caryophyllene and β-caryophyllene oxide. However, the compounds may strongly differ per cultivar. The essential oil has antibacterial, antifungal and spasmolytic properties.

Other compounds isolated from *M. officinalis* include triterpenes, phenolic acids (mainly rosmarinic acid), flavonoids (quercitrin, rhamnocitrin and the 7-glucosides of apigenin and luteolin) and glycosides of monoterpenes and of aromatic alcohols. A hydroalcoholic extract of the leaves showed central nervous system sedative properties in tests with mice, and aqueous extracts exhibited antiviral, antithyroid and antigonadotropic activities. Clinical tests showed promising results for the local treatment of herpes and vaccinia in humans. Potent anti-human immunodeficiency virus type 1 (HIV-1) activity was also reported. The antiviral activity is possibly due to the presence of phenolic acids (rosmarinic acid) or their derivatives. Caffeic acid, isolated from *M. officinalis* leaves, inhibits protein biosynthesis.

Botany An erect, perennial herb up to 100 cm tall; stem with more or less woody base, branched, branches pubescent when young. Leaves decussately opposite, simple, very variable in shape and size, ovate to elliptical or lanceolate-ovate, 1.5–7 cm × 1–3 cm, base rounded or cuneate, apex acute or shortly acuminate, margin serrate-crenate, sparsely pubescent to subglabrous; petiole 0.5–3 cm long; stipules absent. Inflorescence an axillary verticillaster, widely spaced, usually 4–8-flowered. Flowers bisexual, zygomorphic; pedicel 1–2 mm



Melissa axillaris (Benth.) Bakh.f. – 1, base of plant; 2, apical part of plant; 3, flower; 4, fruiting calyx.

long, sericeous; calyx tubular, 5–6 mm long in flower, up to 8 mm long in fruit, 13-veined, 2-lipped with 3-toothed upper lip and 2-toothed lower lip having longer teeth, pilose on the veins; corolla 9–10 mm long, tube slightly exserted from calyx, 2-lipped with emarginate upper lip and 3-lobed, spreading lower lip, white or slightly reddish; stamens 4, inserted in corolla tube, didynamous, included or slightly exserted; ovary superior, 4-celled, style with 2 subequal lobes. Fruit consisting of 4 obovoid, smooth nutlets c. 8 mm long, with a conspicuous scar at base, enclosed by the persistent calyx.

Melissa comprises about 4 species and occurs in southern Europe and Asia.

Ecology In the Malesian region *M. axillaris* occurs in forest edges, open locations along streams and trails, and abandoned fields in the mountains, at 1500–2600 m altitude.

Management *M. officinalis* is easy to propagate (by seeds and cuttings) and grow, and this is probably also the case for *M. axillaris*.

Genetic resources Although *M. axillaris* occurs only very locally in the Malesian region, its preference for anthropogenic habitats and its wide distribution elsewhere in southern Asia seem to ensure sufficient protection against genetic erosion.

Prospects As demonstrated in various tests, *M. officinalis* is certainly an interesting medicinal plant with e.g. antiviral properties. It may be beneficial to do research on the phytochemistry and pharmacological activities of *M. axillaris* as a related indigenous Malesian species for possible development as a local medicinal plant.

Literature 118, 196, 247, 507, 1028.

Other selected sources 334, 646, 1013.

Erlin Rachman

Merope angulata (Willd.) Swingle

Journ. Wash. Acad. Sci. 5: 420 (1915).

RUTACEAE

$2n$ = unknown

Synonyms *Paramignya angulata* (Willd.) Kurz (1875), *Paramignya longispina* Hook.f. (1875).

Vernacular names Malaysia: limau lelang (Peninsular), limau buaya, limau laut (Malay, Sabah and Sarawak).

Origin and geographic distribution *M. angulata* occurs in eastern India, Burma (Myanmar), Indo-China, Thailand and throughout the Malesian region.

Uses In Peninsular Malaysia, the fruits are used to treat stomach disorders and colic.

Properties The leaves gave a faint positive reaction when tested on alkaloids, a faint to moderately strong positive reaction to triterpenes, and a faint positive reaction in the blood gelatin test (haemolysis). An aqueous ethanol extract showed cytotoxic activity against leukaemia P388 cells, but not against Ca-9KB cells.

Botany An erect shrub or small tree up to 3 m tall, often with multiple stems up to 10 cm in diameter and sparse branches, with paired, rarely solitary, stout spines up to 5 cm long. Leaves alternate, unifoliolate, oblong-ovate to obovate, 2.5–16 cm × 1.5–6 cm, rounded at base, acute or shortly acuminate at apex, subentire to faintly notched, leathery, glabrous; petiole 5–7 mm long, articulated at apex; stipules absent. Flowers axillary, solitary, rarely in fascicles of 2, small, bisexual, regular, 5-merous, fragrant; calyx cup-like, acutely lobed; petals free, lanceolate-oblong, 7–9 mm long, white; stamens 10, free, filaments glabrous; ovary superior, 3–4-celled, style short

and thick, with flat stigma. Fruit an ovoid to ellipsoid, angular berry 3–4.5 cm long, with a thick peel, glandular and strongly aromatic, acuminate at apex, green to yellowish when ripe, few-seeded. Seeds 2–3 cm long, somewhat reniform, flat, with rough testa.

The buoyant fruits are dispersed by the tides in the tidal forests and mangroves where *M. angulata* grows.

Merope comprises only a single species. It seems to be related to *Paramignya* (with about 12 species), which comprises lianas with recurved spines and not angled fruits, and to *Atalantia* (about 11 species) and *Severinia* (about 6 species), which both comprise shrubs and small trees.

Ecology *M. angulata* is characteristically found in saline soils of tidal forests and mangrove swamps, and often occurs on the banks of streams. It occurs often in rather small but dense populations, often in association with nipa palm (*Nypa fruticans* Wurmb). Locally, it can be common, e.g. in the southern part of Peninsular Malaysia.

Genetic resources *M. angulata* is potentially threatened by the ongoing decimation of the mangrove forests.

Prospects Research on the phytochemistry and pharmacological properties of *M. angulata* is needed to determine its prospects as a medicinal plant.

Literature 102, 439.

Other selected sources 121, 178, 877, 990.

R.H.M.J. Lemmens

Microglossa pyrifolia (Lamk) O. Kuntze

Revis. gen. pl. 1 : 353 (1891).

COMPOSITAE

$2n = 18$

Synonyms *Conyza pyrifolia* Lamk (1786), *Microglossa volubilis* DC. (1836).

Vernacular names Papua New Guinea: pundari (Awala, Northern Province), goho (Buang, Morobe Province). Philippines: hugas (Bukidnon), maniak (Lanao), saroka (Bagobo). Thailand: khaa bia (north-eastern), tonghung, tonghong (northern). Vietnam: ti[eer]u thi[eej]t.

Origin and geographic distribution *M. pyrifolia* is found in Africa and tropical Asia; it occurs throughout South-East Asia.

Uses In Peninsular Malaysia a root decoction of *M. pyrifolia* is given to treat stomach-ache, and a leaf decoction to treat colds. In Papua New Guinea leaf sap is sprinkled on ulcers, which are subsequently covered by the crushed leaf. The vapour emitted from heated leaves is blown over spear wounds and sore eyes. In Africa emetic, purgative and diuretic properties are ascribed to the plant, when taken orally. Apparently the effects are dose-dependent because leaves are considered toxic and sap is said to be irritant to mucous membranes. A leaf infusion may be drunk as a vermifuge, and the plant is used to relieve oedemas, various stomach complaints and urethral obstructions. Various parts and preparations are used as a bath, taken orally, or externally applied as a febrifuge. A bath is credited with sedative action, and used to remedy insanity, epilepsy, and fits in children. A leaf poultice may be applied to inflammations, or rubbed on the chest to relieve pulmonary troubles. The powdered root is locally used as a snuff to relieve colds or as a local anodyne. Eye drops are made from leaf sap or sap from young roots to treat various eye troubles, e.g. ophthalmia.

Properties Phytochemical analysis of leafy material of *M. pyrifolia* from Ivory Coast revealed the presence of traces of alkaloids, steroids and a strong haemolitic substance. Extracts of roots, stems, leaves and flowers have shown a weak insecticidal activity. Essential oil from the leaves of Cameroonian origin primarily consisted of (E)-β-farnesene (c. 75%) and β-caryophyllene (c. 13%). Acetylated aurone glucosides and acetylenic glucosides have been isolated from the leaves of plants collected in Papua New Guinea. One of these acetylenic glucosides (2-β-D-glucopyranosyloxy-1-hydroxy-trideca-3,5,7,9,11-pentayne) showed moderate antimicrobial activity, especially against *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The following compounds were isolated from the petroleum ether/diethyl ether (1:1) extract: γ-cadinene, caryophyllene, dihydroxycaryophyllenepoxide, β-eudesmol, β-sitosterol, stigmasterol, β-amyrin and β-lupeol.

Botany A scandent shrub up to 6 m tall; branches often climbing, terete, finely ribbed. Leaves alternate, simple, ovate-elliptical, 2–10 cm × 1.5–7 cm, base obtusely cuneate, apex acuminate, entire or with a few coarse teeth; petiole up to 2 cm long, widened at the base; stipules absent. Inflorescence a small, campanulate to funnel-shaped head 3–5 mm in diameter, many-flowered, numerous together arranged in a lax terminal corymb; peduncle 2–10 mm long; involucral bracts 3–4-seriate, lanceolate, 0.5–5 mm long, with an acute or obtuse, fringed top, broadly pellucid-margined. Flowers ligulate at margin of head, tubular

at centre, c. 5 mm long; marginal flowers female, slender, whitish, glandular; disk flowers bisexual, yellow, glandular; stamens 5, forming a tube; ovary inferior, 1-celled, style with 2 short arms. Fruit a small obovoid somewhat compressed achene c. 1 mm long, 4–5-ribbed, pubescent and minutely glandular; pappus 1-seriate, consisting of many dentate hairs 4–5 mm long.

Microglossa consists of 10 species, and occurs in Africa, Madagascar, the Mascarene Islands and tropical Asia. It seems to be related to *Conyza* and *Erigeron*.

Ecology In South-East Asia *M. pyrifolia* is found in open forest and forest margins at 500–1700 m altitude.

Genetic resources *M. pyrifolia* is widespread and also commonly encountered in disturbed habitats, and is not threatened by genetic erosion.

Prospects The antimicrobial activity of some of its compounds, in connection with its widespread medicinal use as an antiseptic, warrants further research on the pharmacological properties of *M. pyrifolia*.

Literature 120, 121, 350, 360, 794, 801.

Other selected sources 62, 112, 347, 511, 802.

J.L.C.H. van Valkenburg

Microstachys chamaelea (L.) Müll. Arg.

Linnaea 32: 95 (1863).

EUPHORBIACEAE

$n = 14$, $2n = 34$, 68

Synonyms *Sebastiana chamaelea* (L.) Müll. Arg. (1866).

Vernacular names Malaysia: ambin-ambin (Peninsular), daun merayat (Lundu Malay, Borneo). Vietnam: k[yf] nh[oo]ng, thu[oos]c l[aaj]u.

Origin and geographic distribution *M. chamaelea* has a very large area of distribution, from tropical Africa to tropical Asia, the Solomon Islands and northern Australia. In tropical Asia, it occurs in India, Sri Lanka, Indo-China, southern China, Thailand, Peninsular Malaysia, Singapore, Sumatra, Java and northern Borneo.

Uses In Sarawak whole young plants of *M. chamaelea* are cooked together with meat and vegetables, and eaten after childbirth for quick recovery. In India a decoction of *M. chamaelea* is considered tonic and is applied to the head against vertigo; the plant is also used to treat diarrhoea and syphilis.

Botany A monoecious, perennial herb or subshrub up to 90 cm tall, often many-stemmed; taproot yellowish-brown. Leaves alternate, simple, elliptical to lanceolate or linear, 1.5–6 cm × 0.3–0.8(–1.2) cm, acute to obtuse at base, rounded to mucronate at apex, with minute appressed teeth and glands at margin, pilose and glabrescent below, pinnately veined but secondary veins often hardly visible; petiole 1–2.5 mm long; stipules triangular, up to 2 mm long, densely pilose to ciliate. Inflorescence a terminal or axillary spike-like thyrse up to 1.5 cm long, often opposite to a leaf, often with 1(–2) female flowers at base and many male flowers higher up. Flowers unisexual, small, regular, nearly sessile, with 3 free sepals, petals absent; male flowers c. 0.5 mm in diameter, with large bract glands at base and 3 stamens; female flowers c. 2 mm in diameter, with superior, 3-celled ovary having 2 longitudinal rows of spine-like excrescences on each carpel, stigmas 3, filiform. Fruit an oblong capsule 3.5–4.5 mm long, with 6 rows of spine-like excrescences, green, turning olive-brown to orange, dehiscing regularly along the septa, 3-seeded. Seeds elliptical-oblong, c. 2.5 mm long, brownish, with a large caruncle.

M. chamaelea can be found flowering and fruiting throughout the year, but particularly in the rainy season.

Microstachys comprises 15 species, 11 of which occur in tropical America and 4 in tropical Africa. Only *M. chamaelea* extends to tropical Asia. *Microstachys* belongs to the tribe *Hippomaneae*. It was formerly part of *Sebastiana*, but a recent reclassification of the genera *Sebastiana* and *Sapium* resulted in the reinstatement of *Microstachys*. *M. chamaelea* is easily confused with *Sauropus bacciformis* (L.) Airy Shaw, which has a similar habit but entire leaves and smooth fruits.

Ecology *M. chamaelea* occurs on beaches, other sandy locations, roadsides, grasslands and waste places, also in open woodland, often gregariously, up to 300 m altitude.

Genetic resources *M. chamaelea* is very widely distributed in anthropogenic habitats, and is not endangered by genetic erosion. Information about genetic diversity is completely lacking, but the dried plant collections are relatively homogeneous.

Prospects The uses of *M. chamaelea* are seemingly limited, and an increase in its medicinal use is not expected.

Literature 121, 235.

Other selected sources 120.

P.C. van Welzen

Mitrella kentii (Blume) Miq.

Ann. Mus. Bot. Lugd.-Bat. 2: 39 (1865).
ANNONACEAE
$2n = 16$

Synonyms *Fissistigma mabiforme* (Griffith) Merr. (1919).

Vernacular names Malaysia: akar larak, akar tawan-tawan, pokok keldai (Peninsular).

Origin and geographic distribution *M. kentii* occurs in Peninsular Malaysia, Singapore, Sumatra, western Java and Borneo.

Uses In Peninsular Malaysia a decoction of *M. kentii* roots is used to treat fever.

Properties An ethanolic extract from *M. kentii* bark showed significant cytotoxic activity against KB cells in vitro. The terpenylated dihydrochalcone derivatives (–)-neolinderatin, (–)-linderatin, 2',6'-dihydroxy-4'-methoxydihydrochalcone as well as (+)-catechin have been isolated from this extract.

Botany A much-branched, more or less climbing shrub up to 5 m tall; young stems finely appressed brownish pubescent. Leaves distichously alternate, simple and entire, ovate-oblong-lanceolate, 3.5–11 cm × 2–5 cm, rounded to obtuse or cuneate at base, acuminate at apex, leathery, finely appressed brownish pubescent below, pinnately veined; petiole slender, 1–1.5 cm long; stipules absent. Inflorescence an axillary fascicle, very shortly peduncled, 1–3-flowered. Flowers bisexual, 3-merous, slightly fragrant; pedicel 1–2.5 cm long; sepals connate at base; petals 6, in 2 whorls, leathery, yellow, finely pubescent, outer ones 2–2.5 cm long, for a long time pressed against each other with the inside of the recurved lower portions, later erecto-patent, inner ones c. 1 cm long, erect, cohering by their margins and forming an obtuse cap; stamens numerous, connective concealing the cells; carpels 9–15, glabrous, style long, stigma not enlarged. Fruit consisting of several globose monocarps 0.5–1 cm long, shortly stalked, 1–2-seeded.
Mitrella comprises about 5 species and is restricted to the Malesian region, from Peninsular Malaysia to New Guinea. It seems to have affinities with *Fissistigma*, but it differs in the much smaller inner petals forming a caplike structure.

Ecology *M. kentii* occurs in forest at 600–1000 m altitude.

Genetic resources There are no indications that *M. kentii* is in immediate danger of genetic erosion.

Prospects It seems worthwhile testing the anti-cancer activity of *M. kentii* bark in vivo. Tests on the febrifugal activity of the roots might reveal positive results, as was the case in several other *Annonaceae*.

Literature 82, 121, 860.

Other selected sources 62.

R.H.M.J. Lemmens

Morinda L.

Sp. pl. 1: 176 (1753); Gen. pl. ed. 5: 81 (1754).
RUBIACEAE
$x = 11$; *M. citrifolia*: $2n = 22$, 44, *M. umbellata*: $2n = 22$

Origin and geographic distribution *Morinda* comprises about 50 species and is distributed in all tropical regions: Central and northern South America, tropical Africa, Madagascar and the Mascarene Islands, tropical Asia (from India and Sri Lanka eastwards), northern and north-eastern Australia, Melanesia and Polynesia. Areas with the largest species diversity include South-East Asia and New Caledonia. The number of species in the Malesian region is estimated at 20.

Uses *Morinda* is commonly applied in traditional medicine in South-East Asia. Various plant parts are used to treat a wide range of complaints including diabetes and beri-beri, asthma, cough and other respiratory problems, ulcers, wounds, boils, haemorrhoids and rheumatoid arthritis. It is also used as an emmenagogue.
Outside South-East Asia, several *Morinda* species are important medicinal plants. *M. citrifolia* is used medicinally throughout the tropics. *M. royoc* L. is applied to treat many complaints in Central America. In China and Vietnam, the roots of *M. officinalis* How are administered as a tonic and an emmenagogue, as well as to treat rheumatoid arthritis, impotence, spermatorrhoea and hypertension. Some species play a role in traditional medicine in western and central Africa: stem, bark, roots and leaves of *M. lucida* Benth. *M. geminata* DC., *M. longiflora* G. Don and *M. morindoides* (Baker) Milne-Redh. e.g. to treat fever, malaria, yellow fever, jaundice and dysentery, and as an anthelmintic.
The root bark of several *Morinda* species is used for dyeing, giving a reddish or yellowish dye. The wood is sometimes used e.g. for poles and as fuel, and the fruits are sometimes eaten.

Properties The results of tests with mice suggest sedative properties for aqueous extracts of *M. citrifolia* roots. The extracts did not exhibit any

toxic effect, but did show a significant, dose-related, central analgesic activity in the writhing and hotplate tests, decreased all behavioural parameters in the two compartment test, the light/dark choice situation test and the staircase test, and induced sleeping time. Aqueous and alcohol extracts of the roots of *M. citrifolia* significantly lowered blood pressure in rabbits and cats.

The fruit juice of *M. citrifolia* contains a polysaccharide-rich substance which displays antitumour activity in the Lewis lung peritoneal carcinomatosis model in mice. It also stimulated interferon induction, which is important in immunomodulating processes. An aqueous ethanol extract of dried fruits exhibited histaminergic effect on smooth muscles in guinea pigs. Tests with rats and mice suggested that prevention of carcinogen-DNA adduct formation and the antioxidant activity of *M. citrifolia* juice may contribute to the cancer preventive effect. An iridoid glycoside, named citrifolinoside, isolated from the leaves showed significant inhibition of activator protein-1 in cell cultures.

The curative properties of *M. citrifolia* and other *Morinda* species are ascribed to the presence of medicinally active anthraquinone derivatives. Damnacanthal is an anthraquinone compound isolated from the root; it showed potent inhibitory activity towards tyrosine kinases. This compound induced normal phenotypes in ras-transformed cells. Alcoholic extracts of tender *M. citrifolia* leaves showed good in-vitro anthelmintic activity against human *Ascaris lumbricoides*.

Anthraquinones (e.g. alizarin) exhibiting potent cytotoxic activity against KB cells and significant activity in the P388 lymphocytic leukaemia assay have been isolated from a *M. umbellata* extract. Antileukaemic anthraquinones have also been found in *M. parvifolia* Bartl., which occurs in Indo-China, southern China, Taiwan and the Philippines.

In China several compounds with antidepressant activities have been isolated from *M. officinalis* roots. Tests with mice indicated that water extracts have anti-fatigue properties, improving immunological action and reducing the excitability of the para-symphatic nervous system, without showing acute toxicity. A root extract of *M. officinalis* enhanced the activity of exogenous androgens and increased the secretion of these hormones in male rats. It also showed a marked anti-inflammatory effect in a rat paw oedema test, and a dose dependent hypoglycaemic activity in streptozotocin-induced diabetic rats.

Leaf extracts of the African *M. lucida* and *M. morindoides* showed in-vitro and in-vivo antimalarial activity. A methanol leaf extract of *M. lucida* showed a strong glucose lowering property when administered to streptozotocin-treated rats, and that of *M. morindoides* showed potent dose-dependent anticomplementary activity. Leaf extracts of *M. lucida* also showed antileishmanial and trypanocidal activities.

The basis of the morindone dyeing matter, called Turkish red, in the root-bark of *M. citrifolia* is the hydrolyzed form of the anthraquinone-glycoside morindin. The fruit contains rancid smelling capric acid and unpleasant-tasting caprylic acid. It is thought that antibiotically active compounds are present. The nutritional value of the fruit and leaves is considerable. The leaves are a rich source of vitamin A.

Botany Shrubs, small trees or lianas; branches terete, smooth or with protruding lenticels. Leaves decussately opposite, simple and entire, pinnately veined, domatia usually present in axils of lateral veins, petiolate; stipules interpetiolar, usually partly connate and forming a sheath enclosing basal parts of internode. Inflorescence a terminal and/or axillary head, usually pedunculate, solitary or arranged in umbel-like cymes. Flowers bisexual or unisexual, 3–7-merous, fragrant; calyx campanulate to cupuliform, tubes connate, usually truncate, persistent; corolla hypocrateriform or infundibuliform, carnose, white, yellow, green, pink or red; stamens usually inserted in the throat of the corolla, usually partly to wholly exserted; disk annular, persistent in fruit; ovaries inferior, 2-celled, later often becoming incompletely 4-celled, connate, style filiform with 2-lobed stigma. Fruit a 1-seeded drupe, connate into a globose, transversely elliptical or elongate syncarp. Seed flattened, ovate or elliptical; endosperm carnose, oily.

The seeds of *M. citrifolia* remain viable for at least 6 months. Germination takes place 3–9 weeks after sowing. Plant growth is up to 1.5 m in 6 months. Flowering and fruiting start usually in the third year and continue throughout the year. Maximum age is at least 25 years. The seeds of *M. citrifolia* float in water and this explains its wide distribution and occurrence on many sea-shores. Inland distribution agents are fruit-eating bats and birds.

Morinda is classified in the tribe *Morindeae* of the subfamily *Rubioideae*, together with e.g. *Gynochtodes* and *Lasianthus*. The connate ovaries have often been regarded as a critical character defining the genus *Morinda*. However, connate

ovaries occur in a number of genera in *Morindeae* as well as other tribes.

A complete revision of *Morinda* is lacking, and badly needed to solve species complexes such as *M. umbellata*, where possibly confusion with other species is common in South-East Asia.

Ecology Most *Morinda* species are restricted to tropical lowland and submontane forest, and many species are favoured by a moderate disturbance of the environment. Some of them are abundant in secondary forest, along roads and forest edges. *M. citrifolia* occurs in various habitats, often along seashores and in secondary vegetation near the coast, usually introduced and naturalized.

Management *M. citrifolia* is propagated by seed sown in nursery beds. After germination, seedlings are transplanted at a spacing of about 1.2 m × 1.2 m in well-tilled soil. Weeding is carried out at least twice and starts about 1 month after transplanting. No maintenance is needed after the first year. Intercropping with cereals and perennials is possible (e.g. as shade in coffee). In Vietnam and southern China *M. officinalis* is cultivated for medicinal purposes and is propagated by seed and cuttings.

Cell suspension cultures of *M. citrifolia* have been maintained successfully for anthraquinone accumulation, e.g. damnacanthal. In Hawaii, capsules containing freeze-dried powder of *M. citrifolia* fruits as well as fruit juice are marketed.

Genetic resources *M. citrifolia* is not likely to be endangered by serious genetic erosion given its pioneering character, its natural variation and its wide, though small-scale cultivation. The other *Morinda* species treated here are also widely distributed and common in secondary habitats. However, their popularity as a medicinal plant may exhaust natural populations, as is now already the case with *M. officinalis* in Vietnam.

Prospects *Morinda* provides important medicinal plants throughout the tropics. In many regions they rank amongst the most popular sources of traditional medicine. In recent years, *M. citrifolia* fruits have been recommended especially for treatment of diabetes, high blood pressure and cancer. The results of provisional studies seem to confirm at least some of the claimed activities. More elaborate research is recommended, not only for *M. citrifolia* but also for other *Morinda* species. A next step might be the identification of proper techniques for the cultivation of *Morinda* for medicinal purposes.

Literature 120, 216, 436, 542, 646, 671, 760, 817.

Selection of species

Morinda citrifolia L.

Sp. pl. 1: 176 (1753).

Synonyms *Morinda bracteata* Roxb. (1824).

Vernacular names Indian mulberry (En). Morinde (Fr). Indonesia: pace (Javanese), cangkudu (Sundanese), mengkudu (Malay). Malaysia: mengkudu besar, mengkudu jantan. Philippines: bankoro, tumbong-aso (Tagalog), apatot (Ilokano). Burma (Myanmar): al. Cambodia: nhoër srôk, nhoër thôm'. Laos: nhoo baanz. Thailand: yo baan (central), mataa-suea (northern), yae-yai (Karen, Mae Hong Son). Vietnam: nh[af]u l[os] chanh, ngao, nh[af]u n[us]i.

Distribution *M. citrifolia* is possibly indigenous in tropical Asia and tropical Australia. It may have been distributed by man and sea currents. It is naturalized in many tropical regions, and is now in fact almost pantropical.

Uses In Indonesia, the fruits are eaten to treat diabetes and beri-beri, asthma, cough and other respiratory problems, and as an emmenagogue; the fruit extract is manufactured and sold in pharmacies. In the Philippines, the fruits are also used as an emmenagogue, the leaves to treat ulcers, and the leaf juice to treat arthritis. *M. citrifolia* is also important in traditional medicine in New Guinea: the roots are used to treat fever and centipede bites, and the leaves to treat sores, headache, pneumonia, fever and stomach-ache. In Thailand, an infusion or decoction of unripe fruits, sliced into thin pieces after drying, is applied as anti-emetic. In Vietnam, the fruits are used as an emollient, stomachic, aperient, and to treat dysentery and cough, the root-bark to treat hypertension, ostalgia and lumbago, and the leaves to treat dysentery, diarrhoea and furuncles. *M. citrifolia* is used for similar complaints in tropical America and Africa, and on many islands in the Pacific Ocean. The red dye from the root bark formerly played an important role in batik dyeing in Indonesia. Despite the smell of putrid cheese when ripe, the fruits are eaten raw or prepared, as are the leaves. The fruit pulp can be applied to cleanse hair, iron and steel. The wood is sometimes used for poles and fuel, and in Malaysia and Thailand, the tree is considered useful as a support for pepper plants.

Observations A shrub or small tree up to 8(–12) m tall; leaves elliptical to elliptical-lanceolate or ovate, (10–)15–30(–50) cm × 4–17 cm; inflorescence solitary in axils of stipules often opposite normally developed leaves, peduncled; corolla

Morinda citrifolia L. – 1, flowering branch; 2, inflorescence-infructescence.

tube slightly longer than lobes, white; compound fruit ovoid, up to 10 cm × 6 cm, whitish-yellow or whitish-green. *M. citrifolia* occurs in various habitats, along seashores and in secondary vegetation near the coast, usually introduced and naturalized, but also up to 1500 m altitude.

Selected sources 121, 210, 217, 337, 339, 347, 436, 542, 671, 760, 814, 817, 971, 977, 1041.

Morinda elliptica (Hook.f.) Ridley

Journ. Roy. As. Soc. Straits Br. 79: 86 (1918).

Vernacular names Malaysia: mengkudu daun kecil (Peninsular). Thailand: muu-duu (Malay, Narathiwat), yo thuean (Chumphon), yo paa (Trang, Satun).

Distribution Burma (Myanmar), Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia, the leaves are used to treat fever, cholera, diarrhoea, convulsions, loss of appetite and headache; they are also applied externally, pounded or as a lotion, to treat wounds, haemorrhoids, and are also administered after childbirth. The root bark is used to treat fishing nets and sails.

Observations A small to medium-sized tree up to 16 m tall; leaves narrowly to broadly elliptical, up to 18 cm × 9 cm; inflorescence a terminal cluster of 2–3 peduncled heads up to 1 cm in diameter; corolla tube subequal to lobes, white; compound fruit globose to ovoid, up to 2 cm long, ripening black. *M. elliptica* occurs in secondary forest and open habitats, and is common.

Selected sources 121, 990.

Morinda umbellata L.

Sp. pl. 1: 176 (1753).

Vernacular names Malaysia: mengkudu akar, mengkudu hutan, akar perut ayam (Peninsular). Philippines: nino, halon (Tagalog). Laos: khua mak mah pa. Thailand: yo yaan (peninsular). Vietnam: nh[af]u t[as]n, nh[af]u d[or], d[ow]n m[awj]t qui.

Distribution Southern Asia from India, Sri Lanka, China and Japan, through Indo-China, Thailand and Malesia, to northern Australia and Fiji.

Uses In India, a decoction of the roots is used to treat dropsy, and a decoction of the leaves as an anthelmintic. In Vietnam, the roots and leaves are applied in treating dysentery. In China, roots and bark are used to treat swollen joints, kidney complaints and lumbar pains. In India, the fruits are eaten, whereas the stems function for binding purposes. The roots provide a yellow dye.

Observations A climbing shrub or liana up to 20 m long; leaves elliptical to elliptical-lanceolate, rarely ovate, (4–)6–10 cm × 2–3.5 cm; inflorescence a terminal umbel of heads; corolla with tube much shorter than lobes, white; compound fruit subglobose, c. 1 cm in diameter, orange when ripe. *M. umbellata* occurs in forest and thickets, usually in the lowland. It is here regarded in the wide sense, but future taxonomic research might reveal that several distinct species are included in the complex.

Selected sources 121, 141, 542, 671, 760.

Nguyen Tap & Nguyen Kim Bich

Mucuna Adanson

Fam. pl. 2: 325 (1763).

LEGUMINOSAE

$x = 11$; *M. pruriens*: $2n = 20, 22, 24$

Origin and geographic distribution *Mucuna* comprises about 100 species in the tropics and subtropics of both hemispheres. A few species are widespread, partly as a result of human activities, but far more species have a very limited distribu-

tion. In the region covered by Thailand, Indo-China and Peninsular Malaysia 13 species occur, in Java 5 and in the Philippines 13, whereas 11 species are found in the islands of the Pacific Ocean.

Uses Traditional medicinal uses of *Mucuna* have been recorded throughout the tropics, but are in general limited. Seeds are used as an aphrodisiac and purgative, and to treat Parkinson's disease, roots as a tonic, leaves to treat fever and headache, bark against rheumatic complaints, and sap to heal wounds and cuts, and to treat fever. The irritant hairs on the outside of the fruits of various *Mucuna* species (e.g. *M. gigantea*) are mentioned as being used in criminal poisoning, whereas apparently minor doses are credited as a vermifuge of very doubtful quality. *M. pruriens* is widely grown as a cover crop and green manure.

In Java the seeds of *M. macrophylla* Miq. (synonym: *M. junghuhniana* (O. Kuntze) Prain) are made into bead chains regarded as charms, to ward off diseases in children. The seeds are also included in a prescription for flatulence.

Properties The use of *M. pruriens* seeds for the symptomatic treatment of Parkinson's disease as supported by modern research is closely linked to the high concentration of the amino acid L-dopa (levodopa; L-3,4-dihydroxyphenylalanine), which stimulates the formation of the neuro-transmitter dopamine in the brain. Dopamine lessens tremors experienced in Parkinson's disease. However, opinions differ on the side effects and efficacy in the long run of L-dopa. The L-dopa content in *M. pruriens* seeds collected in Java is not related to their cultivation status and ranges from 1.6–2.8%. Neither is it correlated to the presence of violently itching hairs predominating in wild forms. *M. macrophylla*, *M. gigantea* and *M. diabolica* Backer ex Keuch. yielded L-dopa at concentrations of 1.6–1.9%, 1.7–2.0% and 2.2–2.3%, respectively.

A seed extract of *M. pruriens* showed in-vivo prophylactic protection against snake (*Echis carinatus*) venom in mice. In-vitro tests on human plasma and bovine prothrombin revealed that the extract activated prothrombin. Main cause of death after the bite of *Echis carinatus* is haemorrhage and this could be partially counteracted by the increase in procoagulant activity as observed in vitro.

An ethanol extract of *M. pruriens* exhibited antipyretic and analgesic activity in rats when given intragastrically at a dose of 1 g/kg. A leaf decoction decreased blood cholesterol and lipid levels. It has been recorded that *M. pruriens* increases sperm count and motility.

Botany Large lianas, sometimes annual or short-lived perennial climbers, rarely erect shrubs. Leaves alternate, pinnately trifoliolate; stipules caducous; lateral leaflets variably asymmetrical; stipels often caducous. Inflorescence axillary on leafy shoots or on old branches, subumbellate, condensed-paniculate or falsely racemose; bracts and bracteoles caducous. Flowers bisexual, showy; calyx 4–5-lobed, 2-lipped with upper pair of lobes connate; corolla papilionaceous, standard rounded with a median claw and a pair of inflexed lateral auricles at base, wings and keel usually much longer, clawed and with small auricle; stamens 10, 9 fused and 1 free; ovary superior, 1-celled, style long, filiform, bent. Fruit an ovoid, oblong or linear pod, valves thick, often ribbed or ornamented with raised lamellae and frequently with irritant bristles, septate or apparently so between the seeds, usually dehiscent. Seeds discoid to globose or oblong, compressed, hilum usually extending around three quarters of the circumference, but sometimes short and surrounded by a rim-aril. Seedling with hypogeal germination; first leaves scale-like or simple.

Seedlings of *M. gigantea* and *M. macrophylla* may attain a height of more than 1 m in 3 weeks time. Nodulating ability is reported for numerous *Mucuna* species. Seeds of *M. gigantea* can be dispersed by sea currents.

Mucuna is divided into 2 subgenera. Most species belong to subgenus *Mucuna*, having a woody habit and large, discoid seeds with hilum extending around three quarters of the circumference, whereas a few (e.g. *M. pruriens*) belong to subgenus *Stizolobium*, being an annual or short-lived, hardly woody perennial with oblong-ovoid seeds having a very short hilum surrounded by a rim-aril. An overall revision of *Mucuna* for South-East Asia is still lacking and an up-to-date account for Indonesia and Papua New Guinea is badly needed in view of the great number of endemics recorded in the literature for these countries.

Ecology *Mucuna* can be found on a wide range of soils in habitats as diverse as coral beaches, coastal swamps, riverine forest, moist evergreen rain forest, dry thickets, limestone cliffs and open country, from sea-level up to well over 2000 m altitude.

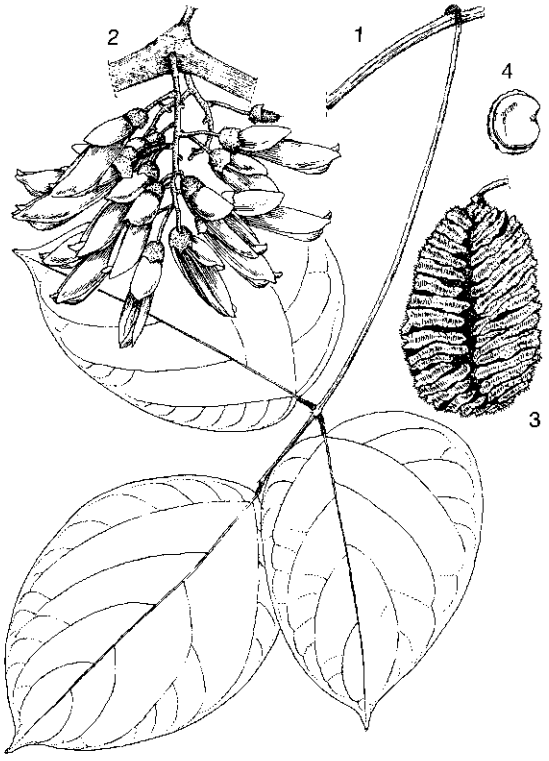
Management Propagation of *M. pruriens* (velvet bean) is mostly by seed. Seed requires no scarification, but dry seed requires soaking in water

for 24 hours. The germination rate of fresh seed is up to 100%, and seed stored in a cool, dry place may remain viable for 2 years. After sowing, velvet bean requires 1–2 weedings. It is little affected by diseases and pests. Seed yields can be as high as 1500 kg/ha on good soils. Cell suspension cultures of *M. pruriens* were able to endogenously accumulate L-dopa up to 6% on a dry weight basis.

Genetic resources In view of their wide distribution and presence in forest margins and secondary regrowth, the *Mucuna* species treated here do not appear to be threatened by genetic erosion. Germplasm collections of *Mucuna* are maintained, for instance at Bogor (Indonesia) where there are 55 accessions of *M. pruriens*, and at Laguna (the Philippines) where there are 29 accessions of *Mucuna* spp.

Prospects Research on the phytochemistry and pharmacological properties of *Mucuna* has led to important discoveries, such as the presence and activities of L-dopa, which is still important in the therapy for Parkinson's disease. More research may reveal other interesting medicinal properties, which was recently the case concerning activity against the effects of snakebites.

Literature 35, 239, 297, 731, 751, 819, 997, 1000.



Mucuna biplicata Teijsm. & Binnend. ex Kurz – 1, part of stem with leaf; 2, part of stem with inflorescences; 3, fruit; 4, seed.

Selection of species

Mucuna biplicata Teijsm. & Binnend. ex Kurz

Journ. As. Soc. Beng. 43(2): 186 (1874).

Vernacular names Malaysia: merading (Bidayuh, Sarawak), akar beruru (Iban, Sarawak), kachang paleh (Peninsular Malaysia).

Distribution Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia heated leaves are applied externally on the abdomen to reduce fever. In Sarawak the black sap from the bark is used to promote healing of cuts and wounds. Sap obtained from the fresh leaves is topically applied for curing mouth-pain in babies. The stems are used as a mosquito repellent.

Observations A liana up to 20 m long, glabrous; leaves 20–25(–40) cm long, terminal leaflet broadly elliptical, 10–12(–18) cm × 5–7(–11) cm; inflorescence 5–9 cm long, with several branches at or near the base, bearing 4–40 side-branches; calyx 5–6 mm × 8–10 mm, corolla violet to purple, standard c. 2.5 cm long, wings and keel 4–5 cm long; fruit broadly oblong, 7–10 cm × 2.5–5 cm × 1–2 cm, not swollen around the seeds, with abundant irritant bristles, 3–5-seeded. Citations for Indo-China refer to *M. revoluta* Wilmot-Dear. *M. biplicata* is found in relatively open or disturbed forest from sea-level up to 70 m altitude.

Selected sources 121, 132, 250, 1000.

Mucuna gigantea (Willd.) DC.

Prodr. 2: 405 (1825).

Vernacular names Malaysia: kacang rimau (Peninsular). Vietnam: d[aaj]u m[ef]o l[ows]n.

Distribution Widespread throughout tropical Asia including South-East Asia, Australia and the Pacific.

Uses In Peninsular Malaysia mention is made of the highly irritant hairs on the pods being used in criminal poisoning. In Vietnam they are mixed with food to get rid of rats. In India the bark is applied externally to treat rheumatic complaints. Powdered seeds are said to be used as a purgative in Hawaii.

Observations A robust liana, up to 80 m long, glabrous or finely appressed-hairy; leaves 13–27

cm long, terminal leaflet elliptical-ovate to ovate, 7–13 cm × 4–8.5 cm; inflorescence 8–25 cm long, bearing up to 6 few-flowered side-branches, crowded; calyx 8–12 mm × 11–15 mm, corolla white tinged yellow, green or pinkish, standard 2.5–4 cm long, wings and keel 3–4.5 cm long; fruit asymmetrically elliptical-oblong to linear-oblong, 7–14 cm × 4–5.5 cm × 0.5 cm, much or little swollen around the seeds, ornamented with a pattern of strongly raised vein-lines, giving a pitted appearance, with scattered bristles, (1–)3(–6)-seeded. Within *M. gigantea* several subspecies are distinguished. *M. gigantea* is most commonly encountered in coastal regions, e.g. along seashores, and along rivers, but it occurs also in mixed tropical rain forest and thickets up to 1200 m altitude.

Selected sources 62, 121, 181, 250, 732, 995, 996, 997, 1000.

Mucuna hainanensis Hayata

Icon. pl. formos. 3: 72 (1913).

Synonyms *Mucuna nigricans* auct. non (Lour.) Steudel.

Vernacular names Philippines: nipai (Tagalog), alilipai (Sulu), bukkau (Iloko). Vietnam: d[aa]y lu[oof]n hang, d[aaj]u b[aaf]n.

Distribution Northern and eastern India, Burma (Myanmar), Indo-China, southern China and the Philippines (Luzon southward to Mindanao).

Uses In the Philippines sap from a freshly cut stem is drunk as a remedy for fever.

Observations A slender liana, glabrous or finely appressed-hairy; leaves up to 32 cm long, terminal leaflet elliptical or elliptical-ovate, 8–17 cm × 4–10 cm; inflorescence 12–40 cm long, often branched once or twice in the lower part, bearing up to 10 knoblike side-branches, bracts and bracteoles fairly persistent; calyx 10 mm × 10–16 mm, lobes long, corolla dark purple, standard 3–3.5 cm long, wings and keel 5–6 cm long; fruit linear-oblong, 13–14 cm × 3.5–5 cm × 1.5 cm, not or hardly swollen around the seeds, with abundant red bristles, (2–)3–4-seeded. *M. hainanensis* is a very variable species with respect to both vegetative and floral parts, and it has been divided into 2 subspecies, of which only subsp. *multilamellata* Wilmot-Dear occurs in the Philippines. It is found in secondary forest, thickets or open country, often near water, from sea-level to medium altitude.

Selected sources 117, 250, 995, 997, 998, 999, 1000.

Mucuna pruriens (L.) DC.

Prodr. 2: 405 (1825).

Synonyms *Stizolobium pruriens* (L.) Medik. (1787).

Vernacular names Velvet bean (En). Cowitch (Am). Pois mascate, pois velus (Fr). Indonesia: kara benguk (Javanese), kowas (Sundanese), kekara juleh (Moluccas). Malaysia: kacang babi, kekaras gatal. Philippines: nipai (Tagalog, Bisaya), hipoi (Bikol), sabawel. Cambodia: khnhaè. Laos: tam nhè. Thailand: mamui (central). Vietnam: d[aaj]u m[ef]o r[uwf]ng, m[os]c m[ef]o.

Distribution Throughout all tropical regions including tropical Asia; widely cultivated, also in some subtropical and temperate regions, e.g. in the United States.

Uses Boiled *M. pruriens* seeds have a reputation as an aphrodisiac. In the Philippines the leaves, pounded and mixed with salt, are externally applied to the forehead and temples to relieve headache. In India the seeds are used in the Ayurveda medication to treat Parkinson's disease. Sap from the stem is used to stop the bleeding of small wounds. Velvet bean is mainly grown as a cover crop and green manure. It is also used as a forage. Boiled seeds are occasionally eaten as a pulse, and boiled immature pods and young leaves as vegetables.

Observations A slender annual or short-lived perennial climber, glabrous or sparsely fine-hairy; leaves up to 46 cm long, terminal leaflet elliptical to rhombic-ovate, 3–16 cm × 3.5–10 cm; inflorescence up to 40 cm long, unbranched, bearing up to 20 knoblike side-branches, bracts and bracteoles usually very early caducous; calyx c. 5 mm × 10 mm, lobes up to 10 mm long, corolla purple, rarely whitish, standard c. 2 cm long, wing and keel c. 4 cm long; pod narrowly linear-oblong, 5–9 cm × 0.8–2 cm × 0.5(–1) cm, often swollen around the seeds, with abundant red-golden or red-brown bristles usually lacking in cultivated plants, 3–6-seeded. Cultivated forms of *M. pruriens* without irritating bristles on the fruit are distinguished as cultivar-group Utilis (synonym: var. *utilis* (Wallich ex Wight) Baker ex Burck). In wild forms with irritating fruit bristles 2 varieties are distinguished: var. *pruriens* and var. *sericophylla* (Perk.) Wilmot-Dear, the latter endemic to the Philippines and with broader and more persistent bracts. *M. pruriens* is found in secondary forest, thickets and on riversides, at low and medium altitudes.

Selected sources 62, 117, 121, 239, 250, 297, 334, 579, 751, 760, 995, 997, 1000.

K.R. Dahal & J.L.C.H. van Valkenburg

Mukia maderaspatana (L.) M.J. Roemer

Fam. nat. syn. monogr. 2: 47 (1846).
CUCURBITACEAE
$2n = 22$

Synonyms *Mukia scabrella* (L.) Arnott (1841), *Melothria maderaspatana* (L.) Cogn. (1881).

Vernacular names Philippines: melon-gubat (Tagalog). Thailand: taneng nuu. Vietnam: c[aaf]u qua [aas]n.

Origin and geographic distribution *M. maderaspatana* occurs throughout tropical Africa, the Indian Ocean Islands, tropical and subtropical Asia and tropical Australia.

Uses In Thailand the ground root of *M. maderaspatana* is applied to the gums to relieve toothache, and a decoction is used as an antiflatulent. The young shoots are taken for the treatment of hepatitis, indigestion, nausea, vomiting, bile duct inflammation, bronchitis and asthma. A decoction of the seed is used as a sudorific. The fixed oil from the seed is topically applied to relieve muscular pain. In Taiwan a decoction of the flowers and root is used as a poison antidote, anodyne and to treat stomach-ache. *M. maderaspatana* is traditionally used for the treatment and control of diabetes mellitus among different tribal groups and rural populations in India. In southern India the leaves are fried and eaten as a vegetable to improve resistance and health. Leaves ground into a paste are given orally as a potent antifertility agent. In East Africa the plant is given to women in labour in order to hasten the childbirth, and cooked leaves may also be eaten as an abortifacient.

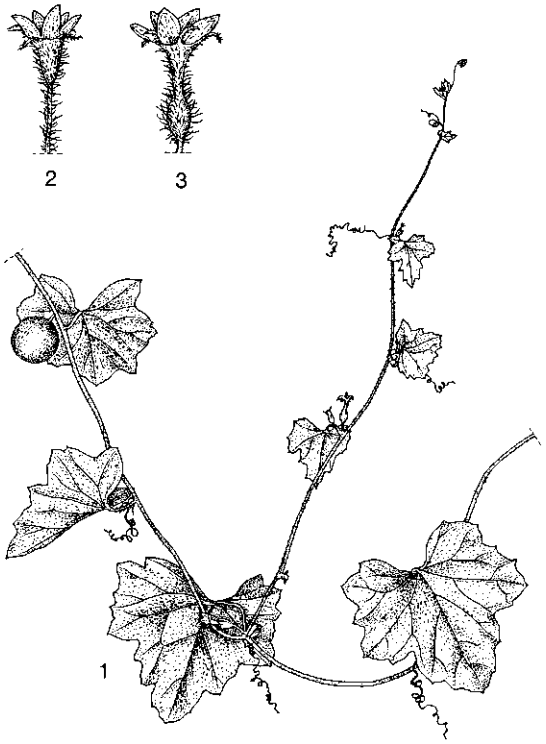
Leaf juice of *Mukia javanica* (Miq.) C. Jeffrey was recorded long ago as a traditional remedy in the Moluccas to treat thrush in children. It was also used as part of a treatment to clear opacity of the cornea.

Properties Treatment with an aqueous extract of the aerial parts of *M. maderaspatana*, before or after CCl_4 administration in rats, markedly decreased CCl_4-mediated alterations in liver histopathology as well as serum enzyme levels. These results provide supportive evidence for the traditional use as a hepatotonic.

Investigation of the effects of aqueous extracts of whole plants of *M. maderaspatana* on the human immune system revealed strong anticomplement activity on both the classical and alternative pathways of the human complement system in vitro.

Botany A monoecious, perennial, herbaceous scrambler or climber up to 4 m long; stem finely grooved, covered with erecto-patent hairs, climbing by simple, shaggy tendrils. Leaves alternate, simple, usually 3–5-lobed, broadly ovate, triangular to sagittate in outline, 1–10 cm × 1–11 cm, base variably cordate, apex acuminate, sinuate to dentate, variably hairy above and beneath; petiole 2–9 cm long, covered with erecto-patent hairs; stipules absent. Inflorescence an axillary fascicle; male flowers 2–20 together, female flowers 2–4 together or solitary. Flowers unisexual, regular, 5-merous, bright yellow; calyx campanulate or subcylindrical; corolla gamopetalous, with ovate-oblong lobes, 1.5–4 mm × 1–2 mm; male flowers with short pedicel, 3 stamens and a pistillode; female flowers subsessile, with inferior, ovoid ovary, densely clothed with very long, thin, soft hairs. Fruit a globose berry 5–13 mm in diameter, clothed with long fugacious hairs, at first green with pale longitudinal bands, turning red, 4–8-seeded. Seeds ovate-oblong, 3.5–5 mm × 2–3 mm × 1–2 mm, conspicuously verrucose, margined.

M. maderaspatana can be found flowering and fruiting throughout the year.



Mukia maderaspatana (L.) M.J. Roemer – 1, part of stem with flowers and fruit; 2, male flower; 3, female flower.

Mukia is placed in the subtribe *Melothiirnae* of the tribe *Melothriae* and is closely related to e.g. *Cucumis*. *Mukia* can be distinguished by its small monoecious flowers, usually fascicled in the leaf axils, its small subsessile baccate fruits often produced in clusters, and its tumid seeds. *M. maderaspatana* shows considerable differentiation over its range into local variants, differing, for example, in number of seeds, seed size and shape, habit and size of plant, number of flowers and petal length. The most frequent variant, however, can be found throughout most parts of the range of the species and seems in fact to have a rather weedy nature. Sometimes these variants are raised to species rank.

Ecology *M. maderaspatana* is found on a wide range of soils in relatively open, often disturbed habitats from sea-level up to 1500 m altitude.

Genetic resources *M. maderaspatana* is widespread and often occurs in disturbed habitats. It is not threatened by genetic erosion.

Prospects Little is known on the pharmacological activities of *M. maderaspatana*. However, the information available supports the traditional uses to treat liver diseases and as a tonic. Although it is not known to be used medicinally in the Malesian region, it might be interesting, and therefore more research is desirable.

Literature 173, 250, 419, 425, 766, 923.

Other selected sources 62, 334, 380, 418, 499, 731, 760.

Mariana Raini

Murdannia Royle

Illus. bot. Himal. Mts.: 403, t. 95 (1839).

COMMELINACEAE

x = 6, 8, 9, 10, 11; *M. edulis*: $2n$ = 18, 40, *M. japonica*: n = 32, $2n$ = 40, *M. loriformis*: $2n$ = 40

Origin and geographic distribution *Murdannia* comprises about 50 species and is pantropical, also occurring locally in warmer temperate regions. It is richest in diversity in tropical Asia, where there are approximately 30 species.

Uses There are few records of medicinal uses of *Murdannia* in South-East Asia. *M. loriformis* is used in Thailand to treat leukaemia and cancer. *M. japonica* is used in Peninsular Malaysia as an abortifacient. However, the roots of *M. edulis* have numerous medicinal applications in India.

The green plant parts of *M. nudiflora* (L.) Brenan and *M. spirata* (L.) A. Brückn. are used as a raw or steamed vegetable, and as a fodder. The leaves of the former species are applied as a poultice to wounds.

Properties An extract of freeze-dried *M. loriformis* plants exhibited weak cytotoxicity against human breast cancer cells; the active compound was identified as sphingosine-1-β-O-D-glucopyranosyl-2-(2'-hydroxy-6'-ene-cosamide). An alcohol extract showed cytotoxicity against hepatoma cell lines of mice and antimutagenic activity against various known mutagens in rats. The steroidal glucoside 3-β-O-D-glucopyranosyl-24ζ-ethylcholest-5-ene has been isolated from whole *M. loriformis* plants from Thailand.

Botany Small to medium-sized perennial or annual herbs, with stems erect or creeping at base; roots fibrous or tuberous. Leaves arranged spirally, simple and entire, ovate-oblong to linear-lanceolate, sessile and with leaf-sheaths at base. Inflorescence a terminal or axillary thyrse, sometimes reduced to 1-flowered cyme. Flowers bisexual, sometimes bisexual and male, regular or slightly zygomorphic, 3-merous, pedicellate; sepals free, subequal; petals free, subequal, usually slightly longer than sepals; stamens 6, 2–3 fertile and 3–4 staminodial, generally all free; ovary superior, sessile, 3-celled, style slender. Fruit a 3-celled capsule, opening with 3 valves, each cell 1–many-seeded. Seeds with punctiform to linear hilum.

The nomenclature of many *Murdannia* species is confusing. They have often been described originally in other genera, usually in *Aneilema*, which is another genus of the tribe *Commelineae*, differing in its bilocular or unequally trilocular, bivalved fruits.

Ecology *Murdannia* is diverse ecologically, but it occurs mainly in open localities, often in moist habitats. Some species are weeds in crops, e.g. the widespread *M. nudiflora* in rice. However, some species prefer the forest undergrowth, e.g. *M. japonica*.

Management In India the roots of *M. edulis* are dried in the shade after collecting.

Genetic resources The *Murdannia* species treated here are widely distributed and do not seem to be under threat of genetic erosion. However, knowledge of the distribution of many species is still very incomplete.

Prospects The applications of *Murdannia* in traditional medicine in Thailand and India are interesting enough to warrant further investigations on pharmacological activities. A study of the taxonomy of the genus is badly needed.

Literature 121, 853.

Selection of species

Murdannia edulis (Stokes) Faden

Taxon 29(1): 77 (1980).

Synonyms *Aneilema scapiflorum* (Roxb.) Kostel. (1831), *Murdannia scapiflora* (Roxb.) Royle (1840), *Aneilema platyphyllum* Merr. (1915), *Murdannia loureirii* (Hance) R.S. Rao & Kammathy (1964), *Murdannia formosana* (N.E.Br.) K.S. Hsu (1978).

Vernacular names Thailand: haeo kratai, wan khao nieo (Nakhon Ratchasima), ka thuean chang (Nakhon Sawan). Vietnam: l[ox]a trai ng[oj]t.

Distribution Nepal, India, Bangladesh, Burma (Myanmar), Indo-China, southern China, Taiwan, Thailand, Java, the Lesser Sunda Islands, the Philippines and New Guinea.

Uses The roots have numerous applications in traditional medicine in India. They are credited with astringent and tonic properties, and used to treat headache, giddiness, deafness, fever, jaundice, and as a cure against snakebites. The root bark is used to treat asthma, colic, piles, infantile convulsions, incontinence and spermatorrhoea.

Observations A perennial herb up to 50 cm tall, with numerous tuberous roots; leaves all in a radical rosette, lanceolate to linear, up to 30(–60) cm × 3(–4.5) cm; inflorescence terminal on a flowering shoot up to 50 cm long arising laterally from the rosette; flowers with lilac to pink or greenish-white petals and 3 fertile stamens. *M. edulis* occurs in forest, thickets and moist, open localities, in Java up to 250 m altitude.

Selected sources 62, 121, 238, 483.

Murdannia japonica (Thunberg) Faden

Taxon 26(1): 142 (1977).

Synonyms *Aneilema herbaceum* (Roxb.) Wallich (1832), *Aneilema japonicum* (Thunberg) Kunth (1843), *Aneilema lineolatum* (Blume) Kunth (1843), *Murdannia elata* (Vahl) A. Brückn. (1930).

Vernacular names Malaysia: pokok mati hidup (Peninsular). Vietnam: trai nh[aaj]t, c[or] r[uw][ow]i th[ar]o.

Distribution From India to Peninsular Malaysia and Java.

Uses In Peninsular Malaysia, bruised stems of young plants have been applied as a suppository to produce abortion.

Observations An erect or ascending herb up to 90 cm tall; leaves lanceolate, 6–20 cm × 2.5–5 cm; inflorescence paniculiform with widely patent branches, up to 30 cm long; flowers with pale lilac or white petals and 3 fertile stamens. *M. japonica* occurs in shaded locations in forest up to 1400 m altitude.

Selected sources 62, 121, 789.

Murdannia loriformis (Hassk.) R.S. Rao & Kammathy

Bull. Bot. Surv. India 3: 393 (1961).

Synonyms *Aneilema loriforme* Hassk. (1852), *Aneilema nudiflorum* (L.) Sweet var. *terminale* (Wight) C.B. Clarke (1874).

Vernacular names Thailand: ya pakking, ya thewada.

Distribution From India and Sri Lanka to Thailand, Peninsular Malaysia and Java.

Uses In Thailand whole plants are mixed with water and the filtrate is drunk twice a day to treat leukaemia and cancer of the throat, liver, uterus, ileum and skin.

Observations A perennial herb with a basal rosette of leaves, roots thin and fibrous; leaves of rosette linear to linear-oblong, 10–28 cm × 1–2 cm, cauline leaves lanceolate, 2–10 cm × 0.5–1.5 cm; inflorescence terminal or axillary on ascending to decumbent flowering shoots up to 75 cm long arising laterally from the rosette, up to 3 cm long on a peduncle up to 10 cm long; flowers with lilac to pale lilac petals and 2 fertile stamens. *M. loriformis* occurs on rocky slopes, sandy localities along streams, sometimes in plantations, in shaded as well as sunny locations, up to 500 m altitude.

Selected sources 397, 432, 433, 782, 789, 817, 969.

Wongsatit Chuakul, Noppamas Soonthornchareonnon & Orawan Ruangsomboon

Mussaenda L.

Sp. pl. 1: 177 (1753); Gen. pl. ed. 5: 82 (1754).

RUBIACEAE

$x = 11$; *M. glabra*, *M. philippica*: $n = 11$

Origin and geographic distribution *Mussaenda* comprises about 200 species and occurs in the Old World tropics. At least some dozens of species occur in the Malesian region.

Uses Different parts of *Mussaenda* plants are used in traditional medicine in South-East Asia: leaves to treat asthma, cough, fever, headache, jaundice, eye infections and as an emollient; roots to treat cough, jaundice and after childbirth; sap to treat headache and eye infections; and flowers to treat headache and jaundice. In addition to the species treated here, boiled leaves of *M. elmeri*

Merr. are taken orally in Sarawak to treat toothache, headache and diabetes.
M. pubescens W.T. Aiton is used in traditional medicine in Vietnam and China, e.g. a flower decoction to treat cough, asthma and intermittent fever, and a decoction of leaves and roots as an analgesic to treat rheumatism. *M. frondosa* L. is used in traditional medicine in India and Sri Lanka: roots to treat leprosy, flowers to treat asthma, fever and dropsy, and leaves to treat externally ulcers and inflammations.
Several *Mussaenda* species are used in folk medicine in Africa, e.g. leaf and bark sap to treat eye infections, and leaves and roots as a poultice on wounds and sores, and to treat elephantiasis.
Mussaenda is highly valued as an ornamental, *M. frondosa* and the African *M. erythrophylla* Schumach. & Thonn. (with spectacular blood-red enlarged calyx lobes) being the most commonly planted species, together with numerous hybrids.

Properties A leaf and stem extract of *M. glabra* (of Sumatran origin) showed slight in-vitro antimicrobial activity against *Staphylococcus aureus*.
The *Mussaenda* species that has been best investigated phytochemically and pharmacologically is *M. pubescens* from Indo-China and China. Several triterpenoid saponins (mussaendosides) and monoterpenes (mussaenins) have been isolated from whole plants. One of these compounds, mussaendoside O, which is the most abundant saponin, significantly inhibited the secretions of the lachrymal and salivary glands induced by galanthamine, and also inhibited the contraction of isolated guinea-pig ileum evoked by carbachol (a muscarin receptor agonist). It also showed immunopromotive and haemolytic activities.
Some triterpenoid glycosides were isolated from root bark of *M. macrophylla* Wallich (occurring in Nepal, India, Burma (Myanmar), southern China and the Philippines). These showed inhibitory activity against the periodontopathic bacterium *Porphyromonas gingivalis*, but were inactive against the cariogenic organism *Streptococcus mutans*.

Botany Scandent, sometimes erect shrubs or lianas. Leaves opposite, rarely ternate, simple and entire, pinnately veined; stipules interpetiolar, entire to 2-fid. Inflorescence a terminal cyme, often corymbose. Flowers unisexual or bisexual, 5-merous, heterostylous; calyx with campanulate to turbinate tube, 1 lobe enlarged into a petaloid, often white, leaf-like appendage in some flowers of inflorescence; corolla salver-shaped, cylindrical or funnel-shaped, with valvate lobes; stamens inserted at the upper part of the corolla tube, alternating with corolla lobes, anthers linear, subsessile; ovary inferior, 2-celled, style short or long, stigma 2-lobed. Fruit a many-seeded berry. Seeds reticulate-ribbed.
Mussaenda belongs to the tribe *Isertieae*. Some species with capsular fruits are separated from *Mussaenda* and placed in the genera *Pseudomussaenda* (5 African species, one of which (*P. flava* Verdc.) is sometimes cultivated as an ornamental in South-East Asia) and *Schizomussaenda* (1 species, *S. dehiscens* (Craib) Li, from northern Burma (Myanmar), Indo-China, China and northern Thailand). Many of the plants cultivated as an ornamental under the name *M. philippica* are probably of hybrid origin.

Ecology *Mussaenda* is most commonly a scandent shrub in forest margins and secondary forest in the lowland, but may ascend up to 2000 m altitude, whereas some species prefer shaded habitats in the undergrowth of closed forest.

Management *Mussaenda* is propagated for ornamental purposes in India by semi-hardwood cuttings about 15 cm long and 1–1.5 cm in diameter. *M. erythrophylla* has also been propagated successfully by in-vitro callus culture.

Genetic resources Many *Mussaenda* species appear to be narrow endemics. In the Philippines, for example, 18 of the 20 indigenous species are considered endemic, many of them restricted to a single island. This makes them very liable to genetic erosion.
Numerous ornamental cultivars exist, mainly selected for striking colours of flowers and enlarged calyx lobes.

Prospects *Mussaenda* is an interesting medicinal plant, which deserves more attention for research in South-East Asia. It is considered of medicinal value in different parts of the world, and the few pharmacological studies available show promising results. Taxonomical studies covering whole South-East Asia are needed because the status of many names commonly used in literature is unclear.

Literature 120, 241, 480, 671, 1021, 1056, 1057.

Selection of species

Mussaenda anisophylla S. Vidal

Phan. Cuming. philipp.: 178 (1885).

Vernacular names Philippines: talig-harap, tinga-tinga (Tagalog), buyon (Bisaya).

Distribution The Philippines (Luzon, Mindanao).

Uses A decoction of fresh leaves is administered to treat asthma.

Observations A scandent shrub up to 8 m tall; leaves oblong-ovate to elliptical, variable in size, 8.5–30 cm × 3–16 cm, softly hairy on both sides; flowers with ovate, up to 10 cm long, white enlarged calyx lobe, corolla up to 3.5 cm long, densely hairy, orange to yellow; fruit ellipsoid, 1.5–2 cm long, pale green. *M. anisophylla* occurs in lowland forest up to 800 m altitude.

Selected sources 422, 760.

Mussaenda ferruginea K. Schumann

K. Schumann & Hollr., Fl. Kais. Wilh. Land: 129 (1889).

Vernacular names Papua New Guinea: aganapa (Awala, Northern Province).

Distribution New Guinea.

Uses In Papua New Guinea a leaf decoction is applied in a bath to treat fever, and the leaves are used externally to treat headache.

Observations A large shrub up to 8 m tall, young twigs rusty hairy; leaves oblong, 4–10 cm × 2–5 cm, appressed hairy mainly on the veins; flowers with ovate enlarged calyx lobe up to 10 cm long, corolla c. 4.5 cm long, pubescent.

Selected sources 347.

Mussaenda glabra Vahl

Symb. bot. 3: 38 (1794).

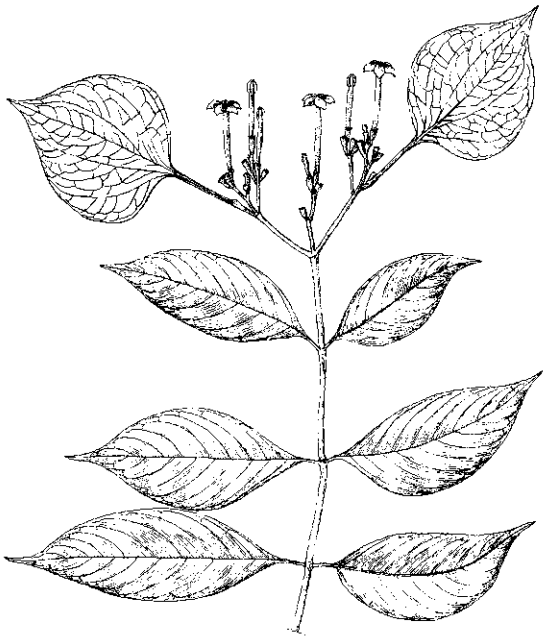
Synonyms *Mussaenda frondosa* auct. non L.

Vernacular names Indonesia: kingkilaban, areuy siwurungan (Sundanese), kalik adep (Javanese). Malaysia: balek adap, adap-adap, daun puteri (Peninsular). Thailand: bai taang dok (Narathiwat).

Distribution India, Burma (Myanmar), southern China, the Ryukyu Islands, Thailand, Peninsular Malaysia, Singapore, Sumatra and Java.

Uses In Java the sap is used to wash infected eyes. In Sumatra an infusion of flowers or leaves, in a mixture with the leaves of other medicinal plants, is drunk to treat jaundice and headache. In Peninsular Malaysia a tea made from the leaves and a root decoction are used to treat cough, the leaves are applied as a poultice to treat headache, and a root decoction is administered after childbirth. In Indonesia tops of branches and flowers are sometimes eaten as a vegetable, raw or steamed.

Observations A scandent shrub up to 5 m tall, with almost glabrous branches; leaves elliptical, oblong or elliptical-lanceolate, 5–14 cm × 1.5–5.5 cm, usually glabrous except the veins; flowers



Mussaenda glabra Vahl – flowering twig.

with broadly ovate to elliptical, white enlarged calyx lobe up to 12 cm long, corolla up to 3 cm long, yellow or orange; fruit ovoid-ellipsoid, up to 12 mm long. *M. glabra* occurs in more open localities in primary and secondary forest, up to 1700 m altitude.

Selected sources 62, 121, 295, 296, 334, 420, 421, 689.

Mussaenda philippica A. Rich.

Mém. Soc. Hist. Nat. Paris 5: 245 (1834).

Vernacular names Philippines: kahoi-dalaga (Tagalog, Sambali), buyon (Tagbanua, Cebu Bisaya, Samar-Leyte Bisaya, Sulu), katudai-bantai (Iloko).

Distribution Throughout the Philippines, the Caroline Islands, the Solomon Islands and Fiji.

Uses In the Philippines a decoction of roots and leaves is used to treat chest and lung affections, roots and enlarged calyx lobes are used to treat jaundice, a leaf decoction as an emollient, and bark juice as a cure for headache. Unspecified plant parts are used against snakebites and dysentery. In Fiji *M. philippica* is considered a cure for stomach-ache.

Observations A shrub up to 8 m tall, with more or less pubescent branches; leaves ovate, oblong-ovate to oblong-lanceolate, 3.5–23.5 cm × 1.5–12 cm, almost glabrous but pubescent on the veins

below; flowers with ovate or orbicular-ovate, white enlarged calyx lobe up to 13 cm long, corolla up to 4 cm long, with pale green tube and orange lobes, pubescent; fruit globular, 1–1.5 cm long. *M. philippica* is common in old secondary forest and thickets, up to 700 m altitude.

Selected sources 422, 760.

Mussaenda vidalii Elmer

Leafl. Philipp. Bot. 3: 993 (1911).

Vernacular names Philippines: ananayop (Samar-Leyte Bisaya), botai (Bagobo), bukang-bukang (Bukidnon).

Distribution The Philippines (Mindanao, Leyte, Samar).

Uses The leaves are soaked in water for a few minutes and the solution is used as an eye wash to treat sore eyes. Macerated leaves are applied externally to treat headache.

Observations A scandent shrub up to 4 m tall, with rusty pubescent branches; leaves ovate, oblong-ovate or elliptical, 9–25.5 cm × 4.5–15 cm, rusty hairy on both surfaces; flowers with whitish enlarged calyx lobe up to 10 cm long, corolla up to 3.5 cm long, with yellowish-green tube and pink to orange-red or yellow lobes, densely hairy; fruit ellipsoid, 1.5–2 cm long, rusty pubescent. *M. vidalii* occurs in forest margins and secondary regrowth, up to 600(–1150) m altitude.

Selected sources 422.

R.H.M.J. Lemmens

Myrmecodia tuberosa Jack

Trans. Linn. Soc. London 14: 123 (1823).

RUBIACEAE

$2n = 44, 88$

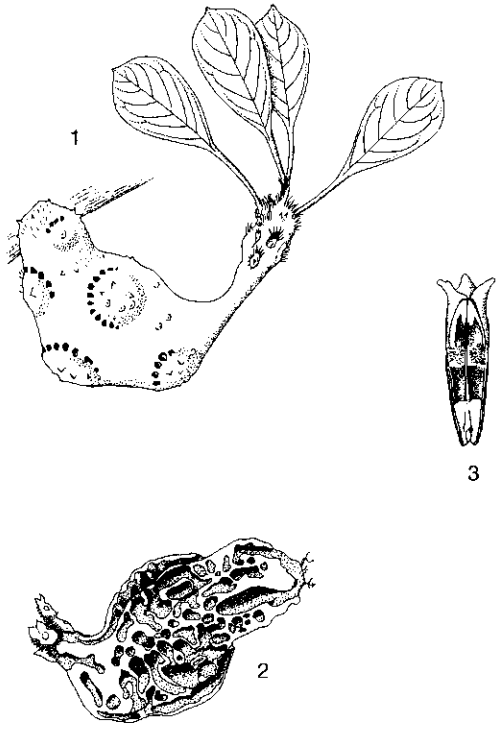
Synonyms *Myrmecodia armata* DC. (1830), *Myrmecodia echinata* Gaudich. (1830), *Myrmecodia rumphii* Becc. (1884).

Vernacular names Indonesia: rumah semut (Sumatra), urek-urek polo (Javanese). Malaysia: periok hantu, perutak, sembuku (Peninsular). Vietnam: k[yf] nam gai, k[yf] nam ki[ees]n.

Origin and geographic distribution *M. tuberosa* occurs throughout Malesia, and also in Vietnam, the Solomon Islands and northern Australia (Cape York Peninsula).

Uses In Indonesia, the pounded tuber has been applied as a poultice to treat swellings and headache.

Botany An epiphytic subshrub, with solitary or few thick stems arising from a variously shaped tuber-like swollen base up to 40 cm long, inside usually with a labyrinth of honeycombed pores, outside with entrance holes often in arcs, with or without spines on tubers and stems. Leaves opposite, simple and entire, elliptical to oblanceolate or spatulate, 10–47 cm × 3–14 cm, base abruptly to gradually tapered, apex acute to acuminate, usually leathery, glabrous, pinnately veined; petiole 2–13 cm long; stipules interpetiolar, triangular, more or less persistent. Flowers a few together at the bottom of cup-shaped cavities in the stem, with hairy bracts, bisexual, 4-merous, sessile, heterostylous; calyx tube cylindrical, limb usually truncate; corolla tubular, c. 11 mm long, tube with a ring of hairs inside, lobes uncinate, white; stamens inserted in corolla tube, usually included, filaments absent or short; disk ring-shaped, prominent; ovary inferior, 4–6-celled, style filiform, included or exserted, stigma 4–6-lobed. Fruit a fleshy drupe c. 7 mm long, developing within cavities in the stem, extruded when mature, yellow, orange-red to pink when ripe, with 4–6 pyrenes. The tuber is formed by the hypocotyl of the seedling which swells, even in the absence of ants.



Myrmecodia tuberosa Jack – 1, plant habit; 2, tuber in longitudinal section; 3, flower in longitudinal section.

Phellogens (meristematic layers which arise in the parenchyma) cut out volumes of tissue which die, leaving cavities. Ants (often of the genus *Iridomyrmex*) usually occupy these cavities and provide the plant with a source of macronutrients through their debris. The flowers are self-fertilizing; the corolla lobes usually do not spread and the corolla remains closed.

Myrmecodia comprises about 25 species and occurs in Vietnam, throughout Malesia, the Solomon Islands and northern Australia (Cape York Peninsula). The greatest number of species occur in the montane areas of New Guinea. *Myrmecodia* is classified in the tribe *Psychotrieae*, and in the subtribe *Hydnophytinae*, together with 4 other ant-inhabited tuberous *Rubiaceae* of which *Hydnophytum* is the most important. The tubers of *Hydnophytum* are used in the same way. These genera are closely related.

M. tuberosa is an extremely variable species. Several morphologically differing variants can be distinguished. These are more or less geographically and ecologically separated, but form a variable continuum considering the very large area of distribution of the species.

Ecology *M. tuberosa* is distributed in widely divergent habitats. It can be found in mangrove trees along the coast, but also at high altitudes, up to 2500 m. It occurs in lowland rain forest (secondary as well as primary), swamp or riverine rain forest, disturbed forest, montane and mossy forest, *Acacia-Melaleuca* woodland, *Casuarina-Melaleuca* and *Eucalyptus-Melaleuca* savanna, and sometimes in plantations. It is epiphytic on a wide range of trees.

Genetic resources *M. tuberosa* is extremely widely spread and, at least locally, common. Moreover, it occurs in many different habitats. There is no reason to consider it to be liable to genetic erosion. The enormous variability in morphology, partly related with habitat preference and geography, is remarkable.

Prospects As long as nothing is known about the phytochemistry and pharmacological properties of *M. tuberosa*, it is not possible to judge its possibly limited value for traditional medicine.

Literature 334, 390.

Other selected sources 62, 121, 387, 388, 389.

R.H.M.J. Lemmens

Myxopyrum nervosum Blume

Bijdr. fl. Ned. Ind. 13: 683 (1826).

OLEACEAE

$2n$ = unknown

Vernacular names Indonesia: areuy ki kupu (Sundanese). Malaysia: akar dedewai, akar pitah-pitah, chiput-chiput (Peninsular). Thailand: thong pling (peninsular).

Origin and geographic distribution *M. nervosum* occurs in peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines (Palawan), Sulawesi, the Moluccas and western New Guinea.

Uses In Peninsular Malaysia leaves, stem and roots are boiled and the decoction is drunk as a tonic during the first three days after confinement. In Java the juice is considered a remedy for intestinal troubles and an anthelmintic. A root decoction in combination with *Alyxia reinwardtii* Blume and *Foeniculum vulgare* Miller is used to relieve fever, and an infusion of the leaves, in combination with the same plants, to treat painful joints.

Properties Three flavonoids (apigenin 7-glycosides) have been isolated from *M. nervosum* leaves.

Botany A liana up to 25 m long; young stem square in cross-section, later becoming terete, up to 1.7 cm in diameter. Leaves opposite, simple, elliptical, sometimes narrowly lanceolate, 10–20 cm × 4–11.5 cm, shallowly toothed towards the apex, 3-veined; stipules absent. Inflorescence a terminal or axillary, lax panicle 3–14 cm long. Flowers bisexual, regular, yellowish-green; calyx c. 1 mm long, 4-lobed; corolla urceolate, tube 1–3 mm long, 4-lobed, fleshy; stamens 2, inserted near the middle of the corolla tube, filaments nearly absent; ovary superior, ovoid, 2-celled, stigma sessile, 2-lobed. Fruit an ellipsoid berry up to 2 cm × 2 cm, pericarp leathery, ripening dark red or black, 2–4-seeded. Seeds with a papery testa and copious, horny endosperm.

Outside Peninsular Malaysia and Java, where it can be found flowering and fruiting throughout the year, *M. nervosum* appears to be rare. The plants with very leathery leaves confined to peat-swamp and heath forests in Borneo are considered a distinct taxon: subsp. *coriaceum* (Blume) Kiew. However, the information on medicinal uses refers to subsp. *nervosum*.

Myxopyrum comprises 4 species, 3 of which occur in the Malesian region. It is found scattered from north-eastern India to southern China and New Guinea.

Ecology *M. nervosum* is found in primary lowland forest, but also in hedges, and often in swampy localities, usually below 100 m altitude, but in Java ascending to 750 m.

Genetic resources Although *M. nervosum* is widespread, it occurs scattered and is in many regions rare. As it prefers lowland forest, a habitat under much pressure, its genetic basis is subject to erosion.

Prospects Research on pharmacological properties is needed to evaluate the potential of the traditional medicinal uses of *M. nervosum*. However, it is unlikely that its use will increase.

Literature 121, 334, 471.

Other selected sources 62, 317, 731.

R. Kiew

Nervilia Comm. ex Gaudich.

Freyc., Voy. Uranie, Bot.: t. 35 (1827), 421 (1829).

ORCHIDACEAE

x = unknown; *N. aragoana*: $2n = 72$, *N. plicata*: $2n = 20, 62, 72, 108$

Origin and geographic distribution *Nervilia* comprises about 60 species and is distributed in tropical and, to a lesser extent, subtropical parts of Africa, Madagascar, Asia and Australia.

Uses In Indo-China and southern China decoctions of *Nervilia* are mainly used internally to treat problems of the respiratory tract. They are also used as a sedative and tonic, and externally to treat bruises, swellings and boils. The use as a protective medicine after childbirth is known from Malaysia.

In Vietnam an infusion of dried leaves of *N. fordii* (Hance) Schlechter is applied orally as a depurative, especially in cases of mushroom poisoning; in China this infusion is considered tonic and sedative, and used to alleviate cough. *N. purpurea* (Hayata) Schlechter is traditionally used in Taiwan to treat inflammation and hypertension.

Properties The phytochemistry of *N. aragoana*, *N. plicata* and *N. purpurea* has been investigated. Phytol, a glycerin ester, cycloeucalenol, stigmasterol, linoleic acid, linolenic acid and L-norleucine have been identified. Several methyl sterols and triterpenes have also been isolated.

The crude extract of *N. purpurea* from Taiwan decreased blood pressure and relaxed the isolated thoracic aorta in rabbits. It was suggested from the tests that nucleotides in *N. purpurea* induced vasodilation. Guanosine and adenosine have been isolated from the aqueous fraction of crude leaf extracts.

Botany Small terrestrial herbs; shoot consisting of a subspherical subterranean rhizomatous tuber of 2–7 internodes. Leaf solitary, often appressed against the ground, elliptical to reniform, cordate or almost circular, plicate, with reticulate venation, lower surface often purplish, petiolate; stipules absent. Inflorescence racemose, erect, 1–many-flowered, with some sheathing cataphylls. Flowers bisexual, zygomorphic, usually resupinate; tepals subequal, greenish or brownish-green, lip (labellum) adnate to the base of the simple, elongate column, spurless or shortly spurred, 3-lobed to almost entire, with upturned lower edges; stamen solitary, with 2 bipartite, sectile pollinia; ovary inferior, stigma elliptical to almost square. Fruit a many-seeded capsule opening by 6 slits. Seeds minute.

Nervilia has an unusual growth habit among the orchids. It is characterized by a subterranean tuber continuing in a very short ascending subterranean stem, from which some horizontal runners are produced, eventually ending in new tubers. This constitutes an effective way of vegetative propagation, and plants are often found in more or less dense colonies probably representing clones. The tuber constitutes a water storage organ, permitting the plant to bridge a dry period. The single leaf develops from the tuber after flowering; consequently flowers and leaves are usually not found at the same time.

Ecology Most *Nervilia* species are found in deciduous and semi-deciduous forest, up to 1500 m altitude. They usually prefer shade, and grow in shallow soils, with the tubers often in the litter layer.

Management In China *N. aragoana* was successfully propagated in vitro from tuber explants cultivated on modified Murashige and Skoog medium supplemented with growth hormones, active charcoal, sucrose and agar. Flowering plants were obtained after transferring the tubers to pots of tree fern dust or moss.

Experiments with the domestication of *N. fordii* in China showed positive results. High yields can be obtained, but the plants should be allowed to form new tubers.

Leaves or whole plants are collected. They are dried in the sun or over a fire for later use. For internal use a decoction of dried plants is usually prepared, for external poultices pounded fresh leaves are applied.

Genetic resources Locally, overcollecting for

medicinal purposes may endanger *Nervilia* populations, as has happened with *N. fordii* in Guangxi (China). In Vietnam *Nervilia* has become uncommon because of overexploitation, so protective measures are needed.

Prospects Research showed interesting pharmacological properties for *Nervilia*. Larger-scale cultivation seems possible and is needed to avoid overexploitation of wild populations.

Literature 373, 379, 671, 735.

Selection of species

Nervilia aragoana Gaudich.

Freyc., Voy. Uranie, Bot.: t. 35 (1827), 422 (1829).

Synonyms *Pogonia flabelliformis* Lindley (1840), *Aplostellis flabelliformis* (Lindley) Ridley (1924).

Vernacular names Malaysia: daun sa-helai satahun, daun satu tahun (Peninsular). Thailand: phaen din yen (Chiang Rai), waan phra chim (Bangkok). Vietnam: ch[aa]n tr[aa]u xanh, thanh thi[ee]n q[uf]y, lan c[owf].

Nervilia aragoana Gaudich. – 1, habit of plant with leaf; 2, habit of flowering plant; 3, flower.

Distribution Nepal, Bhutan, eastern India, Burma (Myanmar), Indo-China, southern China, Taiwan, southern Japan, Thailand, throughout the Malesian region, islands in the Pacific Ocean and northern Australia.

Uses In Peninsular Malaysia a decoction of the leaves is drunk after childbirth as a protective medicine. In Vietnam whole plants are used to treat bruises, swellings, coughs, tuberculosis and scrofula. There are reports from Guam that the tubers are edible; they are sometimes also chewed to quench the thirst.

Observations A small herb; leaf reniform, deeply cordate at base, glabrous, often dark violet blotched when young; inflorescence up to 20-flowered; flowers with tepals c. 1.5 cm long, lip slightly shorter, usually with distinct side lobes, more or less hairy, especially along the 2 lateral veins, yellowish-white. *N. aragoana* is a variable species. It occurs in different types of forest, also in bamboo forest, in Java up to 1200 m altitude.

Selected sources 62, 121, 167, 475, 828, 832, 971.

Nervilia plicata (Andr.) Schlechter

Engl. Bot. Jahrb. 45: 403 (1911).

Synonyms *Nervilia discolor* (Blume) Schlechter (1911), *Aplostellis velutina* (Par. & Reichenb.f.) Ridley (1924).

Vernacular names Vietnam: tr[aa]n ch[aa]u x[ees]p, thanh thi[ee]n q[uf]y l[as] x[ees]p.

Distribution Eastern India, Burma (Myanmar), Laos, Vietnam, southern China, Thailand, Peninsular Malaysia, Java, the Philippines, New Guinea and northern Australia.

Uses In Vietnam whole plants are used to treat hepatitis, pneumonia and tracheitis.

Observations A small herb; leaf cordate-reniform, with coarse hairs on both sides, dark brown on upper surface; inflorescence 2(–3)-flowered; flowers with tepals c. 3.5 cm long, lip c. 2.5 cm long, without distinct side lobes, glabrous above, white but yellow at base inside. *N. plicata* occurs in different types of forest, often in teak forest, up to 500 m altitude.

Selected sources 62, 475, 828, 832, 971.

Dzuong Duc Huyen

Nothocnide repanda (Blume) Blume

Mus. bot. 2: 137, t. 14 (1856).
URTICACEAE
$2n$ = unknown

Synonyms *Pipturus repandus* (Blume) Wedd. (1856).

Vernacular names Indonesia: leuksa, nangsi areuy (Sundanese), dlundung (Javanese). Papua New Guinea: ese-kureka (Northern Province), yakuandumo (Sepik). Philippines: duai, sabsabui (Igorot).

Origin and geographic distribution *N. repanda* is widely distributed in the Malesian region, in Sumatra, Java, Borneo, the Philippines, Sulawesi, the Moluccas and New Guinea.

Uses In Papua New Guinea a bath in a decoction of *N. repanda* leaves is considered a tonic and is used to assist recovery from illness; the leaves are applied to mouth ulcers. Pieces of the stem are sold in markets in Indonesia; pounded and mixed with water, they are used to wash the hair. The bark is used to treat inflammation of the ureter.

Properties An aqueous extract of *N. repanda* stems contains abundant amounts of acid mucilage; saponins are apparently not present.

Botany A dioecious liana up to 35 m long, with stem up to 8 cm in diameter. Leaves arranged spirally, simple and entire, elliptical-oblong, 6–15 cm × 3–5 cm, obtuse to rounded or subcordate at base, acuminate at apex, more or less hairy on the veins below, 3-veined from the base, with 1–2 pairs of secondary veins; petiole 1–4 cm long; stipules connate into an axillary scale 0.5–1 cm long. Inflorescence a cluster combined into an axillary spike up to 8 cm long, mostly 3 together. Flowers unisexual, regular, 4-merous, c. 5 mm in diameter; male flowers with deeply divided perianth, large stamens and rudimentary pistil; female flowers with tubular and dentate, fleshy-juicy perianth and superior, 1-celled ovary, style up to 4.5 mm long, stigma filiform. Fruit a small, subglobular to ovoid achene.

Nothocnide comprises about 4 species, and is spread over South-East Asia and Melanesia. It belongs to the tribe *Boehmerieae*.

Ecology *N. repanda* occurs in forest up to 1600 m altitude, often along streams.

Genetic resources *N. repanda* is widely distributed and at least locally common, and is consequently not easily liable to genetic erosion.

Prospects Too little is known about *N. repanda* to judge its value as a medicinal plant. Research on the phytochemistry and pharmacological properties are needed.

Literature 62, 334, 347.

Other selected sources 331, 621.

R.H.M.J. Lemmens

Oberonia Lindley

Gen. sp. orchid. pl.: 15 (1830).
ORCHIDACEAE
$x = 15$; *O. denticulata*: $2n = 30$

Origin and geographic distribution *Oberonia* comprises approximately 100 species and occurs from eastern and southern Africa (1 species), through tropical and subtropical Asia, to the islands of the Pacific Ocean and northern Australia. India and Thailand seem richest in species, with about 40 and 35, respectively.

Uses *Oberonia* is apparently not much used medicinally. The leaves have been applied to boils in Malaysia. In Vietnam *Oberonia* is used in traditional medicine as a detoxicant and diuretic, to treat rheumatism and to promote blood circulation. In China it is used to treat inflammations of the bladder and ureter, and it is applied to bruises and fractures. In Vietnam *O. longibracteata* Lindley is applied to scorpion stings.

Botany Small, erect or pendulous epiphytic herbs, usually with a short rhizome, with or without a prominent stem. Leaves distichously alternate, simple, fleshy, usually laterally compressed, with or without an articulation at base, without distinct petiole; stipules absent. Inflorescence a terminal spike or raceme, sessile or stalked, bracteate, many-flowered. Flowers bisexual, minute, zygomorphic, pedicelled or sessile; tepals subequal or unequal, sometimes gland-dotted, lip (labellum) spurless, 2–3-lobed or entire, with or without a disk at the proximal end, lobes variously dissected; column minute; anther with 4 pollinia pairwise cohering. Fruit a longitudinally ridged capsule, many-seeded. Seeds minute.

Oberonia is usually easily recognizable by the strongly compressed sheathing leaves and the terminal inflorescence with numerous minute flowers.

Ecology *Oberonia* grows as an epiphyte on trees, but can sometimes be found, like many other epiphytes, on rocks. It can be found in different types of forest, from mangrove forest to mixed forest and teak forest, most commonly in the lowland, but sometimes up to 2100 m altitude.

Genetic resources The two *Oberonia* species

treated here are widespread and locally common and do not seem in immediate danger of genetic erosion, but other species of the rather large genus are undoubtedly rare and in need of protection.

Prospects Research on phytochemistry and pharmacological properties is needed to determine the value of *Oberonia* as a medicinal plant. The ornamental value is limited because of the tiny flowers, although *Oberonia* species are sometimes cultivated by orchid amateurs.

Literature 40, 62, 121, 971.

Selection of species

Oberonia anceps Lindley

Sert. orchid.: sub t. 8 (1838).

Vernacular names Malaysia: sakat lidah buaya (Peninsular). Thailand: lidaa, sakat (peninsular), bua yaa (Malay). Vietnam: m[os]ng r[uf]a hai d[aaf]u.

Distribution Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, eastern Java, the Philippines, Sulawesi and the Moluccas.

Uses There is a record from Peninsular Malaysia stating that the leaves are applied as a poultice to boils.

Observations A small epiphytic herb, with stem up 22 cm long; leaves imbricate, 1–2.5 cm × 0.5–1 cm, without articulation; flowers very densely arranged, completely covering the prominent rachis of the inflorescence, c. 1.5 mm in diameter, brownish-yellow, inner tepals half as broad as outer ones, lip nearly square. *O. anceps* occurs in open forest in the lowland, in Java up to 150 m altitude.

Selected sources 62, 121, 827, 829, 832.

Oberonia denticulata Wight

Icon. pl. Ind. orient. 5: t. 1625 (1851).

Synonyms *Oberonia iridifolia* Lindley (1830) p.p., *Oberonia gammiei* King & Pantling (1897).

Vernacular names Vietnam: lan qu[aj]t l[as] du[oo]i di[eef]u, m[os]ng r[uf]a.

Distribution Nepal, India, Burma (Myanmar), Laos, Vietnam, southern China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines, Sulawesi, islands of the Pacific Ocean and northern Australia.

Uses In Vietnam the plant is applied as detoxicant and diuretic, to treat rheumatism and to promote blood circulation. In China it is used to treat inflammations of the bladder and ureter, and it is applied to bruises and fractures.

Observations A small epiphytic herb, acaulescent; leaves ensiform, up to 20 cm × 2 cm, with articulation at base; flowers in a more or less densely flowered raceme, pedicelled, c. 2 mm in diameter, pale brownish-greenish, inner tepals slightly narrower than outer ones, lip quadrate or ovate in outline, shallowly 2-lobed, fringed to laciniate at margins. *O. denticulata* occurs in mixed forest and teak forest in the lowland, sometimes up to 1500 m altitude.

Selected sources 40, 62, 827, 829, 832, 971.

Dzuong Duc Huyen

Octamyrtus behrmannii Diels

Engl., Bot. Jahrb. 57: 376 (1922).

MYRTACEAE

$2n$ = unknown

Vernacular names Papua New Guinea: kokorabegisi (Kurereda, Northern Province).

Origin and geographic distribution *O. behrmannii* occurs throughout New Guinea.

Uses Young shoots are mixed with water and the solution is drunk to treat tuberculosis.

Botany A shrub or small tree up to 10 m tall; bark flaky, greyish-brown. Leaves opposite, simple and entire, obovate to broadly elliptical, 13.5–23 cm × 5.5–11 cm, obtuse to attenuate at base, acute or acuminate at apex, leathery, tomentose on veins below, pinnately veined; petiole 0.5–2 cm long; stipules absent. Flowers cauliflorous, in clusters or solitary, bisexual, with persistent bracteoles; pedicel 0.5–1.5 cm long; calyx with 4 unequal lobes 4–8 mm long, persistent; petals 6 or 8, free, unequal, ovate to elliptical, up to 3.5 cm long, silky outside, red; stamens numerous, free, up to 5.5 cm long; ovary inferior, 4(–7)-celled, style columnar, up to 6 cm long, stigma capitate. Fruit a globose, dry berry 10–12 mm in diameter, bluish-green, brownish tomentose, many-seeded. Seeds compressed-reniform, 2–2.5 mm in diameter.

Octamyrtus comprises 3 species and is confined to the Moluccas and New Guinea. It is closely related to *Rhodomyrtus*, which differs in the 4–5 less showy petals.

Ecology *O. behrmannii* occurs in rain forest up to 1900 m altitude.

Genetic resources The status of *O. behrmannii* concerning genetic erosion is unclear, but there are no indications that it is threatened.

Prospects It is unlikely that the use of *O. behrmannii* in traditional medicine will increase in the near future.

Literature 347.
Other selected sources 826.
R.H.M.J. Lemmens

Orchidantha fimbriatum Holttum

Gard. Bull. Sing. 25: 243 (1970).
LOWIACEAE
$2n$ = unknown
Synonyms *Orchidantha longiflora* auct. non (Scort.) Ridley.
Vernacular names Malaysia: lobak hutan, lebok hutan (Peninsular).
Origin and geographic distribution *O. fimbriatum* is endemic to Peninsular Malaysia.
Uses Scorched leaves of *O. fimbriatum* are recommended to relieve pains in the chest and back. The leaves are sometimes used for wrapping food in cooking.
Botany A perennial herb with a thick root, creeping rhizome and short, erect or suberect stems, often with lateral branches and then tufted. Leaves distichously alternate, simple and entire, elliptical, up to 100 cm × 15 cm, undulate at margins, with longitudinal veins joined with numerous fine cross-veinlets; petiole long with sheath up to 30 cm long at base. Inflorescence a terminal series of sympodially connected paracladia, each producing a single flower, bracteate. Flowers bisexual, large, 3-merous, short-lived; sepals narrowly oblong, 11–14 cm × 2 cm; lateral petals short, up to 3 cm long, creamy with dark purple base and apex, median one (labellum) large, 10–12 cm × 5 cm, creamy white with dark purple-brown base; stamens 5, free, c. 2.5 cm long; ovary inferior, 3-celled, prolonged into a solid structure, style c. 2 cm long, with deeply 3-lobed, fimbriate stigma c. 2.5 cm long. Fruit an elongate loculicidal capsule c. 8.5 cm long, many-seeded. Seeds c. 1 cm long, hairy, with a lacerated aril.
The flowers are located near the soil and have an unpleasant odour. They last 1–2 days. It has been observed that tree shrews feed on the nutritious tissue in the central part of the labellum. Pollination by scarabaeid dung beetles has been observed in the Bornean *O. inouei* Nagamasu & Sakai, which possesses flowers with a dung-like odour.
Orchidantha comprises about 10 species and is restricted to tropical Asia: Indo-China, southern China, Thailand, Peninsular Malaysia and Borneo. It is the single genus of the family *Lowiaceae*.
Ecology *O. fimbriatum* occurs in the undergrowth of lowland forest, often in wet locations at the base of mountains, and is locally common.
Genetic resources Although locally common, *O. fimbriatum* is endemic to Peninsular Malaysia and occurs there in a habitat that is under pressure, i.e. lowland, humid rain forest. All *Orchidantha* species have a very restricted distribution and should be considered liable to genetic erosion.
Prospects Application of *O. fimbriatum* in traditional medicine is very limited and it is unlikely to increase.
Literature 121, 364.
Other selected sources 806.
R.H.M.J. Lemmens

Osbeckia chinensis L.

Sp. pl. 1: 345 (1753).
MELASTOMATACEAE
n = 10
Vernacular names Philippines: payong-payong, saang-parang (Tagalog), korontillo (Panay Bisaya). Thailand: yaa phlong khon (Chumphon), aa noi (Chiang Mai), en aa noi (Ubon Ratchathani). Vietnam: mua t[es]p.
Origin and geographic distribution *O. chinensis* is widely distributed, from Indo-China, southern China, Taiwan and southern Japan, through Thailand and the whole of Malesia, to northern Australia.
Uses In Papua New Guinea the whole plant of *O. chinensis* is used externally to treat toothache. In Vietnam whole plants are used to treat dysentery, tuberculosis of the lungs and haemorrhages. A decoction of dried leaves of *O. crinita* Benth. ex Triana is applied in northern Vietnam as a gargle to treat toothache. In Sri Lanka *O. aspera* (L.) Blume and *O. octandra* (L.) DC. are both used in traditional medicine to treat liver diseases.
Properties Antioxidant activity has been recorded for *O. chinensis*, possibly due to the presence of kaempferol, quercetin, their 3-glucosides, quercetin-3-glucoglucoside, tannins and osbeckia acid. Other chemical constituents isolated from *O. chinensis* are 2-furoic acid, succinic acid, ursolic acid and daucosterol.
In a screening assay based on protection of human-liver derived HepG2 cells against toxic damage by bromobenzene and 2,6-diMeNAPQI, a crude extract of *O. aspera* from Sri Lanka significantly improved viability of the cells. A leaf extract of *O. aspera* also showed some antioxidant activity. It can markedly decrease carbon tetrachloride-mediated reduction in aniline hydroxy-

lase and p-aminopyrine N-demethylase activity and inhibit peroxidative damage to the cell membrane. Antioxidant compounds in *O. aspera* may be an important mechanism responsible for the in-vivo hepatoprotective activity of this plant. An aqueous leaf extract of *O. aspera* also showed inhibitory effect on lymphocyte proliferation stimulated by phytohaemagglutinin and tuberculin purified protein derivative. The combined hepatoprotective and immunosuppressive effects of the extract are more likely to be beneficial in acute hepatitis rather than chronic hepatitis viral infection.

A leaf extract of *O. octandra*, also from Sri Lanka, markedly decreased carbon tetrachloride-mediated alterations in the liver histopathology as well as the serum enzyme levels in rats. Post-treatment with the extract also resulted in a fast recovery of the liver. An aqueous extract of *O. octandra* significantly lowered the fasting blood glucose level and markedly improved glucose tolerance in Sprague Dawley rats. Maximum hypoglycaemic activity was observed after 3 hours and was comparable to that of tolbutamide.

Botany An erect herb or subshrub, up to 70 cm tall, with 4-angled branches. Leaves opposite, simple and entire, oblong-lanceolate, 1–6 cm × 0.5–2 cm, rounded at base, acute at apex, 3–5-veined from the base, very shortly petioled; stipules absent. Inflorescence a terminal cyme, (1–)5–10-flowered, with involucre of leaves at base. Flowers bisexual, 4-merous, sessile; hypanthium (calyx tube) campanulate, c. 5 mm long, with pectinate scales and tufts of hairs, calyx lobes 6–8 mm long; petals free, 1–1.5 cm long, red-purple; stamens 8, subequal; ovary inferior, adnate to hypanthium, setose at apex, 4–5-celled, style filiform, curved. Fruit a subglobular capsule 3–7 mm in diameter, included in the hypanthium, apically 4–5-valved, many-seeded. Seeds shell-shaped.

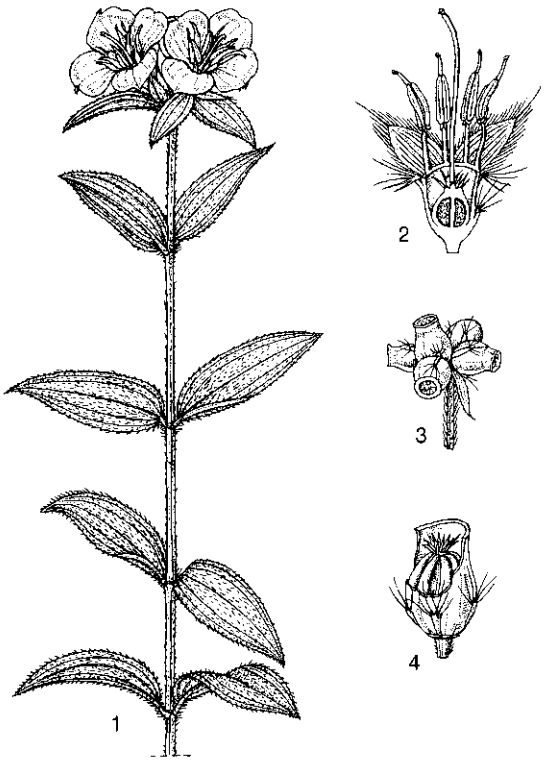
O. chinensis can be found flowering and fruiting throughout the year.

Osbeckia comprises about 50 species and occurs in Africa, tropical and subtropical Asia and northern Australia.

Ecology *O. chinensis* can be found in grassland and roadsides, occasionally in thickets and open forest, up to 2000 m altitude.

Genetic resources *O. chinensis* is widespread and occurs in open anthropogenic habitats. There is no reason to consider it liable to genetic erosion.

Prospects Tests of leaf extracts of *O. aspera* and *O. octandra* from Sri Lanka showed hepatoprotective abilities, thus justifying their use in traditional medicine for the treatment of liver dysfunction. No pharmacological research has yet been done on *O. chinensis*, but its use in traditional medicine in regions as far apart as Vietnam and Papua New Guinea, and the positive results of tests of the Sri Lankan *Osbeckia* species are encouraging.



Osbeckia chinensis L. – 1, flowering stem; 2, flower in longitudinal section; 3, fruits; 4, fruit with hypanthium partly removed.

Literature 62, 248, 331, 347, 817, 1050.

Other selected sources 242, 417, 418, 671, 674, 924, 925.

R.H.M.J. Lemmens

Pandanus Parkinson

J. voy. South Seas: 46 (1773).

PANDANACEAE

$x = 30$; *P. klossii*: $2n = 60$

Origin and geographic distribution *Pandanus* comprises about 700 species and occurs in Africa, Madagascar, islands of the Indian Ocean, Nepal, India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Taiwan, Japan, Thailand,

throughout the Malesian region, Australia and islands of the Pacific Ocean.

Uses Leaf decoctions of *P. affinis* and *P. klossii*, and probably other *Pandanus* species, are administered after childbirth in Peninsular Malaysia. Several other *Pandanus* species are used in traditional medicine in South-East Asia but have another primary use. After soaking *P. amaryllifolius* Roxb. leaves in coconut oil, the oil is employed as an embrocation for rheumatic troubles. Infusions of *P. amaryllifolius* leaves are used internally and externally as a sedative against restlessness, and in Thailand they are used as a traditional medicine as a diuretic. Young leaf tops of *P. furcatus* Roxb. are used as an antidote and, after roasting over a fire, to treat cough, whereas the leaf sap is used against diarrhoea and dysentery. In Papua New Guinea (New Ireland) *P. tectorius* Parkinson bark is scraped into a wild ginger leaf, water is added and the solution is squeezed into a cup and drunk to sedate mental patients. The leaves of *P. odoratissimus* L.f. are used in the Philippines as a cardiotonic and purgative, and those of *P. odoratissimus* and *P. tectorius* are said to be useful against leprosy, smallpox, rabies and heart and brain diseases. The roots of *P. tectorius* are considered diuretic and used in Vietnamese folk medicine to treat oliguria and urinary troubles. The roots of *P. odoratissimus* are considered antipyretic, expectorant and diuretic in Thailand, and the male inflorescence cardiotonic. Decoctions of fresh or dried prop roots of *P. luzonensis* Merr. are credited with diuretic properties in the Philippines. Fresh fruits of *P. polycephalus* Lamk are used in Sulawesi as an abortifacient. *P. antaresensis* St. John is used in New Guinea in healing rituals to treat fever, headache, diarrhoea and difficult breathing.

Pandanus is very important for the production of fibre, especially *P. atrocarpus* Griffith, *P. furcatus*, *P. odoratissimus* and *P. tectorius*. Leaf material, usually reduced to strips, is used for weaving a range of articles, from small handbags and containers to large floor mats or light interior wall panels. Some *Pandanus* species provide food products; fruits of *P. conoideus* Lamk and *P. leram* Jones ex Fontana, and seeds of *P. brosimos* Merr. & Perry are eaten in South-East Asia, and leaves of *P. amaryllifolius* are used fresh in cooking as a spice to impart flavour and colour (chlorophyll) to rice, sweets, jellies and many other food products. Finely cut leaves of the latter species are an ingredient of a hair oil used in Java. *Pandanus* is commonly grown as an ornamental, especially cultivars of *P. tectorius*, and is also used in fences and windbreaks.

Properties The application of *P. amaryllifolius* as antidiabetic drug seems linked to 4-hydroxybenzoic acid, which has been isolated from the roots. It shows hypoglycaemic effects in normal rats (oral administration of 5 mg/kg), and increases serum insulin levels and liver glycogen content. This compound caused a dose-dependent decrease in plasma glucose levels in steptozotocin-diabetic rats, but did not affect serum insulin level and liver glycogen content in the diabetic model. It increased glucose consumption in normal and diabetic rat diaphragms, suggesting a hypoglycaemic effect mediated by an increase in the peripheral glucose consumption.

The oil from *P. odoratissimus* inflorescences is considered to have stimulant and antispasmodic properties, whereas root extracts have shown great antioxidative activity. The leaf juice was found to inhibit the formation of skin, liver and colon tumours in tests with mice.

In New Guinea *Pandanus* fruits have been reported to contain toxic substances capable of producing mental change. Among other alkaloids, dimethyltryptamine has been isolated from the fruits. Fresh fruits may also cause sore lips and blistered tongue.

Botany Dioecious, evergreen, often palm-like trees or shrubs with an erect to decumbent stem, usually with rigid prop roots descending from leaf axils; stem often branched in a trichotomous or dichotomous pattern, often knobbly or prickly, with manifest leaf scars. Leaves arranged in 3 spiral rows, simple, linear, usually M-shaped in cross-section, usually with prickles along the margins and the underside of the midrib, with numerous longitudinal veins, usually amplexicaul. Inflorescence unisexual, male one a bracteate spike, usually arranged in a raceme, female one a globose to cylindrical head, sometimes arranged in a spike. Flowers unisexual, without perianth; male flowers with a cluster of stamens; female flowers with massed 1–many-celled carpels, style indistinct. Fruit a drupe or a syncarp of drupes, resembling a pineapple, ripening to yellow, orange or red, occasionally purplish-red. Seed fusiform or obovoid, with thin seedcoat, containing endosperm.

Seed germination is often very slow, and within the bony endocarp of the fruit. Apomixis is common and parthenocarpy is the rule. Fruit dispersal is usually by birds, mammals or water currents.

The very large genus *Pandanus* is divided into 8

subgenera and over 70 sections. *P. affinis* belongs to subgenus and section *Acrostigma*, *P. klossii* to subgenus and section *Rykia*. The identifications of species in such a large and difficult genus are often doubtful and this makes literature difficult to interpret. It is also somewhat doubtful whether the uses cited for *P. affinis* and *P. klossii* in Peninsular Malaysia really refer to these species. However, several *Pandanus* species are probably used interchangeably for the same purpose.

Ecology *Pandanus* mainly occurs on tropical sea coasts, often on sandy beaches, littoral thickets, on the edges of brackish marshes and mangroves and more inland along water courses, less common at higher altitudes (e.g. *P. klossii*). Rainfall should be high, but soil requirements are low, although heavy, poorly drained loams are not suitable.

Management *Pandanus* is usually propagated vegetatively, from sucker shoots or stem fragments. Cleanly removed from the leaf axils, suckers can be planted straight away or rooted first in a sandy medium. *Pandanus* may also be propagated by seed, but seeds should be soaked for 24 hours before planting.

Genetic resources *Pandanus* is known for its high degree of endemism and thus many species are liable to genetic erosion and sometimes even threatened by extinction. Collection from the wild and habitat destruction endanger many species. Germplasm collection is badly needed.

Prospects Although *Pandanus* may be of considerable local importance in South-East Asia, it has so far only been of marginal interest to agricultural institutions. These multipurpose plants deserve more attention, not only for enhancing their value as fibre plants, food plants and ornamentals, but also to evaluate their pharmacological value. The comparatively few pharmacological tests carried out showed promising results.

Literature 196, 357, 391, 671, 738, 739, 760, 817, 838, 967.

Selection of species

Pandanus affinis Kurz

Journ. Bot. 5: 101 (1867).

Synonyms *Pandanus aurantiacus* Ridley (1903).

Vernacular names Malaysia: mengkuang bunga, pandan ikan (Peninsular). Vietnam: d[uws]a cam.

Distribution Vietnam (rare), Peninsular Malaysia, Borneo and the Philippines (Palawan).

Uses In Peninsular Malaysia, a leaf decoction is applied as a tonic after childbirth.

Observations A large shrub up to 5 m tall, with prop roots up to 60 cm long at stem base; leaves up to 200 cm × 4(–5) cm, prickly at margins and midrib; male spike up to 11 cm × 2 cm, with numerous stamens having short filaments, female heads usually 5 together, ovoid-ellipsoid, up to 7 cm × 5.5 cm, having numerous distinct carpels; fruit obovoid, c. 2 cm × 0.5 cm, beaked, free in the upper third. *P. affinis* occurs in freshwater swamps and along watercourses in the lowland.

Selected sources 121, 250.

Pandanus klossii Ridley

Journ. Fed. Mal. States Mus. 6: 190 (1915).

Vernacular names Malaysia: hakek jehun, mengkuang kayu (Peninsular).

Distribution Peninsular Malaysia.

Uses A leaf decoction is applied as a tonic after childbirth.

Observations A large shrub or small tree up to 8 m tall, with stout, erect trunk and prop roots at stem base; leaves up to 150 cm × 7.5 cm, prickly at margins and midrib; female heads solitary, globose to oblong, c. 25 cm long; fruit c. 6 cm long, (3–)5–7(–10) connate, shortly free at tip. *P. klossii* occurs locally, but sometimes abundantly, in mountains at 1500–1800 m altitude.

Selected sources 121, 789.

Lean Teik Ng & Su Foong Yap

Papuechites aambe (Warb.) Markgr.

Nova Guinea 14: 288 (1927).

APOCYNACEAE

$2n$ = unknown

Synonyms *Anodendron aambe* (Warb.) Warb. (1891), *Strophanthus aambe* Warb. (1891).

Vernacular names Papua New Guinea: kap (Manus Island).

Origin and geographic distribution *P. aambe* occurs in the Moluccas (Ambon, the Aru Islands), New Guinea and the Bismarck Archipelago.

Uses In Papua New Guinea (Manus Island) latex from the stem is applied to sores.

Botany A liana with terete branches and glabrous, sparsely puberulent or tomentose branchlets, producing white latex. Leaves opposite, simple and entire, elliptical, 3.5–13.5 cm × 1–6.5 cm, cuneate to obtuse at base, acuminate at apex, thinly leathery, glabrous to puberulent below, pin-

nately veined with 6–12 pairs of secondary veins; petiole 0.5–1.5 cm long; stipules absent. Inflorescence a terminal or axillary thyrse up to 25 cm long, sparsely to densely tomentose. Flowers bisexual, regular, 5-merous; pedicel 3–9 mm long; sepals free, ovate, up to 2 mm long, with colleters in the corners; corolla with tube up to 5 mm long, slightly widening in upper part, and spreading lobes up to 5 mm long, overlapping to the right in bud, pink or red; stamens inserted where the corolla tube widens, included, filaments short, attached in a ring to the pistil head; disk of 5 free lobes; ovary superior, consisting of 2 separate carpels with a short common style and pistil head. Fruit consisting of 2 divergent follicles 5–7.5 cm long, broad at base, tapering to the apex, with 2 longitudinal ridges, glabrous, many-seeded. Seeds elliptical, flat, c. 1 cm long, with a long apical beak bearing coma hairs.

Papuechites comprises a single species.

Ecology *P. aambe* occurs as a forest climber up to 1300 m altitude.

Genetic resources *P. aambe* is widely distributed in New Guinea and seems to be fairly common there, but there are few records from the Moluccas.

Prospects The medicinal applications of *P. aambe* are limited, and it is unlikely that its utilization will increase.

Literature 347.

Other selected sources 624.

R.H.M.J. Lemmens

Paramignya scandens (Griffith) Craib

Fl. siam. 1: 235 (1926).

RUTACEAE

$2n$ = unknown

Synonyms *Paramignya griffithii* Hook.f. (1875).

Vernacular names Malaysia: mecanduk, susuh ayam, panak rimba (Peninsular). Thailand: chaang ngaa dieo (Chanthaburi), naam khaa bai (Prachuap Khiri Khan), duei kai (Satun). Vietnam: x[as]o leo.

Origin and geographic distribution *P. scandens* has been recorded for eastern India (Assam), southern Burma (Myanmar), Vietnam, southern Thailand, Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia, a decoction of the roots of *P. scandens* is drunk to treat abdominal complaints and after childbirth. A lotion or decoction of the whole plant is used to treat syphilis. Locally in Peninsular Malaysia, a decoction of the roots is considered a good tonic, e.g. to improve the ability to withstand low temperatures.

Properties The few tests that have been carried out on the chemistry of *P. scandens* showed different results. One test demonstrated a moderate amount of saponins in the leaves, but these were absent in the stem, whereas alkaloids and terpenes were not found. In another test, a small amount of terpenes was demonstrated in the leaves and stem, but no alkaloids or saponins. Flavanone, triterpene and chromene derivatives have been isolated from the stems. An aqueous ethanol extract showed antibacterial activity against *Bacillus subtilis*.

Coumarins such as poncitrin, nordentatin and the sterol β-sitosterol have been isolated from *P. monophylla* Wight in Sri Lanka. Flindissone, deoxyflindissone and 4 tirucallane derivatives have been isolated from the fruits.

Botany A liana, with short, recurved spines; twigs zigzag, glabrous or scurfy. Leaves alternate, unifoliolate, elliptical or oblong, 7.5–12.5 cm × 3.5–6 cm, rounded at base, shortly and bluntly acuminate at apex, entire, leathery; petiole short, with a swollen knee at each end; stipules absent. Inflorescence an axillary fascicle, but flowers often solitary. Flowers bisexual, regular, 5-merous, fragrant; calyx cup-like, acutely lobed; petals free, lanceolate-oblong, c. 8 mm long, white; stamens 10, free, inserted round a columnar disk, filaments linear, hairy; ovary superior, 5-celled, style elongate. Fruit a globose-ovoid berry, with a thick peel, resinous glandular, few-seeded. Seeds comparatively large, flattened.

P. scandens produces abundantly viable seeds when it fruits. *Paramignya* comprises about 12 species, and occurs in India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand, Malesia and northern Australia. It seems to be related to the monotypic genus *Merope*, which is an erect shrub or small tree with stout spines and angled fruits, and to *Atalantia* (about 11 species) and *Severinia* (about 6 species), which both comprise shrubs and small trees. A revision of the genus and related genera is needed to clarify species and genus limits, as well as exact species distributions.

Ecology *P. scandens* occurs in lowland forest. It is in general not common, but it may be locally abundant.

Genetic resources In Peninsular Malaysia, *P. scandens* is locally considered an important and valuable medicine as a tonic, which might be a reason for overharvesting. Considerable genetic

variation may exist as phytochemical tests on different samples showed different results.

Prospects Plants used as a tonic have a strong standing in traditional medicine. *P. scandens* might be marketed as a good tonic, if it is accompanied with good publicity and ensured of an adequate supply through cultivation. However, much research on the chemical and pharmacological properties is still needed.

Literature 209, 282, 705.

Other selected sources 121, 515, 706, 731, 789, 982, 990.

H.C. Ong

Pararuellia napifera (Zoll.) Bremek.

Verh. Kon. Ned. Akad. Wetensch. Afd. Natuurk., Sect. 2, 45(1): 30 (1948).

ACANTHACEAE

$2n$ = unknown

Synonyms *Ruellia napifera* Zoll. (1845).

Vernacular names Indonesia: gempur batu, keci beling (a name also used for several other *Acanthaceae*).

Origin and geographic distribution *P. napifera* occurs in eastern Java and the Lesser Sunda Islands.

Uses A decoction of *P. napifera* leaves is used to treat kidney stones.

Properties An orally administered infusion of whole *P. napifera* plants (5 g/kg body weight) had a significant anticalculus effect in tests with rats. This was also the case for an ethanolic extract at a dose of 600 mg/kg body weight.

Botany A small herb up to 15 cm tall; roots often long, sometimes with slightly nodose thickenings. Leaves in a radical rosette, simple, spatulate or obovate, 3–16 cm × 2–4 cm, cuneate to obtuse at base, obtuse to rounded at apex, crenulate at margins, sparingly hairy, with linear cystoliths; petiole 1–4 cm long; stipules absent. Inflorescence an erect, lax, long-peduncled spike 3–15 cm long, solitary or fascicled in the axils of opposite bracts. Flowers bisexual, 5-merous; bracteoles narrowly triangular, up to 7 mm long, pubescent; calyx 5–8 mm long, with narrow, equal segments; corolla c. 2.5 cm long, campanulate with narrow base, equally lobed with lobes contorted in bud, later patent, bright violet; stamens 4, inserted at base of corolla tube, didynamous, basally pairwise connected by a membrane; ovary superior, 2-celled, style subulate, pubescent, with 2 unequal stigmatic lobes. Fruit a terete capsule c. 2 cm long, many-seeded. Seeds orbicular, compressed, ringed with hygroscopic hairs.

P. napifera has originally been described in *Ruellia*, which was considered a large and variable genus. Several attempts to split it up into segregate genera which form more natural groups have been made, one of these being *Pararuellia*, which comprises about 5 species and occurs in Indo-China and the Malesian region east to the Moluccas. However, there is still disagreement among taxonomists about the generic concept within the group of *Acanthaceae* to which *Pararuellia* and related genera such as *Dipteracanthus* and *Ruellia* belong.

Ecology *P. napifera* occurs on shaded rocks, e.g. in fissures of limestone cliffs, up to 150 m altitude.

Management The leaves of *P. napifera* can be dried and stored for some time without losing their activity.

Genetic resources *P. napifera* apparently has a restricted area of distribution and is uncommon. It might easily become endangered by overcollection or habitat destruction, but there are no indications that this is already the case.

Prospects The use of *P. napifera* to treat kidney complaints is in agreement with several other *Acanthaceae* for which pharmacological activities such as diuretic properties have been demonstrated. Future phytochemical research on *P. napifera* may reveal similar compounds as found in e.g. *Hemigraphis alternata* (Burm.f.) T. Anderson. However, its prospects as a medicinal plant seem limited.

Literature 8, 62, 491, 687.

Other selected sources 334.

Yun Astuti Nugroho

Pentaphragma begoniifolium (Roxb. ex Jack) Wallich ex G. Don

Gen. hist. 3: 731 (1834).

PENTAPHRAGMATACEAE

$2n$ = unknown

Synonyms *Phyteuma begoniifolium* Roxb. ex Jack (1820).

Vernacular names Malaysia: pokok salang-suang (Peninsular). Thailand: phak paa, huu mee (peninsular).

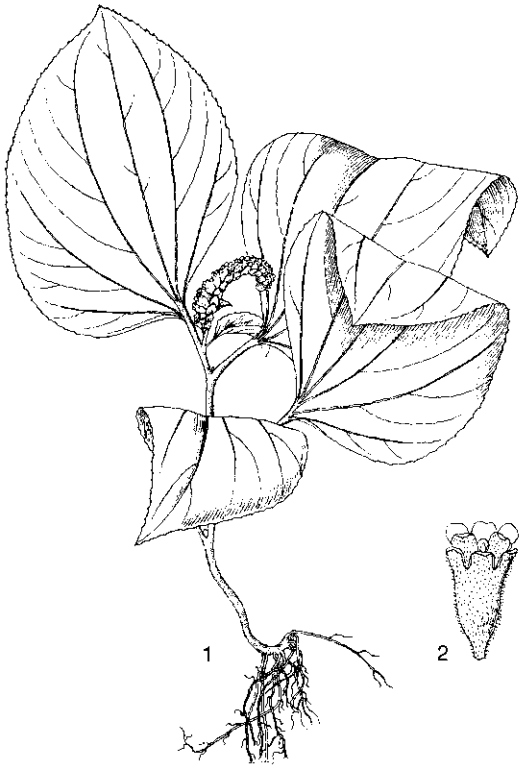
Origin and geographic distribution *P. begoniifolium* is restricted to southern Burma (Myanmar), peninsular Thailand and the northern part of Peninsular Malaysia.

Uses In Peninsular Malaysia *P. begoniifolium*

roots are applied as a poultice to swellings.
The roots of *P. ellipticum* Poulsen var. *flocculosum* (King & Gamble) Kiew are eaten raw in Peninsular Malaysia to treat piles and malaria, whereas in the Lingga Archipelago (Indonesia) an infusion of leaves and especially roots of *P. ellipticum* is used for treating venereal diseases. The leaves are laid on the stomach of small children to treat constipation.

Properties There is no information on the phytochemistry of *P. begoniifolium*, but leaves and stems of *P. ellipticum* var. *flocculosum* show high levels of saponins and the presence of other triterpenes/steroids.

Botany A perennial, succulent herb up to 25 cm tall. Leaves alternate, simple, conspicuously asymmetrical, obliquely ovate to obliquely lanceolate or obliquely reniform, 10–30 cm × 6–13.5 cm, base rounded to cordate on one side, strongly excised-concave on other side, apex shortly acuminate, finely but sharply serrate, fleshy; petiole 2–4 cm long; stipules absent. Inflorescence terminal or axillary, usually solitary, 4–5 cm long, at first dense and scorpioid, ultimately lax and almost straight, bracteolate. Flowers bisexual, 5-merous, subtended by orbicular-obovate bracts 5–9 mm long; calyx tube 4–5 mm × 3 mm, sparsely pilose, lobes unequal, ovate to orbicular, 2–2.5 mm long; corolla 3 mm long, with short tube, lobes spatulate-obovate, slightly fleshy; stamens alternating with corolla lobes; ovary inferior, 2-celled, style short, stigma massive. Fruit an ellipsoid, indehiscent berry 8–9 mm × 3–4 mm, many-seeded. Seeds ovoid, minute.
Pentaphragma belongs to the monotypic family *Pentaphragmataceae*, separated from the *Campanulaceae*. It consists of about 30 species, distributed in southern Burma (Myanmar), Indo-China, southern China, Thailand and throughout Malesia (except Java and the Lesser Sunda Islands). Borneo is the major centre of diversity.



Pentaphragma begoniifolium (Roxb. ex Jack) Wallich ex G. Don – 1, plant habit; 2, flower.

Ecology *P. begoniifolium* occurs in lowland rain forest, often on rocks along streams, from sea-level up to 600 m altitude.

Genetic resources *P. begoniifolium* is apparently confined to lowland rain forest in a relatively small area that in general is subject to logging and clear felling of forest. This makes it prone to genetic erosion.

Prospects Pharmacological research is needed to support the use of *P. begoniifolium* in traditional medicine.

Literature 121, 247, 914.

Other selected sources 472, 474.

R. Kiew

Peristrophe acuminata Nees

Wallich, Pl. asiat. rar. 3: 113 (1832).
ACANTHACEAE
$2n$ = unknown

Vernacular names Malaysia: rumput lidah jin, setawar ular, pokok tangkai jerami (Peninsular). Thailand: yaa chon (Nakhon Si Thammarat).

Origin and geographic distribution *P. acuminata* is known from southern Burma (Myanmar), southern Thailand, Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia, *P. acuminata* has been used externally on wounds, particularly snakebites, and internally in a decoction to treat smallpox.
Some other *Peristrophe* species are better known in South-East Asia. The pounded leaves of *P. bivalvis* (L.) Merr. are used in Malaysia as a poultice to relieve skin complaints and whole plants to treat cough in Vietnam, but the primary use is to

colour cotton and mattings purplish or orange-reddish. *P. paniculata* (Forssk.) Brummitt (synonym: *P. bicalyculata* (Retz.) Nees) is applied in traditional medicine in India and Africa, especially as a remedy for snakebites, but is more commonly used as a green manure and fodder for e.g. horses.

Properties An unidentified alkaloid has been found in leaves and stems of *P. paniculata*, and an isolated essential oil showed tuberculostatic activity in vitro, inhibiting the growth of various *Mycobacterium tuberculosis* strains. A chloroform extract of sun-dried *P. paniculata* leaves showed nematicidal activity on *Meloidogyne incognita*. An extract from this herb inhibited the growth of 3 keratinophilic fungi.

Botany A herb up to 100 cm tall. Leaves opposite, simple and entire, lanceolate, 6–7.5 cm × 1–1.5 cm, narrowed at both ends, glabrous; petiole 1–1.5 cm long; stipules absent. Inflorescence a terminal and axillary short cyme, shortly peduncled, distinctly bracteate. Flowers bisexual; calyx deeply 5-partite; corolla resupinate by torsion of the tube, c. 1.5 cm long, tube long and slender, widened at apex, white, limb 2-lipped, purple with a creamy blotch and many purple spots in the mouth, upper lip entire or minutely emarginate, lower lip shortly 3-lobed; stamens 2, inserted near the apex of the corolla tube at unequal level, long-exserted; ovary superior, 2-celled, style 2-lobed. Fruit a clavate to ellipsoid capsule, c. 1 cm long, pubescent, loculicidally dehiscent, (2–)4-seeded. Seeds compressed orbicular, tuberculate.

Peristrophe comprises approximately 25 species, and occurs in tropical and subtropical Africa and Asia. In Africa, 9 species are found. This genus is closely related to *Dicliptera*, which differs only in the nature of the placental bases in the fruit; these are inelastic in *Peristrophe* and elastic in *Dicliptera*.

A prospective revision of the Asiatic *Peristrophe* species may reveal that *P. acuminata* is conspecific with *P. hyssopifolia* (Burm.f.) Bremek. from Java. If this is the case, the latter name is the correct name for the species.

Ecology *P. acuminata* occurs in waste places and on roadsides, and it is common in many regions within its area of distribution.

Genetic resources This species is not liable to genetic erosion as it is common and often occurs in anthropogenic habitats. Future research may prove that it has a much larger distribution than assumed.

Prospects The obvious similar applications of *Peristrophe* species in traditional medicine in different parts of Asia and Africa seem to indicate a certain activity, particularly for external usage on wounds caused by e.g. snakebites. This warrants further research. As is the case for many *Acanthaceae* genera, a taxonomic monograph of *Peristrophe* is urgently needed.

Literature 121, 459, 789.

Other selected sources 120, 145, 239, 542, 761.

R.H.M.J. Lemmens

Philydrum lanuginosum Banks & Sol. ex Gaertner

Fruct. sem. pl. 1: 62, t. 16 (1788).

PHILYDRACEAE

$2n = 16$

Vernacular names Malaysia: rumput kipas (Peninsular). Vietnam: c[or] du[oo]i l[uw][ow]n, b[oof]n b[oof]n, di[eef]n th[oo]ng.

Origin and geographic distribution *P. lanuginosum* occurs in the Andaman Islands, Burma (Myanmar), Indo-China, southern China, Taiwan, the Ryukyu Islands, peninsular Thailand, Peninsular Malaysia, New Guinea, Guam and northern Australia. It is sometimes cultivated elsewhere.

Uses In Vietnam a decoction of whole plants, excluding the roots, is given to women before and after childbirth. *P. lanuginosum* is occasionally cultivated as a pond-ornamental, e.g. in Java.

Properties Syringetin and derivatives, miquelianin, common flavonols and proanthocyanidins have been recorded for *P. lanuginosum*.

Botany A perennial, caespitose herb up to 130 cm tall, with short rhizome. Leaves in a rosette, but distichously arranged, simple and entire, ensiform, 40–80 cm long, thick, parallel-veined, glabrous, with sheath 14–30 cm long. Inflorescence a terminal spike, simple or paniculate, with scape up to 130 cm long, with few cauline leaves gradually passing into bracts, villous in upper part. Flowers bisexual, zygomorphic, sessile, yellow; perianth consisting of 2 outer tepals up to 15 mm long and 2 inner tepals up to 8 mm long; stamen 1, 8–9 mm long, filament flattened, anther subspherical; ovary superior, 6–7 mm long, 1-celled or imperfectly 3-celled, style 3–4 mm long, stigma broad-triangular. Fruit a triangular-oblong capsule 9–10 mm × 4–5 mm, opening with 3 valves, many-seeded. Seeds bulb-shaped, up to 1 mm long, dark reddish.

The flowers last only one day. *P. lanuginosum* is autogamous. The tiny seeds may be dispersed by water; they float for long periods. *Philydrum* comprises a single species.

Ecology *P. lanuginosum* occurs in ponds, marshes and rice fields, sometimes also in moist savanna, at low altitudes.

Genetic resources Although *P. lanuginosum* seems to be rare in the Malesian region, it has a very large area of distribution and is not restricted to vulnerable habitats; consequently it is not endangered by genetic erosion.

Prospects Pharmacological research is needed to evaluate the use of *P. lanuginosum* in traditional medicine. Its use is very limited within its large area of distribution, and it is unlikely that it will gain importance.

Literature 247, 510, 671.

Other selected sources 62, 97, 121, 249, 250.

R.P. Escobin

Phyllagathis Blume

Flora 14: 507 (1831); Bijdr. Natuurk. Wetensch. 6: 248 (1831).

MELASTOMATACEAE

x = unknown; *P. griffithii*: 2n = 34–36

Origin and geographic distribution *Phyllagathis* comprises about 60 species. It occurs in 3 separate areas: northern Laos, Vietnam and southern China (about 35 species), peninsular Thailand, Peninsular Malaysia and Sumatra (about 12), and Borneo (about 13). Each species is endemic to one of these areas. Northern Vietnam and adjacent areas of southern China are particularly rich in species (about 20). Recently, the genus *Tylanthera* (with 2 species from northern and central Thailand) has been incorporated into *Phyllagathis*.

Uses Some uses in traditional medicine have been recorded for *Phyllagathis* in Peninsular Malaysia, particularly as a remedy for fever and malaria, but also for treating stomach-ache and giving strength after childbirth.

Properties Several galloylated cyanogenic glucosides based on prunasin and an alkyl glycoside constituent have been isolated from methanolic extracts of *P. rotundifolia*. Phytochemical tests on whole plants of *P. rotundifolia* gave negative results for the presence of alkaloids, terpenes and saponins. However, in *P. cordata* Ridley (endemic to Peninsular Malaysia) a high concentration of saponins has been found. The presence of ellagic acid and its derivatives has been demonstrated for the stem of several *Phyllagathis* species.

Botany Perennial herbs, sometimes shrubs up to 3.5 m tall; stem short, thick and gnarled, or elongate, often prostrate, sometimes rooting, plants sometimes acaulescent, usually minutely brown glandular, sometimes with additional indumentum of various trichomes. Leaves opposite, simple and entire, sometimes subdenticulate, 3–5(–7)-veined from the base, petiolate; stipules absent. Inflorescence a terminal umbel, sometimes head-like, a spike-like scorpioid thyrse or simple dichasium, sometimes appearing laterally, usually with long peduncle, bracteate or not, flowers sometimes solitary. Flowers bisexual, 4-merous, rarely 3- or 5-merous, with usually campanulate and more or less quadrangular hypanthium; sepals triangular or ligulate, often keeled, persistent in fruit; petals distinctly longer than sepals, free, red, pink, purple or white; stamens 8 in 2 whorls, equal or unequal, sometimes 4, filaments often flat, usually glabrous, anthers usually curved, dorsally usually with a small spur, opening with one pore; ovary inferior, 4-celled, with distinctly stalked placentas, apically carrying a crown of partly or fully connate lobes, style with small stigma. Fruit a campanulate, cup-shaped or urceolate capsule, often quadrangular and 8-ribbed, with enlarged ovary crown apically and often swollen hypanthium in the basal part, splitting loculicidally, the central column usually becoming 4-horned and thready, many-seeded. Seeds usually obovoid, usually beaked, testa more or less tuberculate, brown.

Growth is sympodial and occurs from the buds in the axils of the uppermost leaf pair subtending the inflorescence. However, growth is often monochasial due to suppression of one of the buds. The leaves of *P. rotundifolia* are iridescent blue in the understorey of the rain forest where the plants grow.

Phyllagathis can be distinguished from related genera such as *Sonerila* by the almost invariably 4-merous flowers and 4-horned and thready placentas.

Ecology *Phyllagathis* grows on the forest floor, usually in the lowland, but some species are found in the mountains.

Management Leaf cuttings have been obtained under natural conditions for *P. griffithii* and *P. rotundifolia*; they develop at the base of leaf blades which have been severed from the petiole. This offers possibilities for vegetative propagation.

Genetic resources Most *Phyllagathis* species

have a restricted occurrence, and many are very local endemics. Several species are classified as endangered plants in Peninsular Malaysia, e.g. *P. magnifica* A. Weber and *P. stonei* A. Weber. This makes them easily liable to genetic erosion or even extinction. Only a few species are more widely distributed, e.g. *P. rotundifolia* in the Peninsular Malaysia-Sumatra area.

Prospects Very little is known about *Phyllagathis* and its prospects as a medicinal plant are unclear. Research on phytochemistry and pharmacological properties is needed, but when considering future medicinal applications the vulnerability of many species should be borne in mind.

Literature 128, 282, 314, 331, 707.

Selection of species

Phyllagathis griffithii (Hook.f. ex Triana) King

Journ. As. Soc. Beng. 69: 45 (1900).

Vernacular names Malaysia: kerakap rimau, tutup bumi rimba, kapu-kapu (Peninsular).

Distribution Peninsular Malaysia.

Uses A decoction of roots and leaves has been used in a bath to treat malaria.

Observations A perennial herb with woody stem growing horizontally in or above the soil, leaf-bearing part ascending-suberect; leaves suborbicular to cordate, 12.5–20 cm × 12–20 cm, dull green above, reddish below, petiole 10–20 cm long; inflorescence up to 40 cm long, 5–6 nodes in upper half with opposite densely condensed cymes of small whitish flowers. *P. griffithii* is locally common in lowland forest, particularly in the foothills of mountains.

Selected sources 121, 789, 983.

Phyllagathis rotundifolia (Jack) Blume

Flora 14: 507 (1831); Bijdr. Natuurk. Wetensch. 6: 248 (1831).

Vernacular names Malaysia: akar serau malam, bawal hutan, seri bulan (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia, a decoction of the roots and leaves has been used to treat malaria, fever in children, stomach-ache and after childbirth to give strength.

Observations A perennial herb with short creeping stem; leaves suborbicular to obovate-cordate, 7.5–15 cm × 6–11 cm, shining dark green above, reddish below, petiole 5–10 cm long; inflorescence head-like, compact and shortly stalked, surrounded by 4 large, cordate or reniform involucral bracts. *P. rotundifolia* is common in lowland forest.

Selected sources 121, 571, 731, 789, 983.

H.C. Ong

Picrasma javanica Blume

Bijdr. fl. Ned. Ind.: 248 (1825).

SIMAROUBACEAE

$2n$ = unknown

Synonyms *Picrasma nepalensis* A.W. Bennett (1844), *Picrasma philippinensis* Elmer (1913).

Vernacular names Indonesia: ki pahit (Sundanese), tuba ulet (Palembang, Sumatra), pati laler (Javanese). Malaysia: balimbing (Sabah), kayu pahit (Sarawak). Thailand: kom khom (northern), dam, yee nam bai lek (peninsular). Vietnam: kh[oor] di[eej]p.

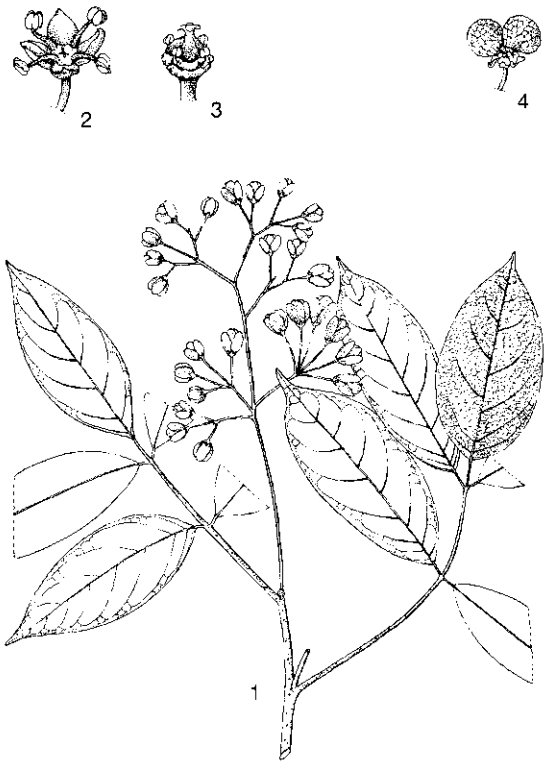
Origin and geographic distribution *P. javanica* occurs from north-eastern India throughout South-East Asia to the Solomon Islands.

Uses In Burma (Myanmar), Thailand and Java, the bark of *P. javanica* is used as a febrifuge, as a substitute for quinine. The leaves are applied to treat festering sores. Another more temperate Asiatic species, *P. quassioides* (D. Don) A.W. Bennett, is widely used in Chinese folk medicine. The fruit is stomachic, and a decoction of stem or bark is taken as a treatment for colic, stomach-ache, and as a febrifuge. The decoction is also applied as a vermifuge for cattle and as an insecticide. The wood of *Picrasma excelsa* Planchon (from Jamaica) is used as a substitute for *Quassia amara* L. wood.

Properties All plant parts of *P. javanica* are exceedingly bitter. The bitterness can be ascribed to the presence of quassinoids, sometimes also known as simaroubolides. Dozens of individual compounds, often classified as picrasidines, picrajavanins, javanicinocides or javanicins, have been recorded. The principal basic skeleton of these decanotriterpenes (C_{20}) is that of picrasan-16-one. In addition, the quassinoids differ in the positions of double bonds, hydroxy-, epoxy-, oxo- and/or ester-groups (often with acetic- or C_5-acids, e.g. hydroxybutyric, isovalerenic). Examples are quassin (= nigakilactone D), isoquassin (picrasmin), neoquassin and quassinol. Other components isolated belong to 2 categories of indole alkaloids: the β-carbolides (e.g. 1-vinyl-4,8-dimethoxy-β-carbolin)

and the canthin-6-ones (e.g. 2-methoxycanthin-6-one). Chloroform and ethanol extracts of *P. javanica* bark showed in-vitro antimalarial activity.
In a screening experiment using the disk diffusion method, extracts of leaves, seeds, stems and roots of *P. javanica*, collected in Papua New Guinea, showed antimicrobial activity. Light petroleum, dichloromethane, ethyl acetate and butanol fractions of the various methanol extracts showed a broad spectrum antibacterial activity but no antifungal activity.

Botany A monoecious or dioecious tree up to 25 m tall; bole fluted, up to 35 cm in diameter. Leaves arranged spirally, imparipinnate; petiole 2–6 cm long; stipules early caducous, foliaceous; leaflets opposite or subopposite, 4–20 cm × 1–10 cm, base cuneate, apex blunt-acuminate, entire. Inflorescence axillary, compound-cymose, unisexual, up to 20 cm long, bracteolate, long-peduncled. Flowers functionally unisexual, 4-merous, white to yellow or green, female ones usually twice as large as male; sepals triangular to ovate, c. 1 mm; petals ovate-oblong or oblong, in male flowers 2–5 mm × 1–2 mm, in female flowers 3–7 mm × 3–5 mm, accrescent; stamens up to 5 mm long in male flowers; disk 4-lobed, hairy; ovaries superior, up to 4, free, in male flowers absent, styles up to 4, united. Fruit consisting of 1–4, hardly fleshy drupelets; drupelet ovoid to depressed-globose, 9–10 mm × 7–12 mm, green to red or blue, exocarp thin, fleshy, wrinkled when dry, endocarp hard.
Picrasma comprises about 8 species, 6 in Central and South America, and 2 in Asia.



Picrasma javanica Blume – 1, flowering twig; 2, male flower; 3, female flower, sepals and petals removed; 4, fruit.

Ecology *P. javanica* occurs scattered in rain forest from sea-level up to 1500 m altitude.

Genetic resources Although widespread throughout South-East Asia, *P. javanica* is always rather scarce.

Prospects Little is known with respect to the pharmacology of *P. javanica*, as compared with other South-East Asian *Simaroubaceae* (e.g. *Ailanthus*, *Brucea*, *Eurycoma*, *Quassia*). In general quassinoids and canthin-6-ones, as found in numerous *Simaroubaceae*, display various interesting pharmacological effects, which make them of potential use in the development of templates for new drugs, e.g. to treat malaria. Because of the growing resistance of malaria parasites to the well-known, and even newer, antimalarials currently in use, there is a continuous need to develop new compounds to control this important infectious disease. The quassinoids and the canthin-6-one alkaloids might also have good potential for the development of a cytostatic drug to treat various cancers. Therefore, *P. javanica* merits scientific attention to explore its pharmacological potency.

Literature 44, 247, 463, 497, 731.
Other selected sources 121, 334, 496, 877.

Syamsul Hidayat

Pilea microphylla (L.) Liebm.

Kongel. Danske Vidensk. Selsk. Skr. 5, ser. 2: 296, 302 (1851).

URTICACEAE

$2n = 36, 42, 48, 50, 60$

Synonyms *Pilea muscosa* Lindley (1821).

Vernacular names Artillery plant, gunpowder plant (En). Indonesia: katumpangan (Jakarta), akar nasi, jalu-jalu bobudo (Moluccas). Philippines: alabong (Igorot). Vietnam: ph[as]o b[oo]ng, l[aw]n t[aw]n.

Origin and geographic distribution *P. microphylla* originates from South and Central America, but has escaped from cultivation and is

widely spread in other tropical and subtropical regions, e.g. in Africa, Madagascar and Asia. In South-East Asia it is naturalized, e.g. long since in Java, and also in towns in Peninsular Malaysia and the Philippines, but also elsewhere. In temperate regions it is a greenhouse weed, but locally, e.g. in the United States, it occurs persistently outdoors in flowerbeds and lawns.

Uses In Peninsular Malaysia *P. microphylla* plants, pounded with a little garlic and salt, have been applied to the abdomen of babies to expel worms. In the Philippines an infusion of entire plants is used as a diuretic. Numerous applications of *P. microphylla* in traditional medicine have been recorded for South and Central America. In Guatemala crushed plants are applied to sores and bruises, and a decoction of whole plants is used internally in Cuba as a diuretic and to treat liver and urinary inflammation, and in Jamaica as a tonic and to treat asthma. In the Grenadines the decoction is applied to children with diarrhoea.

P. microphylla is cultivated in gardens and as a pot plant, and also as a ground cover. A cultivar exists with leaves blotched white and pink.

Properties The presence of leucocyanidin, kaempferol, quercetin, caffeic acid and ferulic acid have been demonstrated in *P. microphylla* leaves. Two cytotoxic triterpenoids, epi-oleanolic acid and oxo-oleanolic acid, have been isolated from the aerial parts of *P. pumila* (L.) A. Gray in Korea. They exhibited cytotoxicity against cultured human tumour cell lines.

Botany A small monoecious annual or short-lived perennial herb up to 30 cm tall, but usually smaller, often much-branched and forming mats; stems drooping or ascending when older, juicy, usually glabrous; often short side-shoots present in leaf axils. Leaves opposite, but the leaves of a pair of very unequal size, simple and generally entire, obovate to elliptical or ovate, 1–15 mm × 0.5–4 mm, rounded to cuneate at base, rounded to obtuse at apex, glabrous, with prominent cystoliths above, indistinctly veined; petiole 0.5–6 mm long; stipules minute, caducous. Inflorescence an axillary small cymose cluster 1–4 mm long, sessile or pedunculate, usually with a few male and 5–10 female flowers. Flowers unisexual, small, 3-merous, subsessile; male flowers with subequal perianth segments and 3 stamens; female flowers with unequal perianth segments and superior, 1-celled ovary. Fruit an ovoid achene 0.5–1 mm long, smooth, brown.

When shaken or moistened, plants explosively scatter clouds of pollen. The small mature fruits are actively ejected by the reflexing staminodes.

Pilea microphylla (L.) Liebm. – 1, plant habit; 2, part of flowering stem; 3, fruit.

Pilea is a large genus of about 250 species and occurs in warmer regions throughout the world, except Australia and New Zealand. The Asiatic species are poorly known and in need of a revision. *Pilea* belongs to the tribe *Lecantheae*, together with e.g. *Elatostema*.

Ecology *P. microphylla* occurs on old walls, dams, roads and pathways, in Java up to 1400 m altitude.

Management Propagation of *P. microphylla* by stem cuttings is easy; they root easily in a sandy propagation mixture in a closed case.

Genetic resources *P. microphylla* is extremely widely spread and is still expanding its area of distribution. In many regions it is even considered a serious weed. The genetic variability is not yet well understood, but seems to be large, especially in the original area of distribution in the New World tropics.

Prospects Research on the pharmacological properties of *P. microphylla* seems worthwhile because it is used in traditional medicine in areas

which are far apart. Moreover, it is easy to propagate and grow, which could be advantageous for developing it into a medicinal plant to be cultivated under good management practices.

Literature 261, 334, 646, 760.

Other selected sources 62, 121, 331, 522.

R.H.M.J. Lemmens

Polyalthia Blume

Fl. Javae Anonac.: 68 (1830).

ANNONACEAE

$x = 9$; *P. longifolia*, *P. suberosa*: $2n = 18$

Origin and geographic distribution *Polyalthia* comprises approximately 100 species and occurs in the tropics of Africa (about 6 species), Madagascar (18 species) Asia and Australia. South-East Asia is particularly rich in species. *Polyalthia* is found throughout the Malesian region.

Uses In the Malesian region roots of *Polyalthia* are used in a decoction after childbirth and as an abortifacient, leaves are applied externally to treat skin diseases, and the bark is used as a febrifuge. Several other non-Malesian species are used in traditional medicine in Thailand: a decoction of *P. cerasoides* (Roxb.) Bedd. roots to treat fever and anaemia, and as a contraceptive for women and tonic for men, the roots or stems of *P. debilis* (Pierre) Finet & Gagnep. against abdominal pain, and a root decoction of *P. evecta* (Pierre) Finet & Gagnep. to treat abdominal pain and as a galactagogue.

The generally tough and flexible wood of *Polyalthia* is used for house building, interior trim, furniture, implements, packing cases, boxes, veneer and plywood. It is also suitable as firewood. The fibrous bark of several *Polyalthia* species is used to make rope. *P. longifolia* is planted as an ornamental.

Properties The leaves and branches of *P. suberosa* contain suberosol, a C-31 lanostane-type triterpene, which inhibits the growth of human immunodeficiency virus (HIV) in vitro. An azaanthracene alkaloid has also been isolated from the stem of *P. suberosa*. The alkaloids 7,7'-bisdehydro-O-methylisopiline, 7-dehydronornuciferine, 7'-dehydro-O-metylisopiline and urabaine have been isolated from *P. bullata* stem bark.

Clerodane-type diterpenes with cytotoxicity against human tumour cell lines have been isolated from *P. longifolia* stem bark. The stem bark also afforded the cytotoxic aporphine alkaloid liriodenine. Extracts of *P. longifolia* showed antifungal activity against various plant pathogenic fungi, and were also found to be toxic to mosquito larvae.

Clerodane-type diterpenes exhibiting broad cytotoxicity against a panel of human cancer cell lines were purified from an ethyl-acetate-soluble extract of stem bark of the Philippine *P. barnesii* Merr.

The compound pyridine-N-oxide-2-thiolate (as zinc or copper complexes) has been isolated from roots of *P. nemoralis* Aug.DC., a species of Vietnam and southern China. This compound showed strong antimalarial, antimycotic and antiseptic activities.

In tests in India the alcoholic extract of *P. cerasoides* stem bark significantly prevented cold immobilization stress-induced changes in lipid peroxidation, ascorbic acid content in both brain and liver and vitamin E levels in the serum, suggesting it possesses antistress activity. The benzopyran derivative polyalthidin has been isolated from the stem bark of *P. cerasoides*; this compound showed potent biological activity as an inhibitor of the mammalian mitochondrial respiratory chain.

A labdane type diterpene with activity against the promastigote *Leishmania donovani* has been isolated from the stem bark of *P. macropoda* King from Malaysia.

In tests in Indonesia a chloroform extract of *P. lateriflora* (Blume) King leaves showed distinct insecticidal activity on *Spodoptera litura*; terpene compounds have been suggested as active compounds.

Botany Erect or sometimes scandent shrubs to fairly large trees. Leaves distichously alternate, simple and entire, glabrous or with simple hairs, pinnately veined, shortly petiolate; stipules absent. Inflorescence an axillary, extra-axillary or leaf-opposed fascicle or umbelliform raceme, flowers often solitary, often cauliflorous or ramiflorous. Flowers bisexual, 3-merous; sepals free or connate at base, valvate; petals 6(–8), free, often quite large and showy, equal or unequal, spreading, sometimes erect or cohering, leathery to fleshy; stamens usually numerous, cuneate, with orbicular or rhomboid connective concealing the anther cells; carpels 3 to numerous, free, style absent, stigma oblong, capitate or irregularly shaped. Fruit consisting of few to many, stalked or subsessile monocarps, fleshy, 1–5-seeded. Seeds with a longitudinal groove. Seedling with epigeal or hypogeal germination; cotyledons emergent

and leafy or not emergent; hypocotyl elongated or not.

Early growth is reputed to be slow, becoming more rapid afterwards. *Polyalthia* develops according to Roux's architectural tree model, characterized by a monopodial orthotropic trunk with plagiotropic branches inserted continuously and with distichous leaf arrangement, flowering not influencing the architecture. Flowering can occur twice a year and flowers appear just before the new leaves. In general, *Annonaceae* fruits are eaten and dispersed by birds, mainly pigeons; fruits of *P. longifolia* are eaten and dispersed by bats.

Polyalthia is badly in need of revision. Some *Polyalthia* species from Africa have been placed in the separate genus *Greenwayodendron*, but this is still much disputed.

Ecology *Polyalthia* occurs scattered as an understorey tree or shrub, or as a main canopy tree in primary or secondary lowland forest, sometimes in lower montane forest, up to 1200(–1800) m altitude. It is found in evergreen and monsoon forest, both on well-drained hills and poorly drained level sites. Individual species may occur as common elements of peat-swamp forest, occasionally also in 'kerangas'.

Management *Polyalthia* can be propagated by seed, but germination is unpredictable. Seeds of several species showed 10–35% germination in 1–10 months in experiments in Peninsular Malaysia. *P. cauliflora* is highly vulnerable in the nursery, as the cotyledons and epicotyl are easily trapped in the testa and then rot. Sufficient watering and manual removal of the testa may resolve the problem. In natural forest the regeneration of *Polyalthia* is generally profuse.

Genetic resources Some *Polyalthia* species have a rather narrow geographical distribution and face the risk of genetic erosion by deforestation.

Prospects The numerous pharmacological tests showed many interesting properties of *Polyalthia* extracts, e.g. anti-HIV, antitumour, antifungal, antimalarial, antistress, antileishmanial and insecticidal activities. This certainly warrants more research, which may result in the development of modern drugs derived from these interesting medicinal plants. A taxonomic study of Asiatic *Polyalthia* is needed.

Literature 173, 581, 714, 785, 856, 883, 1048.

Selection of species

Polyalthia bullata King

Mat. fl. Malay Penins. 4: 313 (1893); Ann. Roy. Bot. Gard. Calc. 4: 79, pl. 111 (1893).

Vernacular names Malaysia: pokok peleh angin, tongkat ali (Peninsular). Thailand: lang kong (Trang).

Distribution Southern Thailand and Peninsular Malaysia.

Uses The vernacular names in Malaysia suggest that *P. bullata* is used there to treat liver diseases and as a tonic.

Observations A shrub up to 3 m tall, young twigs covered with golden hairs; leaves lanceolate or oblong-lanceolate, 28–37 cm × 3–12 cm, deeply cordate and auricled at base, papery or thinly leathery, bullate, petiole 3–5 mm long, stout; flowers solitary or 2–3 together opposite the leaves, petals linear, c. 2.5 cm long; monocarps subglobose, c. 1 cm in diameter, stalk c. 0.5 cm long, 2-seeded. *P. bullata* occurs in lowland forest.

Selected sources 121, 177, 860.

Polyalthia cauliflora Hook.f. & Thomson

Fl. ind. 1: 138 (1855).

Synonyms *Polyalthia beccarii* King (1893).

Vernacular names Malaysia: buah larak merah, pokok ruseh (Peninsular), balet (Sarawak). Thailand: champaa khom (Phangnga).

Distribution Southern Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia pounded leaves are applied as a poultice to treat skin diseases. In Sarawak, boiled roots are taken orally as an aid for birth control. The wood is used in house building.

Observations A shrub or small tree, twigs soon glabrous; leaves broadly elliptical to elliptical-lanceolate, 9–20 cm × 4–8 cm, acute or slightly rounded at base, thinly leathery, petiole 5–7 mm long; flowers mostly cauliflorous or ramiflorous, petals up to 5.5 cm long, cream-coloured to pinkish-brown; monocarps ovoid to subglobose, c. 1 cm in diameter, stalk 2–2.5 cm long, 1–2-seeded. *P. cauliflora* occurs in lowland forest.

Selected sources 121, 241, 860.

Polyalthia hypoleuca Hook.f. & Thomson

Fl. Brit. India 1: 63 (1872).

Vernacular names Indonesia: tepis (Sumatra), banet, usai (Bangka). Malaysia: akar larak hutan, melilin (Peninsular), selaut (Iban, Sabah). Thai-

land: sang yuu khaao (Nakhon Si Thammarat).

Distribution Peninsular Thailand, Peninsular Malaysia, Sumatra, Bangka and Borneo.

Uses In Peninsular Malaysia a decoction of the roots is given as a protective medicine after childbirth. The wood is used for implements, bows, oars, crates and toys. The fibrous bark is used for binding, also under water.

Observations A small to medium-sized tree up to 35 m tall with bole diameter up to 50 cm, twigs soon glabrous; leaves elliptical to narrowly elliptical, 6–12.5 cm × 2–3.5 cm, acute or rounded at base, leathery, petiole 3–7 mm long; flowers in axils of leaves or fallen leaves, petals linear, up to 1.2 cm long, pale yellow; monocarps ellipsoid, 1–2 cm long, stalk 2–5 mm long, 1-seeded. *P. hypoleuca* occurs in lowland forest, also in peat-swamp forest, up to 600 m altitude.

Selected sources 121, 334, 795, 860, 883, 990.

Polyalthia longifolia (Sonn.) Thwaites

Enum. pl. zeyl. 5: 398 (1864).

Distribution Native to southern India and Sri Lanka; planted in South-East Asia, e.g. in Peninsular Malaysia and Java.

Polyalthia longifolia (Sonn.) Thwaites – 1, flowering branch; 2, centre of flower; 3, fruiting branch.

Uses In India the bark is used as a febrifuge. The tough and flexible wood is used for making barrels. *P. longifolia* is cultivated as an ornamental, roadside and shade tree.

Observations A small to medium-sized tree up to 25 m tall, with a straight bole and dense crown, twigs soon glabrous; leaves ovate-oblong to narrowly lanceolate, 11–22 cm × 2–4.5(–6) cm, cuneate to rounded at base, wavy at margins, membranous, petiole 4–8 mm long; flowers in axils of leaves or fallen leaves, usually numerous, petals narrowly lanceolate, up to 1.2 cm long, greenish-yellow; monocarps subglobose to ovoid, 2–2.5 cm long, stalk 8–12 mm long, 1-seeded.

Selected sources 62, 121, 623, 782, 860, 883, 1055.

Polyalthia suberosa (Roxb.) Thwaites

Enum. pl. zeyl. 5: 398 (1864).

Vernacular names Philippines: duhat-matsing, baling-manok (Tagalog), munat (Iloko). Thailand: klueng klom (Ratchaburi), ching klom (peninsular), phak cham (northern). Vietnam: qu[aaf]n d[aaf]u v[or] s[oos]p.

Distribution Eastern and southern India, Sri Lanka, Burma (Myanmar), Indo-China, southern China (Hainan), Thailand, Peninsular Malaysia and the Philippines.

Uses In the Philippines a decoction of fresh roots is used as an abortifacient. The fruits are edible.

Observations A shrub up to 4 m tall, twigs densely fulvous pubescent when young, becoming glabrescent; leaves oblong to narrowly obovate or oblong-lanceolate, 2–11 cm × 1–3.5 cm, rounded or truncate and asymmetrical at base, membranous, petiole 1–4 mm long; flowers solitary, usually extra-axillary, sometimes leaf-opposed, petals elliptical to oblong, up to 0.6 cm long, yellowish-green, mostly suffused with purple; monocarps subglobose, c. 5 mm in diameter, blackish when ripe, stalk up to 1 cm long, 1–2-seeded. *P. suberosa* occurs in lowland forest and thickets.

Selected sources 173, 545, 760, 782, 860, 937.

R.H.M.J. Lemmens

Pothos scandens L.

Sp. pl. 2: 968 (1753).

ARACEAE

$2n = 24$

Synonyms *Pothos zollingerianus* Schott (1855), *Pothos hermaphroditus* (Blanco) Merr. (1918).

Vernacular names Indonesia: klabangan (Ja-

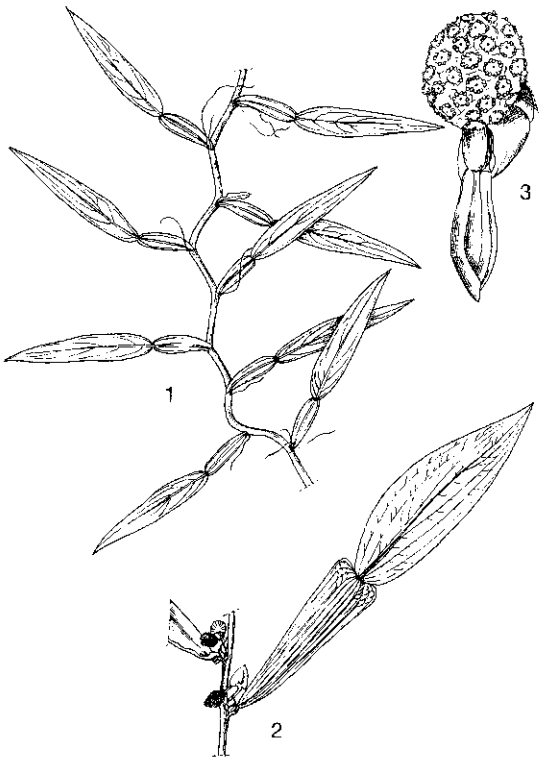
vanese), tapanawa kecil (Ambon). Malaysia: seginting, juloh-juloh (Peninsular). Philippines: apis (Tagalog), hipan, oro-ola (Bikol). Burma (Myanmar): wai mai (Shan). Laos: cha-kep, ma nok hon. Thailand: cha khep (central), waai tamoi (Uttaradit), kho kiu (Surat Thani, Yala). Vietnam: r[as]y leo.

Origin and geographic distribution *P. scandens* has an extremely large area of distribution: Madagascar, the Comores, the Seychelles, Nepal, India, Sri Lanka, Bangladesh, Burma (Myanmar), Indo-China, southern China (Yunnan), Thailand, and the whole Malesian region except New Guinea.

Uses In Peninsular Malaysia the leaves of *P. scandens* are applied externally to the abdomen of children to expel worms, and an infusion is used as a bath to treat convulsions. A powder of the leaves is applied to smallpox, and the steam from the heated stem, mixed with camphor, is inhaled against asthma. *P. scandens* is used in traditional medicine in Thailand as a blood coagulant, mainly to treat wounds, and as an antipyretic; fruits and leaves are applied as a compress. In Vietnam stems and leaves are used to treat fractures, bruises, swellings, ecchymosis and rheumatism. The lignified, tough central cylinder of the stem is often used for binding and basket-work.
Several other, non-Malesian species including *P. chinensis* (Raf.) Merr., *P. kerrii* Buchet ex P.C. Boyce, *P. pilulifer* Buchet ex P.C. Boyce and *P. repens* (Lour.) Druce are used for similar purposes in Indo-China, southern China and Thailand, and additionally to treat epilepsy, infantile paralysis, cough, indigestion and urinary problems.

Properties Medicinal preparations from *P. scandens* are bitter and acrid. An ethanol-water (1:1) extract exhibited antispasmodic activity against histamine.

Botany A root-climbing liana up to 6 m long; stem weakly angled or terete, up to 1 cm in diameter. Leaves distichously alternate, simple and entire, ovate to elliptical or lanceolate, 3–14 cm × 2–10 cm, rounded to cuneate at base, attenuate-mucronate at apex, entire, with 2 intramarginal veins per side and numerous parallel small veins; petiole 2–14 cm long, broadly winged, truncate, rounded or auriculate at apex; stipules absent. Inflorescence a solitary spadix in leaf axil, with spathe at base; spadix with stipe sharply bent at anthesis, globose to ovoid, 4–10 mm in diameter, yellowish-green to dirty white; spathe ovate, 4–8 mm long, margins variously inrolled, greenish to maroon. Flowers bisexual, 1–2 mm in diameter,



Pothos scandens L. – 1, part of sterile shoot; 2, part of fertile stem with leaf and inflorescences; 3, inflorescence.

with 6 tepals, 6 stamens, and a superior, 3-celled ovary, stigma sessile, punctiform. Fruit an obclavate berry 1–1.5 cm long, 1–5 per infructescence, ripening to deep scarlet, 1–3-seeded. Seeds ellipsoid to compressed-globose, 3–6 mm in diameter, with smooth testa, lacking albumen.
On germination, *P. scandens* produces a thread-like shoot with congested leaves. This shoot is shade-seeking and able to extend over a considerable distance along the forest floor. When a suitable vertical surface is encountered, the shoot attaches itself to the substrate by means of short clasping roots, and starts climbing. By the time the plant has reached 2–3 m height plagiotropic side branches develop to form extensive curtains of foliage. Flowering shoots arise from the leaf axils of these side branches.
Pothos comprises approximately 70 species and is distributed in the tropical and subtropical regions from Madagascar to southern China, eastern Australia and western Oceania. The greatest diversity is found in Malesia, particularly in Borneo. *Pothos* belongs in the tribe *Potheae* together with 2 mono-

specific genera, *Pedicellarum* and *Pothoidium*, from the Malesian region. *P. scandens* is highly variable, but unmistakable with its small inflorescences on bent stalks.

Ecology *P. scandens* grows on trees and rocks in primary and secondary, wet to dry forests in the lowland and mountains up to 2100 m altitude. Sometimes it is found in hedges, scrub vegetation and plantations, or on sea cliffs.

Management The stems and leaves of *P. scandens* are harvested from the wild and dried in the sun.

Genetic resources *P. scandens* is very widespread in widely divergent habitats and not in danger of genetic erosion.

Prospects Although *P. scandens* is widely used in traditional medicine, there is no information on its phytochemistry and pharmacological properties. Research seems worthwhile in view of its similar applications in widely divergent regions, and is needed to confirm the reputed activities.

Literature 106, 121, 971.

Other selected sources 88, 334, 611.

Nguyen Van Dzu

Prismatomeris tetrandra (Roxb.) K. Schumann

Engl. & Prantl, Nat. Pflanzenfam. 4: 138 (1891).
RUBIACEAE
$2n$ = unknown

Synonyms *Prismatomeris malayana* Ridley (1920), *Prismatomeris albidiflora* auct. non Thwaites.

Vernacular names Indonesia: mentulang (Bangka). Malaysia: sepedeh, mundess, susun kelapa hutan (Peninsular). Philippines: hagpo (Ibanag). Cambodia: romdenh men, romdenh meas. Thailand: kraduk kai (peninsular), to kraduk (Loei), son pa (Nakhon Ratchasima). Vietnam: mu[oof]i, l[aw]ng trang.

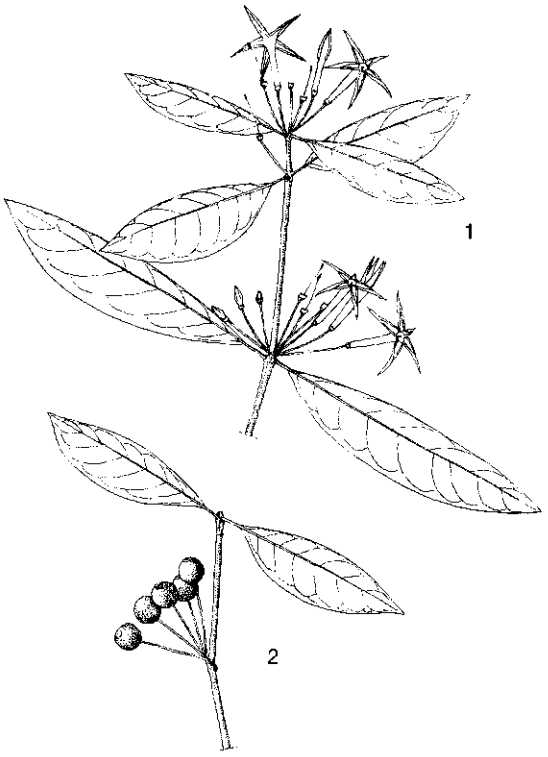
Origin and geographic distribution *P. tetrandra* occurs in north-eastern India, Sri Lanka, Bangladesh, Burma (Myanmar), southern Laos, Vietnam, southern China, Thailand, Peninsular Malaysia, Singapore, Anambas Islands (Indonesia) and the Philippines (Luzon).

Uses In Peninsular Malaysia leaves of *P. tetrandra* have been applied as a poultice to fresh wounds. In Thailand the roots or stem, mixed with *Hyptis suaveolens* (L.) Poit. and *Barleria strigosa* Willd. roots and whole plants of *Elephantopus scaber* L., are used in a decoction to treat bloody vomiting, whereas the roots macerated in water are used in cases of snakebite. In Indo-China a decoction of the roots has been used to treat bronchitis in a mixture with coconut and henna (*Lawsonia inermis* L.). The wood is considered tonic and depurative in a herbal tea drunk after childbirth. Root-shavings have been recorded as one of the ingredients of a complex dart poison in Malaysia.

In Thailand powdered roots or stems of *P. fragrans* Geddes, which occurs in Indo-China, Thailand and the Andaman Islands, are used internally as a tonic. The roots of *P. sessiliflora* Pitard, which is restricted to Indo-China and Thailand, are crushed in water and applied to snakebites.

Properties The anthraquinones rubiadin and rubiadin-1-methyl ether have been isolated from methanol extracts of *P. tetrandra* and *P. sessiliflora* roots. These exhibited weak antimalarial activity against *Plasmodium falciparum*.

Botany A shrub or small tree up to 7 m tall; young branches with 2 prominent longitudinal ridges. Leaves decussately opposite on vertical branches, distichously opposite on horizontal



Prismatomeris tetrandra (Roxb.) K. Schumann – 1, flowering branch; 2, fruiting branch.

branches, simple and entire, elliptical or narrowly elliptical to ovate or narrowly ovate, 3–23 cm × 1–8 cm, base truncate, apex acute to acuminate, papery to leathery, pinnately veined; petiole 2–25 mm long; stipules interpetiolar, narrowly triangular, up to 7.5 mm long, caducous or persistent. Inflorescence a terminal or axillary cyme, up to 20-flowered. Flowers bisexual, (4–)5(–6)-merous, heterodistylous, strongly scented; pedicel up to 3.5 cm long; calyx tubular, up to 2.5 mm long, usually denticulate; corolla hypocrateriform, tube up to 3 cm long, lobes up to 2.5 cm long, spreading, white; stamens inserted above the middle of the corolla tube; disk annular; ovary inferior, 2-celled, style filiform, stigma 2-lobed. Fruit a subglobose drupe 7–11 mm in diameter, blackish-purple to blackish-blue, 1-seeded. Seed almost spherical, up to 9 mm in diameter, with dark reddish-brown testa; endosperm corneous.

The seeds may be dispersed by birds such as fruit-pigeons, and perhaps also by small mammals like rodents and monkeys.

Prismatomeris comprises 15 species and is distributed in the same region as indicated for *P. tetrandra*, plus Sumatra, western Java, Borneo and the Philippines. It is classified in the tribe *Morindeae*, together with e.g. *Morinda* and *Rennellia*; it seems closely related to the latter genus. However, some authors place it in a separate tribe *Prismatomerideae*.

P. tetrandra forms a very variable complex, particularly varying in corolla and fruit size. Two subspecies are distinguished: subsp. *tetrandra* and subsp. *malayana* (Ridley) J.T. Johansson. The first subspecies occurs from north-eastern India, Bangladesh and northern Burma (Myanmar) to northern Vietnam, southern China, Thailand and Luzon (the Philippines), the second one from Sri Lanka (extinct?) and southern Burma (Myanmar) to southern Indo-China, Thailand, Peninsular Malaysia, Singapore and Anambas Island.

Ecology Subsp. *tetrandra* occurs mainly in highland regions up to 1800 m altitude, and has been collected in primary and secondary, damp and dry, evergreen and deciduous forests, and occasionally in savanna woodland. Subsp. *malayana* occurs mainly in the lowland, up to 500 m altitude, but sometimes in montane forest up to 1700 m altitude, in humid evergreen forest as well as dry forest, scrub vegetation, on dunes, also on shale and limestone.

Genetic resources *P. tetrandra* is widely distributed in a wide range of habitats and thus not endangered.

Prospects Although several medicinal applications have been indicated for *P. tetrandra*, there is little information available on its phytochemistry and pharmacological properties. Until now, its prospects as a medicinal plant of importance are not promising.

Literature 121, 434, 549.

Other selected sources 168, 174, 732.

Wongsatit Chuakul,
Noppamas Soonthornchareonnon
& Orawan Ruangsomboon

Pseuderanthemum Radlk.

Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 13: 282 (1883).

ACANTHACEAE

$x = 21$

Origin and geographic distribution *Pseuderanthemum* comprises about 100 species and is pantropical. Probably a few dozens of species occur in South-East Asia. Several species are widely planted as an ornamental.

Uses Some applications of *Pseuderanthemum* in traditional medicine in South-East Asia have been recorded; it is used externally to treat wounds, ulcers, abscesses, aphthae and as a diuretic, and internally after childbirth.

Unidentified *Pseuderanthemum* plants are used in the Solomon Islands to treat boils, diarrhoea and fever. In Africa several *Pseuderanthemum* species are used in traditional medicine, e.g. to treat intestinal complaints and as a tonic. Some *Pseuderanthemum* species are popular garden plants, also in South-East Asia, especially appreciated for their ornamental foliage, but also for their flowers, e.g. *P. carruthersii* (Seem.) Guill. (synonym: *P. atropurpureum* Radlk.) and *P. reticulatum* Radlk., which originate from Polynesia. The leaves of some *Pseuderanthemum* species are eaten as a vegetable, e.g. *P. racemosum* (Roxb.) Radlk. in the Moluccas.

Properties In tests in India an aqueous leaf extract of *P. bicolor*, when sprayed or rubbed onto leaves of several field crop plants, provoked the synthesis of a virus inhibitory agent associated with the induction of systemic resistance against virus infection. Similar activities have been recorded for *P. carruthersii*.

Botany Small to medium-sized shrubs or perennial herbs. Leaves opposite, simple, with cystoliths; petioles connected by transverse ridges; stipules absent. Inflorescence a terminal or axil-

lary panicle, raceme or cyme; bracts small. Flowers bisexual, 5-merous; calyx deeply partite; corolla with narrow tube, shortly widened apically, lobes usually slightly unequal, 2 posterior ones mostly connate higher up and smaller, imbricate in bud, afterwards spreading; stamens 2, inserted near top of corolla tube, slightly exserted, staminodes 2, shortly filiform; ovary superior, 2-celled, style filiform, stigma small, 2-lobed. Fruit a stalked, clavate capsule constricted between the seeds, few-seeded. Seeds compressed.

Pseuderanthemum is classified in the *Justicieae*, a large, wide-ranging and taxonomically difficult tribe. Like many other genera in this tribe, the taxonomy of *Pseuderanthemum* has not yet been comprehensively studied.

Ecology Most *Pseuderanthemum* species native to South-East Asia occur in lowland forest, sometimes in lower montane forest, but *P. bicolor* and *P. diversifolium* are often found in disturbed localities such as thickets and open secondary forest.

Management *Pseuderanthemum* can be propagated by softwood cuttings. It can best be grown in a coarse, fertile, well-drained but moisture retentive loam-based soil mix under partial shade.

Genetic resources The *Pseuderanthemum* species treated here do not seem to be threatened by genetic erosion because they are locally common, often also in anthropogenic habitats, and also planted.

Prospects Research on the pharmacological properties of *Pseuderanthemum* is desirable, especially considering the external applications to treat wounds etc., which may relate to antimicrobial activities. The antiviral properties of *Pseuderanthemum* extracts are remarkable and may offer possibilities for protection of important crops against viral diseases.

Literature 1, 120, 332.

Selection of species

Pseuderanthemum bicolor (Schrank) Radlk.

Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 13: 286 (1883).

Vernacular names Philippines: limang-sugat (Tagalog), maladosdos (Bisaya), kublit (Bikol).

Distribution Native to eastern Malesia (throughout the Philippines), cultivated elsewhere in South-East Asia.

Uses In the Philippines a decoction of roots, stems and leaves is used to treat aphthae, wounds and ulcers. *P. bicolor* is also planted as an ornamental.

Observations A small shrub up to 110 cm tall; leaves ovate-oblong to oblong-lanceolate, 5–18 cm × 1.5–7 cm, contracted into the petiole at base, rather long-acuminate at apex; flowers all or mainly in axillary (1–)3-flowered cymes, corolla with 3.5–4 cm long tube and 1.5–2 cm long lobes, white, red-dotted; fruit 2.5–3 cm long. *P. bicolor* is often common in thickets at low altitudes, e.g. in the Philippines.

Selected sources 1, 62, 760.

Pseuderanthemum diversifolium (Blume) Radlk.

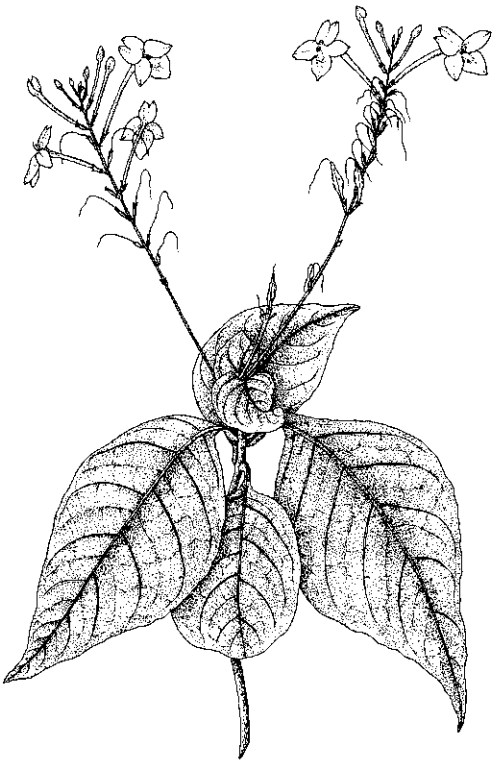
Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 13: 282 (1883).

Synonyms *Pseuderanthemum zollingerianum* (Nees) Bremek.

Vernacular names Indonesia: posor (Javanese).

Distribution Java.

Uses The leaves are used externally to treat dysuria and abscesses.



Pseuderanthemum diversifolium (Blume) Radlk. – flowering and fruiting branch.

Observations A small shrub up to 150 cm tall; leaves ovate to lanceolate, 6–30 cm × 1–12 cm, contracted into the petiole at base, usually rather long-acuminate at apex; flowers in a panicle or raceme, terminal or in the higher leaf axils, corolla with 3–3.5 cm long tube and 1–1.5 cm long lobes, pale lilac, rarely white, anterior lobe purple-dotted. *P. diversifolium* occurs in brushwood, village-groves and open forest, in moderately shaded localities, up to 1000 m altitude.

Selected sources 62, 334.

Pseuderanthemum graciliflorum (Nees) Ridley

Fl. Malay Penins. 2: 591 (1923).

Vernacular names Malaysia: kemoja hutan, pokok tampang puteri, gurah bukit (Peninsular). Thailand: yaai plang (Surat Thani), rong mai (peninsular, Surat Thani). Vietnam: xu[aa]n hoa m[ar]nh.

Distribution Southern Vietnam, southern Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia a decoction of the roots is given after childbirth as a protective medicine and tonic. *P. graciliflorum* is also planted as an ornamental.

Observations A small to medium-sized shrub up to 200 cm tall; leaves ovate-lanceolate to lanceolate, 14–15 cm × 2.5–5 cm, contracted into the petiole at base, acuminate at apex; flowers in a dense spike, terminal or in the higher leaf axils, corolla with 3.5–4 cm long tube and c. 2.5 cm long lobes, lilac-purple, rarely white, anterior lobe with a white spot often red-dotted; fruit c. 2.5 cm long. *P. graciliflorum* is common in lowland forest, and is also cultivated in gardens.

Selected sources 121, 789.

R.H.M.J. Lemmens

Pterisanthes Blume

Bijdr. fl. Ned. Ind.: 192 (1825).

VITACEAE

x = unknown

Origin and geographic distribution *Pterisanthes* comprises about 12 species and occurs in western Malesia (Peninsular Malaysia, Sumatra, Java, Borneo and the southern Philippines). Borneo is the centre of diversity with about 10 species.

Uses In Peninsular Malaysia *Pterisanthes* roots are applied externally to swellings.

Botany Climbing shrubs or slender lianas, with tendrils. Leaves alternate, simple or digitately 3(–5)-foliolate, often toothed, petiolate. Inflorescence leaf-opposed, consisting of a irregularly lobed, flattened and broadened, fleshy rachis, at first green, later becoming reddish, with many sessile, immersed flowers on both sides and sometimes with long-pedicelled sterile flowers along the margins, with tendrils, pendulous and long-peduncled. Flowers small, usually bisexual, 4(–5)-merous; calyx slightly lobed; petals free, usually broadly ovate; stamens opposite petals; ovary at the base immersed, 2-celled, style short, conical, stigma small, capitate. Fruit a 1–3(–4)-seeded berry, sessile on the rachis. Seeds with convex back and keeled ventral side, furrowed on both flat sides.

The broadly flattened and fleshy inflorescences are very characteristic, and distinguish *Pterisanthes* from all other *Vitaceae*.

Ecology *Pterisanthes* occurs in forests, often in forest edges, and thickets, up to 1300 m altitude.

Genetic resources There is no reason to consider the *Pterisanthes* species treated here endangered or liable to genetic erosion.

Prospects It seems unlikely that *Pterisanthes* will become more important in traditional medicine in the future, unless pharmacological research were to reveal important pharmacological properties.

Literature 121.

Selection of species

Pterisanthes cissoides Blume

Bijdr. fl. Ned. Ind.: 193 (1825).

Synonyms *Vitis cissoides* (Blume) Backer (1911).

Vernacular names Malaysia: akar gamat (Peninsular).

Distribution Peninsular Malaysia, Singapore, Sumatra, Java and Borneo.

Uses In Peninsular Malaysia roots are rubbed upon the legs to treat swellings.

Observations A liana up to 25 m long; leaves 3(–5)-foliolate, leaflets oblong or oblong-obovate, 8–17 cm × 3–8 cm, arachnoid-hairy below when young but glabrescent, petiole 1.5–6 cm long; inflorescence 10–18 cm × 1.5–3 cm (excluding peduncle); fruit obovoid. *P. cissoides* occurs in forest margins, secondary forest and thickets, up to 1200 m altitude.

Selected sources 62, 121, 530, 789.

Pterisanthes rufula (Miq.) Planchon

A.DC. & C.DC., Monogr. phan. 5(2): 419 (1887).

Vernacular names Malaysia: akar sebengkak, lakum hutan (Peninsular).

Distribution Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia roots are rubbed upon swellings.

Observations A liana, stems tomentose when young; leaves 3-foliolate, leaflets oblong to lanceolate-obovate, 12.5–17.5 cm × 3–6.5 cm, densely red hairy below, petiole c. 6 cm long; inflorescence c. 6 cm × 1.5 cm (excluding peduncle). *P. rufula* occurs in forest edges.

Selected sources 121, 530, 789.

R.H.M.J. Lemmens

Pterocaulon redolens (Willd.) Fern.-Vill.

Nov. app.: 116 (1880).

COMPOSITAE

$2n$ = unknown

Synonyms *Conyza redolens* Willd. (1803), *Monenteles spicatus* Labill. (1825), *Pterocaulon cylindrostachyum* C.B. Clarke (1878).

Vernacular names Philippines: sambong-gala (Tagalog), subusob (Ilokano). Vietnam: b[oo]ng b[oos]ng n[us]oc, b[oj] x[is]t n[uw][ows]c.

Origin and geographic distribution *P. redolens* occurs in eastern India, Burma (Myanmar), Indo-China, southern China, Thailand, the Philippines, New Guinea, Australia and New Caledonia.

Uses In the Philippines a decoction of the leaves of *P. redolens* is used for stimulant baths.

P. sphacelatum (Labill.) Benth. & Hook.f. ex F. v. Mueller from central Java, the Lesser Sunda Islands, New Guinea, Australia and New Caledonia is used in Australian Aboriginal folk medicine for the treatment of colds.

Properties In a general screening experiment for antiviral activity, the ethanol extract of aboveground parts of *P. sphacelatum* showed a potent inhibition of poliovirus type 1 at a concentration of 52 µg/ml. Further studies revealed the flavonol chrysosplenol C to be the active compound. This compound is a 4'-hydroxy-3-methoxyflavone, one of a group of compounds known to be potent and specific inhibitors of picornviral replication. The poliovirus belongs to the picornivirusses, responsible for respiratory and central nervous system infections in humans.

Botany A perennial, aromatic herb up to 100 cm tall; stems conspicuously winged, variably grey-hairy. Leaves alternate, simple, oblanceolate, (2–)3–5(–7) cm × 0.7–2 cm, base cuneate, apex acute or obtuse, denticulate to almost entire, densely woolly above, thinly so below; petiole with decurrent wings; stipules absent. Inflorescence composed of small heads c. 4 mm long, forming terminal spike-like clusters 2–5 cm × 0.8–1 cm; outer involucral bracts oblong, shortly apiculate, densely woolly, inner ones much longer, glabrous, falling off together with the flowers. Flowers all tubular; marginal flowers female, numerous, 2–3 mm long, with slender corolla, entire or very shallowly toothed; disk flower bisexual, solitary, corolla cylindrical, 5-lobed, lobes papilose outside; stamens 5, anthers fused; ovary inferior, 1-celled, style with 2 filiform arms, exserted in female flowers. Fruit an oblong achene c. 1 mm long, obscurely angular, glabrous to pubescent; pappus hairs thin, c. 2 mm long, dentate.

Pterocaulon comprises 18 species and has a disjunct distribution, 12 species occurring in the

Pterocaulon redolens (Willd.) Fern.-Vill. – 1, upper part of flowering plant; 2, flower head; 3, marginal flower; 4, disk flower; 5, fruit.

Americas and 6 in South-East Asia, Australia and New Caledonia.

Ecology *P. redolens* occurs in open localities, e.g. wasteland, at low to medium altitudes.

Genetic resources *P. redolens* is relatively widespread and commonly encountered in disturbed habitats, and thus is not threatened by genetic erosion.

Prospects There is no information on the pharmacological properties of *P. redolens*. The observed antiviral activity of *P. sphacelatum* against poliovirus 1 supports further research on this species and *P. redolens*, and these species may be a possible template in the development of future phytomedicines.

Literature 124, 760, 834, 835.

Other selected sources 112, 264.

A.M. Aguinaldo

Ptyssiglottis kunthiana (Nees) B. Hansen

Nord. Journ. Bot. 9: 214 (1989).

ACANTHACEAE

$2n$ = unknown

Synonyms *Polytrema vulgare* C.B. Clarke (1908), *Polytrema javanicum* Bremek. (1948).

Vernacular names Malaysia: daun lipah, daun sekeras akar, peparu hitam (Peninsular). Thailand: phre (Malay, Narathiwat). Vietnam: thu[oos] d[aas]u.

Origin and geographic distribution *P. kunthiana* occurs in Laos, Vietnam, Thailand, Peninsular Malaysia, Sumatra, western Java (rare) and the Philippines.

Uses In Peninsular Malaysia, the leaves have been used externally as a poultice to treat pain in the region of the heart, abdominal complaints and ulcers.

Botany A herb up to 40 cm tall; stem occasionally prostrate, puberulous especially on 2 opposite lines, but glabrescent. Leaves opposite, equal to unequal within each pair, simple and entire, elliptical-lanceolate, (0.6–)1.5–10 cm × (0.2–)1–4 cm, pubescent on veins below, with linear cystoliths; petiole 2–13 mm long; stipules absent. Inflorescence an axillary, compound, strongly reduced dichasium, 1–2 cm × 1–2 cm, with 2 contracted branches around the midflower and 2–4 pairs of bracts. Flowers bisexual; calyx 5-lobed, 5–6.5 mm long, enlarging to 10 mm; corolla 16–20 mm long, with tube cylindrical in lower part and narrowly funnel-shaped in upper part, 2-lipped, upper lip 2-lobed, lower lip 3-lobed, pubescent, white with a pale patch on lower lip; stamens 2, inserted in the middle of the funnel-shaped part of the corolla tube; ovary superior, 2-celled, style usually glabrous. Fruit a clavate capsule 11.5–16 mm long, 4-seeded. Seeds lenticular, rugulose tuberculate.

P. kunthiana can be found flowering throughout the year.

Ptyssiglottis comprises 33 species and is distributed in tropical Asia from Sri Lanka, through Indo-China and Thailand, to Malesia (not recorded for the Lesser Sunda Islands and Sulawesi). *P. kunthiana* has the largest area of distribution of all *Ptyssiglottis* species; most species are confined to small areas, with 17 species endemic to Borneo. *Ptyssiglottis* is classified into the subtribe *Isoglossinae* within the tribe *Justicieae*, and is most closely related to *Isoglossa*. It is characterized by the strictly dichotomously branching inflorescence.

Ecology *P. kunthiana* is found in evergreen forest, often on limestone, up to 200 m altitude, rarely higher. It is very common in southern peninsular Thailand and Peninsular Malaysia, but is more scattered elsewhere.

Genetic resources The *Ptyssiglottis* species are restricted to lowland forest, which is under high pressure, and many of them have very restricted areas of distribution. This makes them easily liable to genetic impoverishment or even extinction. *P. kunthiana* is the least vulnerable species because it is the most widespread and locally common.

Prospects The single report from Peninsular Malaysia on uses as a poultice does not allow predictions on future importance as a medicinal plant. *P. kunthiana* will not attract much interest as long as tests on pharmacological properties are not done.

Literature 121, 311.

Other selected sources 62.

R.H.M.J. Lemmens

Pyramidanthe prismatica (Hook.f. & Thomson) J. Sinclair

Gard. Bull. Sing. 14: 362 (1955).

ANNONACEAE

$2n$ = 16

Synonyms *Melodorum prismaticum* Hook.f. & Thomson (1855), *Fissistigma cylindricum* (Maingay ex Hook.f. & Thomson) Merr. (1919), *Fissi-*

stigma prismaticum (Hook.f. & Thomson) Merr. (1919).

Vernacular names Malaysia: akar pisang-pisang bukit, tepak (Peninsular). Thailand: plao (Yala).

Origin and geographic distribution Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo.

Uses In Peninsular Malaysia, a decoction of the plant is used internally to treat diarrhoea and snakebites.

Botany A large liana with simple hairs; twigs lenticellate. Leaves alternate, distichous, simple and entire, oblong to elliptical-oblong, 11–26 cm × 4–8.5 cm, glabrous; petiole 1–2 cm long; stipules absent. Flowers axillary or terminal, solitary or in pairs, bisexual, regular, odourless; calyx disk-like, circular or obtusely 3-angled, 5–7 mm broad, pubescent outside; petals 6, in 2 whorls, valvate, free, outer ones (5–8 cm long) much longer than inner ones (c. 1 cm long), leathery, yellowish; stamens numerous, with slightly produced, truncate connective; carpels 6, elongate. Fruit consisting of oblong, tuberculate and pubescent monocarps 3–5 cm long, with stalk of c. 2.5 cm long, many-seeded. Seeds shining dark brown.

Pyramidanthe comprises only a single species that is incorporated in the large genus *Fissistigma* in older literature. It differs in the flowers that are not leaf-opposed as in *Fissistigma*, the disk-like calyx, the inner petals much shorter than the outer ones, and the tuberculate monocarps.

Ecology *P. prismatica* is locally common in lowland forest, e.g. in southern Peninsular Malaysia, but may occur up to 1200 m altitude.

Genetic resources Although knowledge of the distribution of *P. prismatica* is probably very incomplete, it seems not to be in immediate danger of genetic erosion.

Prospects As long as nothing is known about the phytochemistry and pharmacological properties of *P. prismatica*, little can be said about its prospects as a medicinal plant.

Literature 121, 860.

Other selected sources 789.

R.H.M.J. Lemmens

Rafflesia R.Br.

Trans. Linn. Soc. 13: 201 (1821).

RAFFLESIACEAE

x = unknown; *R. patma*: $2n = 24$

Origin and geographic distribution *Rafflesia* comprises about 13 species and is restricted to peninsular Thailand and western Malesia, east to Java, Borneo and the Philippines, possibly formerly also Bali.

Uses *Rafflesia* flowers have always struck the imagination of people because of their rarity, colour and size. The flowers of *R. arnoldii* R.Br. are the largest ones in the plant kingdom, measuring up to 100 cm in diameter and weighing up to 11 kg. The applications of the flowers in traditional medicine are strongly interweaved with superstition. The flower buds are applied especially during and after childbirth, to promote delivery and recovery. They are also in demand as an aphrodisiac. These uses may well be linked with the shape and colour of the flower buds, being rounded and flesh-coloured to red.

Properties The presence of ellagitannins has been demonstrated in *Rafflesiaceae*. These compounds may be responsible for the reputedly strong astringent activity of *Rafflesia* flower buds.

Botany Parasitic plants growing like a thallus inside the woody stems and roots of the host, rootless and without chlorophyll. Flowers solitary, unisexual, regular, large to very large; buds sessile, first protruding as a corky swelling with hexagonal patches, the corky base remaining as a cup-shaped body below 3 whorls of 5 scales on the flowering sessile shoot; perianth tube inside covered with variably shaped ramenta, perianth lobes 5, imbricate, reddish, often with whitish warts, inserted around an annular central diaphragm with a rounded opening in the centre; central column present at base of perianth tube, widened into a disk at apex, often with processes on apex; male flowers with sessile anthers situated around the overhanging rim of the column; female flowers with inferior 1-locular ovary with many placentas, stigma situated in a ring around the rim of the column disk. Fruit a many-seeded berry. Seeds minute, c. 1 mm long, surrounded by pulp, with hard, thick and often pitted testa.

It is estimated that the life cycle of *Rafflesia* from seed to seed is 3–4.5 years. A flower bud may take 10 months to develop into a mature flower. The flowers are open for 4–5 days and then start to rot. They have a foetid smell that attracts carrion-flies. These are believed to be the pollination vectors. Ripening of fruits may take 8 months. The fruits may contain millions of tiny seeds. Ground squirrels and tree shrews have been observed to feed on the whitish pulp surrounding the seeds in the fruit, and they may contribute to the dispersal of the seeds.

The closest relatives of *Rafflesia* are *Sapria* from continental Asia, which differs in its 10 perianth lobes and ramenta on top of the diaphragm, and *Rhizanthes*, which occurs in the same region as *Rafflesia* and differs in its 16–18 perianth lobes and absence of a diaphragm.

Ecology *Rafflesia* is an obligate parasite of the liana genus *Tetrastigma* (*Vitaceae*). It occurs in primary and adjacent secondary lowland forest up to 1000(–1800) m altitude, often on slopes of hills. All species can be considered rare, several ones are even very rare or possibly extinct.

Management Although some *Rafflesia* species have been transplanted from the wild together with the host, and seeds have been inoculated on *Tetrastigma* stems in the botanical gardens of Bogor (Indonesia), which both resulted in flowering plants, cultivation was never really successful.

Genetic resources All *Rafflesia* species are endangered by habitat destruction because they occur in a type of habitat (lowland forest) that is under much pressure. Overcollection of flower buds for medicinal purposes may also have contributed to the decline of some species, e.g. *R. patma* in Java and Sumatra.

Prospects Efforts should be directed towards banning *Rafflesia* collection for application in traditional medicine or rituals. Protection of natural sites is needed to save these spectacular plants for future generations.

Literature 247, 334.

Selection of species

Rafflesia hasseltii Suringar

Acta Soc. Reg. Sc. Neerl. [4–5] (1879).

Vernacular names Indonesia: cendawan matahari (Sumatra). Malaysia: pakma, pama (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia the flower buds are used in a preparation to expedite delivery during childbirth.

Observations Flowers 38–50 cm in diameter, perianth tube inside with slender ramenta having swollen apices, perianth lobes reddish, with about 5 large, whitish pustules across, diaphragm whitish or yellowish with a dark brown zone near the rim and a basal ring of dark brown warts, opening about half as wide as apex of perianth tube, central column with 15–24 processes, these pale yellowish, but dark brown at apex. *R. hasseltii* occurs in primary and secondary lowland forest up to 600 m altitude, and is rare.

Selected sources 121, 247.

Rafflesia patma Blume

Flora 8: 609 (1825).

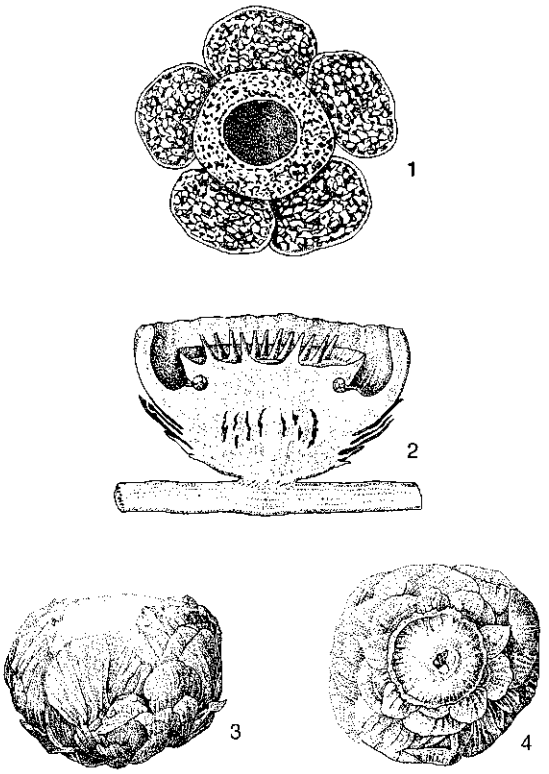
Synonyms *Rafflesia zollingeriana* Koord. (1918).

Vernacular names Indonesia: padma (Javanese), kembhang pakma (Madurese).

Distribution Southern Sumatra and Java.

Uses An infusion of the flower buds is applied after childbirth to purify the uterus and to stop bleeding, and is highly valued as an aphrodisiac for women.

Observations Flowers (30–)37–52(–60) cm in diameter, perianth tube inside with very short tuberculate ramenta, perianth lobes flesh-coloured to brown-ochre or carmine red, with numerous whitish warts, diaphragm strongly pitted, glaucous or with clear circular whitish blots, opening 5–9 cm in diameter, central column with (24–)37–44(–54) processes. *R. patma* occurs in lowland forest up to 400 m altitude. Most localities are in



Rafflesia patma Blume – 1, flower; 2, base of flower bud in longitudinal section; 3, flower bud in side view; 4, flower bud in basal view.

remnants of forest along the south coast of Java, and it is close to extinction.

Selected sources 247, 334, 335.

Slamet Sutanti Budi Rahayu

Reissantia indica (Willd.) N. Hallé

Mém. Inst. Fr. Afr. Noire 64: 85 (1962).

CELASTRACEAE

$2n$ = unknown

Synonyms *Hippocratea indica* Willd. (1797), *Pristimera indica* (Willd.) A.C. Smith (1941).

Vernacular names Indonesia: areuy mangender, hoeh tutung (Sundanese), saripangil (Dusun, Kalimantan). Philippines: lagitik (Tagalog). Vietnam: d[aa]y h[us]c.

Origin and geographic distribution *R. indica* is widespread, but occurs scattered in India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Singapore, Sumatra, Java, the Lesser Sunda Islands, Borneo, the Philippines and Sulawesi.

Uses In Java the stem juice of *R. indica* is drunk to treat fever; heated leaves are administered to women after childbirth, and a leaf poultice is applied against rheumatism.

Properties Several triterpenoids have been isolated from *R. indica* bark, e.g. the unusual triterpene anhydride celastranhydride, which has also been found in *Cassine* and *Kokoona*. The chinone pristimerin has been isolated from the root bark; this compound showed antibacterial activity. Dulcite is another compound found in *R. indica* root bark.

Botany A small liana or shrub up to 3 m tall. Leaves decussately opposite, simple, ovate to elliptical or elliptical-oblong, 3.5–13 cm × 2–6.5 cm, cuneate at base, acuminate at apex, margins crenulate, pinnately veined; petiole 5–8 mm long; stipules small, triangular, 3-lobed, laciniate or fimbriate, caducous. Inflorescence an axillary dichotomous cyme up to 6 cm long, usually with very short peduncle. Flowers bisexual, regular, small, pale yellow or greenish-yellow, 5-merous; calyx almost divided to the base; petals free, oblong, 1–1.5 mm long; stamens 3; disk inconspicuous; ovary superior, 3-celled, style short, stigma obscure. Fruit consisting of 3 ellipsoid to obovoid follicles 3–5.5 cm × 1–1.5 cm. Seeds elliptical, with a basal wing, up to 3.5 cm × 1 cm.

Reissantia comprises 7 species and occurs in Africa and tropical Asia; in the Malesian region 4 species are found.

Ecology *R. indica* occurs in rain forest and monsoon forest, also in secondary forest and thickets, up to 650 m altitude.

Genetic resources Although *R. indica* occurs scattered, it seems sufficiently widespread and adapted to divergent habitats to be protected against genetic erosion.

Prospects The value of *R. indica* for traditional medicine seems limited at present, and it is unlikely that it will increase in the future.

Literature 247, 334.

Other selected sources 265, 331, 731.

Pudjiastuti

Rennellia Korth.

Nederl. Kruidk. Arch. 2: 255 (1851).

RUBIACEAE

x = unknown

Origin and geographic distribution *Rennellia* comprises 4 species and is restricted to the humid parts of western Malesia (Peninsular Malaysia, Sumatra and Borneo) extending into peninsular Thailand and peninsular Burma (Myanmar). *R. elliptica* Korth. is the most widespread species, occupying almost the entire range of the genus.

Uses In Peninsular Malaysia, scrapings of *R. morindiformis* bark have been used to treat wounds, whereas a decoction of the bark or roots of *R. speciosa* is used to treat dropsy, pain in the bones and swollen abdomens in children. A decoction of the leaves and roots is valued in a bath to treat rheumatism. The latter species is also used as a protective medicine after childbirth.

Botany Shrubs or small trees up to 8 m tall. Leaves opposite, decussate on vertical branches, distichous on horizontal branches, simple and entire, narrowly cuneate at base, petiolate; stipules interpetiolar, usually sheathing, with numerous colleters on adaxial side, caducous. Inflorescence terminal, consisting of spike-like, panicle-like or umbel-like arranged capitula, puberulous; bracts small. Flowers bisexual, 4–5-merous, fragrant, heterodistylous; pedicel lacking or connate; calyx campanulate, denticulate or truncate; corolla hypocrateriform, with long tube and recurved lobes ridged above, pale violet to bluish-white or pinkish-white outside, white inside; stamens inserted in upper part of the corolla tube, filaments linear, anthers narrowly oblong; disk annular; ovary inferior, connate together, 2-celled, style filiform, with 2-lobed stigma. Fruit a syncarp or rarely a single

drupe, globose or subglobose, bluish-black to purplish-black, few-seeded. Seeds globose or subglobose, with a hollow on funicular side, testa brown with dark spots, endosperm corneous.

Rennellia can be found flowering throughout the year. It belongs in the tribe *Morindeae*, and is closely related to *Gentingia*, *Motleyia* and *Prismatomeris*. It is characterized particularly by the corolla, which is violet to bluish-white outside, usually connate ovaries and usually elongate inflorescences.

Ecology All *Rennellia* species inhabit tropical evergreen forest, mainly in the lowland.

Genetic resources The *Rennellia* species treated here are fairly widely distributed and do not seem to be in immediate danger of genetic erosion. However, the fourth species of the genus, *R. amoena* (Bremek.) J.T. Johansson, is known only from one single collection in south-western Sumatra.

Prospects The prospects for *Rennellia* as medicinal plants remain obscure as long as no data on phytochemistry or pharmacological properties are available.

Literature 121, 435.

Selection of species

Rennellia morindiformis (Korth.) Ridley

Kew Bull.: 609 (1939).

Synonyms *Rennellia paniculata* King & Gamble (1904).

Vernacular names Malaysia: akar bumi, urap gundor (Peninsular).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia, scrapings of the bark have been used to treat wounds.

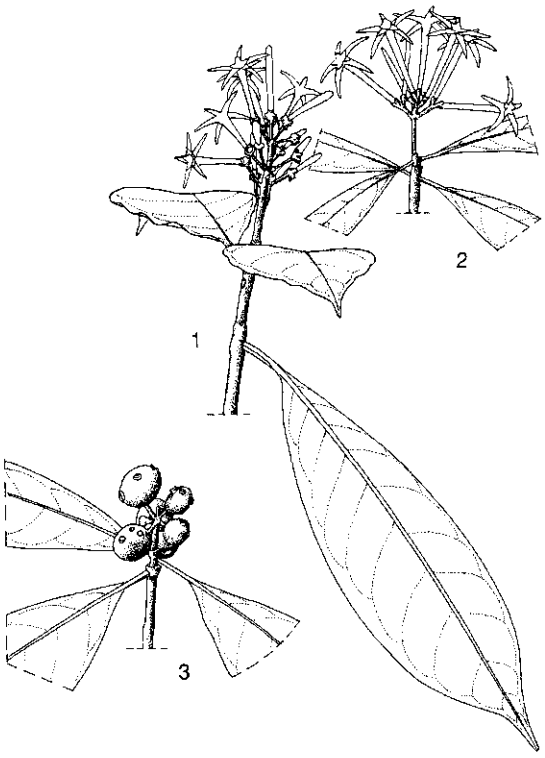
Observations A shrub or small tree up to 8 m tall; leaves usually obovate or elliptical, 10–26 cm × 3.5–11 cm, petiole (0.5–)1.5–4 cm long; inflorescence panicle-like, capitula 10–40 mm long peduncled; calyx tube 0.5–1.5 mm long, corolla tube 1.5–2 cm long; fruit 1–1.5 cm in diameter. *R. morindiformis* occurs in rain forest up to 1500 m altitude.

Selected sources 121, 435, 990.

Rennellia speciosa (Wallich ex Kurz) Hook.f.

Fl. Brit. India 3: 158 (1880).

Synonyms *Morinda speciosa* Wallich ex Kurz (1875).



Rennellia speciosa (Wallich ex Kurz) Hook. f. – 1, flowering branch; 2, tip of branch with inflorescence; 3, tip of branch with infructescence.

Vernacular names Malaysia: mengkudu rimba, semburan angin, meroyan kemput.

Distribution Peninsular Burma (Myanmar), peninsular Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia, a decoction of the bark or roots is used to treat dropsy, pain in the bones and swollen abdomens in children, and a decoction of the leaves and roots in a bath to treat rheumatism. The plants are also used as a protective medicine after childbirth.

Observations A shrub or small tree up to 7 m tall; leaves usually obovate or elliptical, 8.5–22 cm × 2.5–5.5 cm, petiole 0.5–3 cm long; inflorescence panicle-like or umbel-like, capitula 3–7 mm long peduncled; calyx tube c. 0.5 mm long, corolla tube 1.5–2.5 cm long; fruit 1–2 cm in diameter. *R. speciosa* occurs in rain forest up to 800 m altitude.

Selected sources 121, 435, 705, 731, 990.

H.C. Ong

Rhaphidophora Hassk.

Flora 25(2), Beibl. 1: 11 (1842).
ARACEAE
$x = 27, 28, 30$; *R. decursiva*: $2n = 26, 54, 56$

Origin and geographic distribution *Rhaphidophora* comprises about 100 species, and occurs in tropical and subtropical Asia from the Himalayas of Nepal, India and China to southern Japan and throughout Indo-China, Thailand and Malesia, in northern Australia and the islands of the western Pacific. However, 2 or 3 species occur in Africa.

Uses Leaf extracts of some *Rhaphidophora* species are used in traditional medicine in South-East Asia to treat cancer and skin diseases, and a decoction of leaves and roots to expedite childbirth.

R. decursiva (Roxb.) Schott from Nepal, India, Sri Lanka, Burma (Myanmar), Indo-China and southern China, is commonly used as a medicinal plant in Vietnam. Pounded stems are applied externally to wounds, contusions and burns, and a decoction of whole plants in combination with other plants is administered internally to treat chronic enteritis, diarrhoea and dysentery. A decoction of fresh leaves and twigs is applied as a bath to treat scabies, and pounded stems and leaves are made into a poultice to treat carbuncles, phlegmon and dermatomycosis.

Properties In tests in Singapore, extracts of *R. korthalsii* showed in-vitro cytotoxic activity against P388, Molt 4, KB and SW620 cell lines, and also stimulated activity of mouse splenocytes. The active constituent was identified as 5,6-dihydroxyindole.

Pounded stems of *R. decursiva* showed antibacterial activity against e.g. *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pseudomonas aeruginosa* and *Bacillus subtilis* in tests in Vietnam. The drug stimulates the proliferation of new tissue, improves the healing process and prevents the formation of keloid scars. The plant also exhibited marked anti-inflammatory activity in a carrageenin-induced rat paw oedema model, but not in the cotton-pellet implantation test.

Bioassay-directed fractionation led to the isolation of 6 compounds with antimalarial activity from dried leaves and stems of *R. decursiva*. Polysyphorin and rhaphidecurperoxin showed strong activities against *Plasmodium falciparum*, the other compounds were less active.

Botany Medium-sized to very large, root-climbing lianas; stem with internodes of various length separated by prominent leaf scars, producing a clear, odourless juice when cut; clasping roots sparsely to densely arising from the stem, feeding roots rare to abundant. Leaves usually arranged distichously alternate, sometimes spirally, lanceolate to oblong, more or less oblique, entire to regularly pinnatifid or perforated, pinnately veined; petiole canaliculate, with prominent sheath and variously prominent basal and apical genicula; stipules absent. Inflorescence a subglobose to clavate-cylindrical spadix enclosed by an ovate to boat-shaped, often early caducous spathe. Flowers bisexual, without perianth; stamens 4(–6); ovary 1-celled to partially 2-celled, usually hexagonal, style well-developed. Fruit a many-seeded berry, red or yellow. Seeds oblong, with thin,smooth testa and copious endosperm.

Rhaphidophora is classified in the tribe *Monstereae* together with e.g. *Amydrium*, *Epipremnum* and *Scindapsus*.

It is best characterized by its fruits which contain numerous straight seeds.

Ecology *Rhaphidophora* usually climbs on the bole of trees, but sometimes on rocks. It is most commonly found in well-drained primary and old secondary forest, humid to seasonally moderately dry, at low to mid-montane elevations.

Management Stem cuttings of *R. decursiva* are normally used for propagation. Shoot tips and stem nodes have been cultured successfully on modified Murashige and Skoog medium.

Genetic resources The *Rhaphidophora* species treated here are widespread and do not seem to be in danger of genetic erosion. However, other species with limited areas of distribution may easily become endangered because of their preference for a vulnerable type of habitat, i.e. lowland rain forest.

Prospects The limited research on pharmacological properties of *R. decursiva* and *R. korthalsii* has already shown interesting results, so more testing seems worthwhile.

Literature 560, 611, 671, 1051.

Selection of species

Rhaphidophora korthalsii Schott

Ann. Mus. Bot. Lugd.-Bat. 1: 129 (1863).

Distribution Southern Thailand, Peninsular Malaysia, Singapore, Sumatra, Java, Borneo, the Philippines, to New Guinea and islands of the western Pacific.

Uses Leaf extracts are used in Peninsular

Rhaphidophora korthalsii Schott – 1, part of sterile shoot; 2, flowering shoot with leaves removed; 3, spadix.

Malaysia and Singapore against cancer and skin diseases.

Observations A large, slender to rather robust liana up to 20 m long; leaves broadly oblong-elliptical to oblong-lanceolate, 10–44 cm × 14–94 cm, pinnatisect to pinnatifid, petiole 9–65 cm long; spathe 10–30 cm × 3–5 cm, greenish to dull yellow, spadix cylindrical, 9–26 cm long, dull green to dirty white. *R. korthalsii* is a variable species that occurs in primary and secondary forest up to 1700 m altitude.

Selected sources 105, 107, 1005.

Rhaphidophora minor Hook.f.

Fl. Brit. India 6: 544 (1893).

Synonyms *Rhaphidophora celebica* K. Krause (1932).

Vernacular names Malaysia: kelemoyang akar (Peninsular).

Distribution Southern Thailand, Peninsular Malaysia, Singapore, Sumatra, Borneo, Sulawesi and the Philippines (Mindanao, Palawan).

Uses In Peninsular Malaysia, a decoction of leaves and roots is used in cases of delayed confinement, apparently to expedite childbirth.

Observations A small to moderate liana up to 6 m long; leaves narrowly falcate-elliptical to falcate-lanceolate, 2.5–16 cm × 1–3 cm, entire, petiole 3–6 cm long; spathe 3–9 cm × 1–1.5 cm, dull green to dull yellow, spadix slender cylindrical, 2.5–7 cm long, dull yellowish-white. *R. minor* occurs in lowland forest up to 100 m altitude, often along streams, sometimes in swampy locations.

Selected sources 105, 107, 121.

Tran Cong Khanh

Rhododendron L.

Sp. pl. 1: 392 (1753); Gen. pl. ed. 5: 185 (1754).

ERICACEAE

$x = 13$

Origin and geographic distribution *Rhododendron* comprises about 900 species, and occurs in the temperate Northern hemisphere, with a major centre of diversity in the Himalaya, and in South-East Asia, with some 300 species in the Malesian region, mostly confined to montane forest. New Guinea is a major centre of diversity with 155 endemic species. In Australia (Queensland) 1 species occurs naturally.

Uses *Rhododendron* is only little used in South-East Asian folk medicine. In New Guinea it is used for the treatment of skin diseases, whereas in Sabah root decoctions are drunk as a tonic. In the Philippines *R. vidalii* is applied as a cure for itches.

Rhododendron is of great horticultural importance. This also applies to several large-flowered Malesian species and their hybrids.

Properties In a general screening experiment in Indonesia, *R. culminicolum* F. v. Mueller, *R. herzogii* Warb., *R. konori* and *R. macgregoriae* showed antibacterial activity against several gram-positive bacteria in vitro. Several flavonoids have been isolated from *R. javanicum* and *R. macgregoriae*.

The sweetly flavoured honey produced by bees that collect nectar from *Rhododendron* flowers may be toxic, due to the presence of certain diterpenes, so-called grayanotoxins (e.g. acetylandromedol). Symptoms begin acutely, but last rarely for more than 24 hours. Most prominent symptoms are loss of consciousness, weakness, severe salivation, sweating, vomiting, diarrhoea, bradycardia and arterial hypotension. Fatal cases are extremely rare. Apart from close surveillance

only symptomatic therapy is generally necessary.

Botany Evergreen, terrestrial or epiphytic shrubs or small trees; new shoots marked by distinct nodes. Leaves arranged spirally or opposite, or mostly in 3–8-merous pseudowhorls, simple and entire, variably coriaceous, clothed with scales, petiolate; stipules absent. Inflorescence a terminal or axillary condensed umbelliform raceme, sometimes reduced to a single flower. Flowers bisexual, 5–7-merous, protandrous, with 2 bracteoles at the base of pedicel; calyx cup- or disk-shaped, deeply partite to subentire, persistent; corolla tubular or campanulate to funnel-shaped, sometimes salver-shaped, lobed; stamens 5–10(–14), inserted at the base of the corolla; disk present; ovary superior, 5(–7)-celled, style mostly as long as the stamens. Fruit a capsule, dehiscent from the top, central column persistent, many-seeded. Seeds minute, bearing thread-like tails on both ends.

Virtually all Malesian *Rhododendron* species belong to subgenus *Rhododendron* and the lepidote ('scaly') section *Vireya*, that comprises only 2 Indo-Chinese and 1 Australian species outside Malesia. Some of the more temperate Asiatic species belonging to other subgenera are cultivated as ornamentals in mountainous areas of Malesia.

In most species flowering is rather irregular, so that flowers may be found during the whole year, but other species have a more pronounced flowering period. In New Guinea and probably elsewhere in Malesia, insects are important for pollination at lower altitudes and birds at higher ones. The long-tailed, lightweight seeds produced in large amounts are an apparent adaptation to the epiphytic habit of many species.

Ecology Most South-East Asian *Rhododendron* species occur in montane forest as a terrestrial shrub or epiphyte; only occasionally are they found in lowland forest or even mangrove. They are dwarf shrubs in the alpine zone, growing in grassland and on rocks, reaching an altitude of 4000 m in Borneo and New Guinea.

Rhododendron mostly thrives on acid soils. Endotrophic mycorrhizae, as found in *Ericaceae* as a whole, appear to give them a great advantage in obtaining nutrients under these acid conditions.

Management *Rhododendron* can be propagated by seed, cuttings and layering. It should preferably be grown in constantly moist but freely draining and acidic soils, ideally with pH 4.5–5.5.

Genetic resources Many Malesian *Rhododendron* species are narrow endemics, which may easily become endangered by habitat destruction. No direct genetic barriers to hybridization appear to exist for *Rhododendron* species of section *Vireya*, but natural hybrids are very rare. Hybrids are more common in disturbed habitats. Hybridization may be prevented by spatial or altitudinal isolation and differences in pollinators and flowering time.

Prospects There are relatively few phytochemical and pharmacological investigations of *Rhododendron*. Further research is needed to evaluate the potential of the traditional medicinal uses of South-East Asian *Rhododendron*.

Literature 48, 247, 704, 731.

Selection of species

Rhododendron fallacinum Sleumer

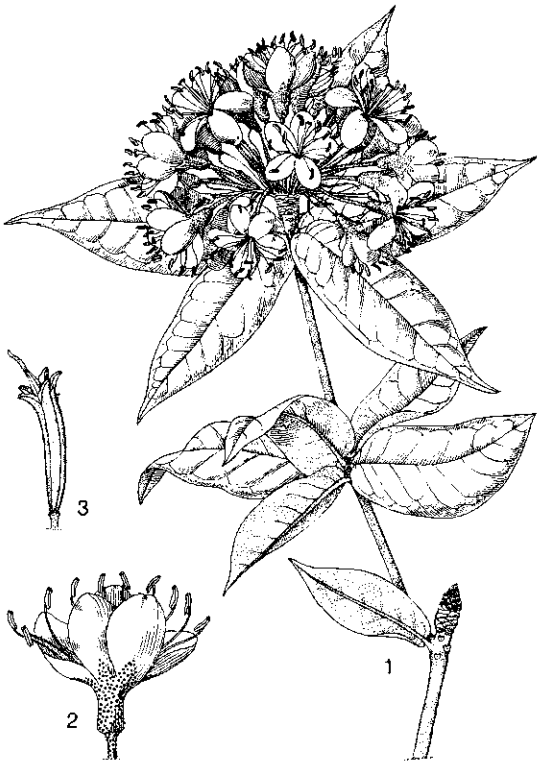
Reinwardtia 5: 99 (1960).

Vernacular names Malaysia: petagar Hamzar (Kedayan, Sabah).

Distribution Sabah.

Uses A decoction of the root is drunk as a general tonic.

Observations A shrub or treelet up to 6 m tall;



Rhododendron fallacinum Sleumer –1, flowering twig; 2, flower; 3, fruit.

scales star-shaped, of two obviously different sizes, equally found on inflorescences and leaves; leaves 3–5(–6) per pseudowhorl at the upper nodes, ovate-oblong or subovate-lanceolate, (7–)10–16 cm × (2–)2.5–6(–7) cm, base rounded to auriculate, apex acute or acuminate, sessile or subsessile; inflorescence 10–35-flowered; flowers scentless, with stout pedicel 2–3(–4) cm long, calyx disk-like, minute, corolla funnel-shaped, up to 2.5 cm long, pale red, deep orange-pink to pale scarlet, densely lepidote outside, at least at the tube, tube 7–12 mm long, lobes obovate to rounded, stamens 10; fruit cylindrical, 2.5–3 cm × 0.3 cm. *R. fallacinum* occurs in mossy forest, but also in open exposed localities, locally common at 1200–2600 m altitude.

Selected sources 11, 48, 247.

Rhododendron javanicum (Blume) Benn.

Pl. jav. rar.: 85 (1838).

Synonyms *Vireya javanica* Blume (1826), *Rhododendron brookeanum* Low ex Lindley (1848), *Rhododendron moultonii* Ridley (1912).

Vernacular names Indonesia: kembang geni (Javanese), dener, congkok (Sundanese). Malaysia: petagar bunga (Kedayan, Sabah). Philippines: lasatan (Bontok), luhung di kamaduyung (Ifugao), malagos (Bagobo).

Distribution Peninsular Malaysia, Sumatra, Java, Bali, Borneo, the Philippines and Sulawesi.

Uses In Sabah, general malaise is treated by drinking a root decoction and by bathing in the solution obtained by boiling the whole plant.

Observations A shrub or treelet up to 5 m tall; scales star-shaped to various degrees, already distant from each other on the young leaves; leaves (4-)5–7(–8) per pseudowhorl at the upper nodes or scattered, broadly oblong to lanceolate, 4–15(–22) cm × (1.8–)2.5–6(–8) cm, base broadly to narrowly cuneate, apex broadly acute to acuminate, petiole up to 2 cm long; inflorescence 4–7(–12)-flowered; flowers scentless, pedicel 2–4 cm long, calyx disk-like, corolla funnel-shaped, rather fleshy, (3–)4–6 cm long, yellow, orange, red or pink, glabrous or nearly so outside, tube (1.7–)2–2.5 cm long, lobes obovate to subspatulate, stamens 10, alternately slightly unequal; fruit elongate-cylindric, up to 5(–8) cm × 1.3 cm. Several subspecies and varieties are recognized of this widespread species. *R. javanicum* occurs in primary and secondary forest, and even on barren land near volcanic craters, as well as an epiphyte in mangrove forest, from sea-level up to 2500 m altitude.

Selected sources 11, 48, 247, 704.

Rhododendron konori Becc.

Malesia 1: 200 (1878).

Synonyms *Rhododendron devrieseanum* Koord. (1909), *Rhododendron astrapiae* Förster ex Schlechter (1918).

Vernacular names Indonesia: soksaikokohugwe, tetjai, wagadei (Irian Jaya).

Distribution New Guinea.

Uses *R. konori* is used to treat skin diseases.

Observations A shrub or treelet up to 6 m tall; scales disk-shaped, entire or nearly so; leaves scattered in the upper third of the upper nodes, sometimes in pseudowhorls, elliptical or oblong-elliptical to ovate-oblong, (7–)10–18(–21) cm × (4–)5–8(–12) cm, base broadly cuneate to rounded, apex obtuse to rounded, petiole up to 3.5 cm long; inflorescence (3–)5–8(–12)-flowered; flowers fragrant, with rather stout pedicel up to 1.5 cm long, calyx shortly and irregularly lobed, corolla salver-shaped, fleshy, 9–16 cm long, white to deep pink, glabrous or nearly so outside, tube (6–)7–8(–11) cm long, lobes obovate-spatulate to suborbicular, stamens 12 or 14, unequal; fruit fusiform, 6–9(–12) cm × 1.2–1.5(–1.8) cm. *R. konori* occurs in montane forest as well as in open fern regrowth, peat bogs, swamps and marshes, generally on poor clayey or humic soils at 750–2500 m altitude.

Selected sources 247.

Rhododendron macgregoriae F. v. Mueller

Journ. Bot. 29: 177 (1891).

Synonyms *Rhododendron hansemannii* Warb. (1892), *Rhododendron lauterbachianum* Förster (1914).

Vernacular names Indonesia: nektamuk (Dani, Irian Jaya). Papua New Guinea: degene-esi (Simbu Province), kanama (Aseki, Morobe Province).

Distribution New Guinea.

Uses In Papua New Guinea the sap from young leaves and flowers is squeezed onto ulcers and sores. For the Dani people in Irian Jaya, *R. macgregoriae* is important for treating skin diseases. It may cause vomiting and diarrhoea when used internally.

Observations A shrub or treelet up to 5(–15) m tall; scales star-shaped to various degrees, already distant from each other on the young leaves; leaves mostly in 3–5(–7)-merous pseudowhorls, rarely subopposite at the upper nodes, ovate-lanceolate to subovate-elliptical, (4–)5–8(–15) cm × (1.7–)3.5(–6) cm, base cuneate, apex shortly

acuminate to obtuse, petiole 0.6–1.2 cm long; inflorescence (4–)8–15-flowered; flowers mostly scentless, with slender to rather stout pedicel 2.5–3.5(–7) cm long, calyx with ciliate margin, sometimes rudimentary, corolla tubular below, generally much expanded at the lobes, 2–3 cm long, pale yellow to dark orange, laxly lepidote outside, tube c. 1 cm long, lobes broadly obovate-spatulate, stamens 10, unequal; fruit cylindrical, manifestly 5-ribbed, 3.5–4.5 cm × 0.3–0.4 cm. *R. macgregoriae* is fairly common, locally abundant, in primary and secondary vegetation, in both dry and moist localities, invading clearings on various soils, at (120–)500–3000(–3350) m altitude.

Selected sources 247, 352, 359, 731.

Rhododendron vidalii Rolfe

Journ. Bot. 24: 348 (1886).

Synonyms *Rhododendron lussoniense* Rendle (1896), *Rhododendron whiteheadii* Rendle (1896), *Rhododendron curranii* Merr. (1908).

Vernacular names Philippines: lopong, tingei (Bontok), ayalea (Ifugao).

Distribution The Philippines (Luzon).

Uses *R. vidalii* is used as a cure for itch.

Observations A shrub up to 2(–3) m tall; scales star-shaped to various degrees, already distant from each other on the young leaves, branches divaricate; leaves mostly in 3–5(–7)-merous pseudowhorls at the upper nodes, oblanceolate to obovate-oblong, (1.5–)2–4(–5.5) cm × (0.8–)1–1.5(–2) cm, base cuneate, apex rounded or subemarginate, petiole 0.2–0.3(–0.5) cm long; inflorescence 2–3(–4)-flowered; flowers fragrant, with rather slender pedicel 1.5–2.5 cm long, calyx small, obscurely toothed, corolla funnel-shaped, 2.5–3 cm long, white, laxly lepidote outside, tube c. 1.5 cm long, lobes broadly cuneate-spatulate, stamens 10, subequal; fruit subcylindrical, 1.5–2 cm × 0.4–0.5 cm. *R. vidalii* occurs as an epiphyte in moss forest but also terrestrially on exposed sites including grassland, at 1000–2100 m altitude.

Selected sources 247, 731, 760.

Hartutiningsih M. Siregar

Rinorea Aubl.

Hist. pl. Guiane 1: 235 (1775).

VIOLACEAE

x = unknown

Origin and geographic distribution *Rinorea* comprises about 170 species and is pantropical, Africa being richest in species (approximately 100), followed by tropical America (about 50) and tropical Asia (about 15).

Uses *Rinorea* roots, and more rarely leaves, are occasionally used in traditional medicine in Peninsular Malaysia and Sumatra, as a post-partum medicine, and to treat diarrhoea, ulcerated noses and fever. In Java crushed leaves of *R. javanica* (Blume) O. Kuntze have been administered internally as an antidote. Several *Rinorea* species are used in traditional medicine in Africa to treat various complaints, e.g. fever, snakebites and syphilis.

Rinorea wood is sometimes used for e.g. implements.

Properties The bark of *R. anguifera* showed some in vitro antimicrobial activity against *Staphylococcus aureus* and *Escherichia coli*.

Botany Shrubs or small trees; twigs usually angular when young, later terete. Leaves alternate, distichous, simple, more or less distinctly acuminate, margins often shallowly crenate or dentate, pinnately veined, shortly petiolate or subsessile; stipules often longitudinally striate, often caducous. Inflorescence an axillary fascicle, sometimes a raceme, corymb or panicle. Flowers bisexual, regular, 5-merous; pedicel articulated; sepals free, imbricate, subequal, fimbriate; petals free, generally contorted, subequal; stamens usually connate into a tube, anthers with distinct triangular appendage; ovary superior, 1-celled, style straight, stigma more or less 3-lobed. Fruit a subglobose capsule, generally subtended by calyx, corolla and stamen remains, opening by leathery valves, (1–)3–6(–9)-seeded. Seeds ellipsoid, glabrous, with leathery testa and often distinct hilum and raphe, rich in endosperm.

Ecology *Rinorea* occurs predominantly in the understorey of primary lowland rain forest, occasionally up to 1000 m altitude, on various soils including limestone.

Genetic resources *Rinorea* may be liable to genetic erosion as it occurs mainly in lowland primary rain forest, a habitat under much pressure in many regions of South-East Asia.

Prospects *Rinorea* is at present unimportant as a medicinal plant in South-East Asia, and it is unlikely that its utilization will increase. However, research on pharmacological properties and phytochemistry might be interesting considering the medicinal uses of *Rinorea* in both South-East Asia and Africa for more or less similar purposes.

Literature 120, 121, 247.

Selection of species

Rinorea anguifera (Lour.) O. Kuntze

Revis. gen. pl. 1: 42 (1891).

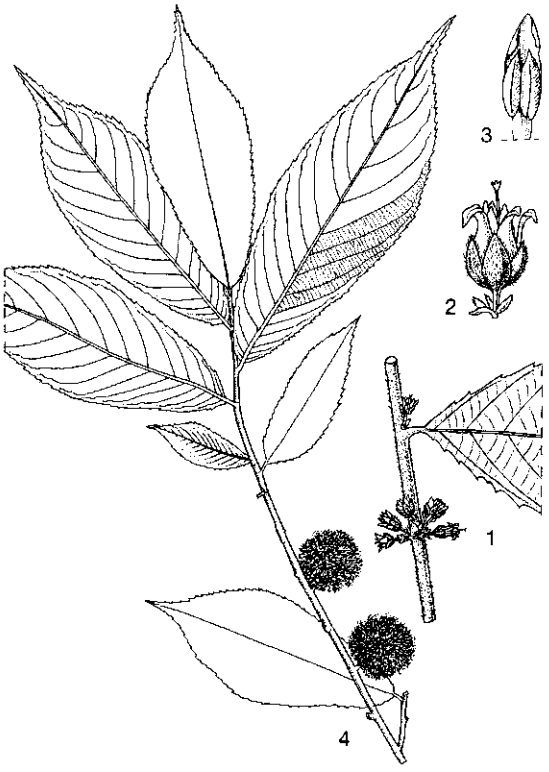
Synonyms *Alsodeia echinocarpa* Korth. (1848), *Alsodeia capillata* King (1889), *Alsodeia comosa* King (1889).

Vernacular names Indonesia: rambutan pacat (Sumatra). Malaysia: janggut baung, medang gambot, rengkok (Peninsular). Thailand: kriap (Nakhon Si Thammarat), ngoh paa (Chiang Mai, Narathiwat, Trat), leng (peninsular). Vietnam: k[ee] nao.

Distribution Indo-China, Thailand, Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia an infusion of the roots is given as a protective draught after childbirth. The seeds are reportedly purgative. In Sumatra ground young leaves are rubbed on the stomach as a post-partum medication, and a root decoction is drunk to treat diarrhoea.

Observations A shrub to small tree up to 10 m tall; leaves (8–)14–28(–37) cm × (3–)4–8(–10.5) cm; inflorescence usually a fascicle; flowers with petals 5–7 mm long, white to sometimes yellow, anthers with small appendage; fruit 1.5–3.5 cm in diameter, valves with many moss-like appendages, greenish. *R. anguifera* occurs in humid localities in primary rain forest, sometimes in heath forest or secondary forest, up to 600 m altitude. It is locally common.



Rinorea anguifera (Lour.) O. Kuntze – 1, part of flowering twig; 2, flower; 3, upper part of stamen; 4, fruiting twig.

Selected sources 121, 247, 295, 296, 990.

Rinorea horneri (Korth.) O. Kuntze

Revis. gen. pl. 1: 42 (1891).

Synonyms *Alsodeia horneri* Korth. (1848), *Alsodeia kunstleriana* King (1889), *Rinorea kunstleriana* (King) Taub. (1895).

Vernacular names Malaysia: sigoh, gemotan pachat, meroyan minko (Peninsular). Thailand: toei-cha-khruu (Karen, Kanchanaburi).

Distribution Peninsular Thailand, throughout the Malesian region (except Java and the Lesser Sunda Islands) and the Solomon Islands.

Uses In Peninsular Malaysia ulcerated noses are treated with a poultice and a decoction of *R. horneri*, and by inhaling the smoke from burning roots.

Observations A shrub to small tree up to 5 m tall; leaves 11–34 cm × 4–9.5(–11) cm; inflorescence usually a fascicle; flowers with petals (2–)3–6(–8) mm long, white to pale greenish-yellow, anthers with well-developed appendage; fruit 1–1.5 cm in diameter, glabrous, greenish. *R. horneri* occurs in primary forest, rarely in secondary forest, up to 600(–1500) m altitude, often on limestone.

Selected sources 121, 247, 990.

Rinorea lanceolata (Wallich) O. Kuntze

Revis. gen. pl. 1: 42 (1891).

Synonyms *Alsodeia lanceolata* Oudem. (1867), *Alsodeia floribunda* King (1889), *Rinorea floribunda* (King) Merr. (1934).

Vernacular names Malaysia: melor angin, babi kurus, inai kechil (Peninsular).

Distribution Southern Burma (Myanmar), peninsular Thailand, Peninsular Malaysia, Sumatra and south-western Java.

Uses In Peninsular Malaysia boiled roots are applied to the body to treat fever.

Observations A shrub to small tree up to 13(–23) m tall; leaves 10–29(–42) cm × (2.5–)3.5–9(–20) cm; inflorescence on a peduncle; flowers with petals 3.5–7(–9) mm long, white-yellow, anthers with small appendage; fruit c. 1 cm in diameter, more or less hairy, greenish. *R. lanceolata* oc-

curs in primary forest, also in forest edges, up to 750 m altitude.

Selected sources 121, 247, 990.

Rini Sasanti Handayani

Rotula aquatica Lour.

Fl. cochinch.: 121 (1790).

BORAGINACEAE

$2n$ = unknown

Vernacular names Philippines: takad, kulutai (Tagalog), bongtal (Iloko). Vietnam: r[uf] r[if] c[as]t.

Origin and geographic distribution *R. aquatica* occurs in eastern Brazil, western Africa, and from India, throughout continental South-East Asia, to southern China and the Malesian region, where it is found in Peninsular Malaysia, Borneo, the Philippines, Sulawesi and New Guinea.

Uses In the Philippines and Thailand a stem decoction is used as a sudorific and diuretic. In the Ayurvedic system of medicine the root is well known for the treatment of urinary troubles. In Kerala (India) tender stems and leaves are used as a psychoactive agent; they are dried and smoked in combination with tobacco, or drunk mixed with coconut milk. It is said that *R. aquatica* provokes physical and mental stimulation and enhances thought processes.

Botany A shrub with many elongate, terete shoots, up to 3 m tall. Leaves alternate, crowded on numerous lateral short-shoots, simple and entire, oblanceolate to oblong, 0.6–2.5 cm × 0.2–0.9 cm, base cuneate to rounded, apex obtuse and mucronate, subcoriaceous, strigose, rarely glabrous; petiole 0.5–3 mm long; stipules absent. Inflorescence a terminal, short, few-flowered cyme, bracteate. Flowers bisexual, 5-merous, pedicellate; calyx with unequal lobes, 4–5 mm long; corolla 5–7 mm long, tube 1–2 mm long, lobes rounded, pink to purplish; stamens alternate with corolla lobes, exserted; ovary superior, 4-celled, style undivided. Fruit a subglobose drupe 3–4 mm in diameter, yellowish to brownish-red, with a strongly 4-lobed endocarp breaking up into 4 single-seeded pyrenes at an early stage. Seeds oblong, without endosperm.

Rotula comprises 2(–3) species. It is closely related to *Ehretia*, but differs especially in the undivided style. The populations of *R. aquatica* in eastern Brasil and western Africa are sometimes considered a separate species: *R. lycioides* (Mart.) I.M. Johnst.

Ecology *R. aquatica* is restricted to forested lowland areas, where it grows in rocky, gravelly or sandy localities that are periodically inundated, especially along streams.

Genetic resources *R. aquatica* is not threatened by genetic erosion in view of its large natural distribution.

Prospects Research on the phytochemistry and pharmacological activities of *R. aquatica* has not yet been carried out, but might give interesting results because of its close affinity to *Ehretia*, which has shown promising pharmacological activities. The claimed psychoactive activity deserves attention in research.

Literature 247, 668, 760.

Other selected sources 621, 1013.

A.M. Aguinaldo

Ruellia tuberosa L.

Sp. pl. 2: 635 (1753).

ACANTHACEAE

$2n$ = 32, 34

Vernacular names Thailand: toi ting (Bangkok). Vietnam: q[ur]a n[oor], tanh t[as]ch.

Origin and geographic distribution *R. tuberosa* originates from tropical America, but is naturalized in South-East Asia (Thailand, Peninsular Malaysia, Java) and elsewhere in the tropics (India, Sri Lanka, Africa), as an escape from cultivation as an ornamental.

Uses Although *R. tuberosa* is apparently only rarely used medicinally in South-East Asia, it has numerous applications in traditional medicine in tropical America, most commonly the roots, which are emetic and purgative. A decoction of dried and powdered roots is used as a diuretic, often in cases of gonorrhoea and syphilis, to treat kidney troubles and diabetes, as a febrifuge, and to treat colds. A decoction of whole plants is applied externally to sores and wounds and internally to treat pulmonary catarrh, asthma, influenza and colds. The leaves are used to treat toothache, and a leaf decoction against fever, chronic bronchitis and leucorrhoea. In Thailand, seeds and leaves are applied as a poultice to ulcers and abscesses.

R. tuberosa is grown as an ornamental for its attractive flowers.

Properties An aqueous extract of *R. tuberosa* stems of Cuban origin showed antineoplastic activity on *Neurospora crassa* (83.5% inhibition).

In-vitro bactericidal effects against plant pathogenic bacteria have been demonstrated for *R.*

tuberosa infusions. *R. tuberosa* root extracts containing 2,6-dimethoxyquinone, acacetin and a C_{16}-quinone had protective and curative effects against fusarial wilt of safflower (*Carthamus tinctorius* L.). Triterpenes (lupeol) and phytosterols (sitosterol, stigmasterol and campesterol) have been isolated from the roots. Flavone glucuronides such as apigenin-7-β-D-glucuronide were isolated from the leaves and flowers.

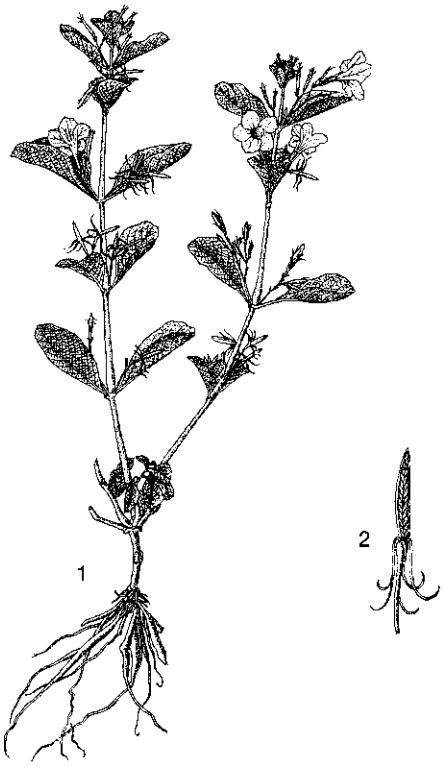
Botany An erect perennial herb up to 90 cm tall, with elongately tuberous roots and subquadrangular stem thickened above the nodes. Leaves opposite, simple and entire, oblong to oblong-obovate, 6–18 cm × 3–9 cm, decurrent at base, obtuse to rounded at apex, sparingly hairy or glabrous, with cystoliths; petiole up to 1.5 cm long, connected by transverse ridges; stipules absent. Inflorescence an axillary cyme, rather lax, 1–15-flowered; bracts narrow, up to 9 mm long; peduncle up to 2.5 cm long. Flowers bisexual, 5-merous; pedicel up to 2.5 cm long; calyx 2–3 cm long, partite with narrow, finally reflexed segments; corolla 5–6 cm long, infundibular with narrow base, unequally to subequally lobed with rounded lobes up to 2.5 cm long, irregularly sinuate-dentate, bright violet to pale blue, sometimes white; stamens 4, inserted at base of corolla tube, didynamous; ovary superior, 2-celled, style subulate with 2 unequal stigmatic lobes. Fruit a fusiform capsule 2–3 cm long, many-seeded. Seeds orbicular, compressed, ringed with hygroscopic hairs.

The flowers are ephemerous, but plants may flower throughout the year. Cleistogamous flowers only about 2.5 mm long are commonly present, often producing fruits.

Numerous species have been described in *Ruellia*, resulting in a large and variable genus. Several attempts have been made to split it up into segregate genera which form more natural groups, one of these resulting in a small genus concept of *Ruellia* consisting of only 2–5 species. However, there is still disagreement among taxonomists about the generic concept within the group of *Acanthaceae* to which *Ruellia* belongs. Some medicinal species in South-East Asia formerly included in *Ruellia* are described in this publication in the genera *Dipteracanthus*, *Hemigraphis* and *Pararuellia*.

Ecology *R. tuberosa* occurs along roadsides and in waste places, in Java up to 150 m altitude, and is locally common.

Management In cultivation *R. tuberosa* is propagated by seed, suckers and cuttings. It is planted in garden borders, and is especially suited for slightly shaded, humid localities.



Ruellia tuberosa L. – 1, plant habit; 2, fruit.

Genetic resources *R. tuberosa* is widely spread through cultivation and naturalization, and does not seem liable to genetic erosion. Its area of distribution still seems to be expanding.

Prospects Although, as an introduced species, *R. tuberosa* is little known in the Malesian region, it deserves attention as a medicinal plant given its reputation in the American tropics.

Literature 62, 273, 575, 646.

Other selected sources 120, 121, 972.

Yun Astuti Nugroho

Rungia laxiflora C.B. Clarke

Journ. As. Soc. Beng., Pt. 2, Nat. Hist. 74: 698 (1908).

ACANTHACEAE

$2n$ = unknown

Synonyms *Justicia uber* C.B. Clarke (1908), *Justicia bracteata* Ridley (1909), *Justicia clarkeana* Ridley (1923).

Vernacular names Malaysia: puding hutan jantan, serupet, akar ratus (Peninsular).

Origin and geographic distribution *R. laxi-*

flora occurs in southern peninsular Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia, the leaves have been used externally as a poultice to treat headache and abdominal complaints, whereas the plant has been used internally as an ingredient in a complex decoction to treat diarrhoea.

R. klossii S. Moore is a popular vegetable in the highlands of New Guinea. The leaves are also used in a poison antidote, in mixtures with other plants which induce vomiting. Roasted or boiled leaves are eaten to treat colds, influenza and sore throat.

The leaves of the African *R. grandis* T. Anderson are used in Gabon as anthelmintic and the bark as an antidysenteric.

Properties There is no information on phytochemistry and pharmacological properties of *R. laxiflora*. A fair quantity of alkaloids has been detected in *R. grandis* material from Nigeria, e.g. macrorin and isomacrorin.

Botany A herb up to 90(–150) cm tall, sometimes straggling, glabrous or slightly hairy. Leaves opposite, ovate-elliptical to elliptical-lanceolate, 5–25 cm × 2.5–10 cm, narrowed at both ends, with cystoliths; petiole 0.5–3 cm long; stipules absent. Inflorescence an axillary or terminal spike with flowers arranged on one side, up to 15 cm long, distinctly bracteate. Flowers bisexual; calyx deeply 5-fid; corolla 6–15 mm long, tube short, widened upwards, 2-lipped, upper lip slightly emarginate, lower lip shortly 3-lobed, creamy-yellow or whitish, often striped or spotted purplish on lips; stamens 2, inserted at the base of the widening of the corolla tube, anthers 2-celled with lower cell basally spurred; ovary superior, 2-celled, style entire or shortly 2-lobed. Fruit a clavate capsule 8–15 mm long, with rising elastic placenta, 4-seeded. Seeds compressed orbicular, pubescent, pustulate.

Rungia comprises approximately 50 species and occurs in tropical Africa and tropical Asia. It is related to *Justicia*, but can be distinguished by the combination of the following characters: placentas in the fruit rising, and inflorescence always spicate with one bract sterile and the other fertile at each node. *R. laxiflora* is a variable species, particularly in the shape and size of the bracts and bracteoles, and many species have been distinguished in the past. However, the variation seems to be continuous and does not support specific distinction.

Ecology *R. laxiflora* is locally common in lowland and lower montane forest in Peninsular Malaysia, up to 1300 m altitude. It is also found on limestone.

Genetic resources The area of distribution of *R. laxiflora* seems limited; up till now it has only been recorded from Peninsular Malaysia and the adjacent part of peninsular Thailand. However, in these areas it is common, at least locally, and seems not to be endangered.

Prospects The topical applications of *R. laxiflora* are comparable to those of other *Acanthaceae*, e.g. *Hygrophila ringens* (L.) R.Br. ex Steudel, *Justicia* and *Peristrophe* species, and *Ptyssiglottis kunthiana* (Nees) B. Hansen. Research on active compounds and pharmacological properties for these species is desirable. A taxonomic treatment of the genus *Rungia* is urgently needed to gain an insight into the delimitation and distribution of its species.

Literature 121, 363.

Other selected sources 120, 331, 347, 789, 853.

R.H.M.J. Lemmens

Salomonia cantoniensis Lour.

Fl. cochinch. 1: 14 (1790).

POLYGALACEAE

$2n$ = unknown

Vernacular names Indonesia: rumput sekera (Palembang, Sumatra). Malaysia: rumput buak (Peninsular). Vietnam: sa m[oo]n qu[ar]ng d[oo]ng.

Origin and geographic distribution *S. cantoniensis* is widely distributed from Nepal, eastern India, Bangladesh and Burma (Myanmar), through southern Vietnam, southern China and Thailand, to the Malesian region: Peninsular Malaysia, Sumatra, Java, the Lesser Sunda Islands, Borneo, the Philippines, Sulawesi and the Moluccas.

Uses There is only one record of medicinal application of *S. cantoniensis* from Sumatra, where pounded plants are pulped and rubbed in the mouth to treat thrush in children.

Properties The presence of saponins has been recorded for *Salomonia*.

Botany A small, erect short-lived herb up to 30(–40) cm tall, with aromatic roots; stem angular with 3 transparent wings, lateral stems often long and patent. Leaves alternate, broadly ovate, 4–15 mm × 3–10 mm, slightly cordate at base, mucronate at apex, glabrous, 3–5-veined; petiole 0.5–2 mm long; stipules absent. Inflorescence a terminal spike up to 6 cm long, with caducous bracts. Flowers bisexual, 1.5–2.5 mm long, white to pale violet;

sepals 5, connate at very base, subequal, persistent; petals 3, unequal, asymmetric, halfway adnate to the staminal tube, the 2 upper ones halfway connate to the lower one, free part of lower petal cup-shaped and completely enclosing stamens and stigma; stamens 4 or 6, anthers sessile; ovary superior, 2-celled, style strongly curved, apically with 2-lobed stigma completely enclosed by the anthers. Fruit a transversally elliptical, laterally compressed capsule c. 1 mm × 1.5–2 mm, far exceeding the sepals, at the margin of each cell with a double row of spines, dehiscent, 2-seeded. Seeds ellipsoid, laterally flattened, glabrous, black, embryo translucent, endosperm nearly absent in ripe seeds.

Salomonia comprises 6 species, 2 of which are widespread in the Malesian region, and 4 endemic to Thailand (one also in neighbouring Cambodia). *S. ciliata* (L.) DC. is the most widespread species with the same area of distribution as *S. cantoniensis*, but additionally Sri Lanka, Korea, Japan, New Guinea, northern Australia and islands of the Pacific Ocean. These species are frequently confused and mixed collections are not uncommon. *Salomonia* is closely related to *Epirixanthes*, which differs by the absence of chlorophyll (plant not green), its straight style and its indehiscent fruit.

Ecology *S. cantoniensis* occurs in sunny or slightly shaded localities in grassland or open forest, usually in wet places, up to 1500 m altitude. It is widespread and may be abundant locally.

Genetic resources Although *S. cantoniensis* is in general uncommon, it is so widespread, also in disturbed habitats, that it is unlikely to be liable to genetic erosion.

Prospects *S. cantoniensis* is so little used in its large area of distribution that it seems unlikely that it will gain importance as a medicinal plant in the future.

Literature 247, 334.

Other selected sources 121, 506.

R. Kiew

Salvia plebeia R.Br.

Prodr.: 501 (1810).

LABIATAE

$2n = 16, 32$

Synonyms *Salvia brachiata* Roxb. (1820), *Salvia minutiflora* Bunge (1835).

Vernacular names Vietnam: x[oo]n d[aj]i, kinh gi[ows]i daj]i.

Origin and geographic distribution *S. plebeia* is found from India to Indo-China, China, Taiwan, Korea and Japan, to as far south as Australia. In Malesia it is very rare and only found in northern Sumatra and Luzon (the Philippines).

Uses *Salvia* species are cultivated worldwide as ornamentals and commonly used in flavouring and traditional medicine. In India the seeds of *S. plebeia* are valued on account of their mucilaginous properties and given in cases of menorrhagia, diarrhoea and haemorrhoids. The leaves are used to treat toothache. The herb is employed as a diuretic, astringent and anthelmintic. In Indo-China the whole plant is prescribed to treat colic, cholera and dysentery. In China an aqueous solution is used as a skin wash, and in the treatment of abscesses and boils. The leaves are utilized as a remedy for catarrh, dysentery and skin eruptions. In Korea the plant is credited with diuretic, vermifugal and astringent properties. A decoction of aerial parts is used to treat tumours. In Taiwan *S. plebeia* is used together with *Ocimum* species in a herbal remedy credited with anti-inflammatory activities; the mixture is also used to treat hepatitis and as a detoxicant.

In Java the seeds of *S. hispanica* L. are used as a subtitute for the mucilaginous *Ocimum basilicum* L. seeds in medicinal drinks. *S. officinalis* L., locally cultivated in mountain areas in South-East Asia, is best known as a spice and is an old domestic remedy for numerous afflictions in Europe. In China and Indo-China the roots of *S. miltiorrhiza* Bunge are a well-known drug, which is considered a general blood tonic, invigorating circulation, and to have alterative, antispasmodic, anti-arthritic, tonic, sedative, astringent and vulnerary properties. It is used to treat urogenital and gastro-intestinal inflammations, and internal abscesses.

Properties *Salvia* is a rich source of polyphenolic flavonoids and phenolic acids. Flavones, flavonols and their glycosides constitute the majority of flavonoids. The phenolic acids are exclusively formed from caffeic acid building blocks. The caffeic acid derivatives are believed to be responsible for the many biological activities, including antioxidant, antiplatelet, antitumour and antiviral activities. Many *Salvia* species contain a volatile oil.

A *S. plebeia* extract showed protection of the liver against carbon tetrachloride and galactosamine-induced hepatotoxicity in rats. The active principles were identified as pectolinarigenin, eupafolin and hispidulin. The extract also showed an in-

hibitory effect on murine macrophage-mediated cytotoxicity.

Experimental studies have shown that drugs based on *S. miltiorrhiza* roots dilated coronary arteries, increased coronary blood flow, and scavenged free radicals in ischaemic diseases; they reduced the cellular damage from ischaemia and improved heart functions. Clinical trials indicated that *S. miltiorrhiza* is an effective medicine for angina pectoris, myocardial infarction and stroke. Experimental studies in rats indicate beneficial effects of a hot-water extract of *S. miltiorrhiza* roots on liver fibrosis.

Botany An annual or biennial herb (15–)40–60(–90) cm tall, much-branched; stems 4-angled, grooved, tomentose or glabrescent. Leaves opposite, simple, narrowly elliptical to narrowly ovate, 2–4(–6) cm × 0.8–1.5(–2.5) cm, base rounded to cuneate, apex subacute or obtuse, crenate, hirsute; petiole 2–4 cm long; stipules absent. Inflorescence a pseudoraceme, terminal or in the upper leaf axils, often forming a large panicle 10–25 cm long, with the flowers grouped in 4–10-flowered verticillasters; bracts small, lanceolate. Flowers bisexual, zygomorphic; calyx campanulate, 2-lipped, 2 mm long accrescent to 2.5 mm, densely tomentose and glandular; corolla tubular, 3–3.5 mm long, 2-lipped, upper lip oblong, obtuse, lower lip 3-lobed, violet, purplish or blue; stamens 2, slightly exserted; ovary superior, deeply 4-partite. Fruit composed of 4 nutlets; nutlets ovoid, 1 mm × 0.7 mm, rugose, brown.

Salvia comprises about 500 species, and is widely distributed in temperate and subtropical regions, but with few species in the tropics. About 20 species occur in South-East Asia, 6 of which are native or naturalized; the others occur only in cultivation (mainly as ornamentals).

Ecology In Sumatra *S. plebeia* occurs as a weed in fallow land at 1000–1350 m altitude, whereas in Luzon it is a weed in urban areas at low altitude.

Management In Korea aboveground parts of *S. plebeia* are harvested at the end of the flowering period.

Genetic resources *S. plebeia* is a widespread species often occurring in disturbed habitats, and does not seem to be seriously threatened by genetic erosion. However, its distribution in Malesia is very limited; therefore its genetic basis might be narrow there.

Prospects Although the pharmacology of *S. miltiorrhiza* is very well studied, little is known about *S. plebeia*. Further research is needed to support its traditional medicinal uses, and to judge its prospects as a cultivated medicinal plant for South-East Asia.

Literature 181, 247, 428, 553, 578, 664, 708, 731, 760, 942.

Other selected sources 196, 334, 732.

J.L.C.H. van Valkenburg

Sambucus javanica Reinw. ex Blume

Bijdr. fl. Ned. Ind. 13: 657 (1826).

CAPRIFOLIACEAE

$2n = 36$

Synonyms *Sambucus thunbergiana* Blume ex Miq. (1866), *Sambucus formosana* Nakai (1917), *Sambucus henriana* Samutina (1986).

Vernacular names Javanese elder (En). Indonesia: sengitan (Javanese), ki tespong (Sundanese). Philippines: galamat, kalamat (Igorot), sauko (Tagalog). Vietnam: c[ow]m ch[as]y, thu[oos]c m[oj]i, s[os]c d[ij]ch.

Origin and geographic distribution *S. javanica* occurs in India, Burma (Myanmar), Indo-China, southern China, Taiwan, Japan, Thailand and throughout Malesia except Peninsular Malaysia and the Moluccas.

Uses In Mindanao (the Philippines) the plant is considered a remedy for fatigue. In Indonesia the leaves are considered laxative, and an infusion of flowers and leaves is used as a sudorific and diuretic. An infusion of dried leaves is considered antirheumatic and analgesic in Malaysia. In Indo-China the flowers and fruits are used in folk medicine as a depurative, diuretic and laxative. In Thailand crushed aerial parts are applied as a poultice to inflammations. In China the whole plant is used as an antirheumatic, an analgesic and to treat bone diseases in general. It is considered diaphoretic, but also poisonous and emetic. A decoction is used in a bath for treating skin diseases, painful swellings or inflammations resulting from mechanical injuries. External use is said to soothe rheumatic pains and accelerate the healing process after fractures. The young leaves are occasionally used as a tea substitute or as a cooked vegetable.

Properties *S. javanica* shows antihepatotoxic properties, which can be attributed to the presence of ursolic acid (a triterpene carboxylic acid). Fruit extracts of the European black elder (*S. nigra* L.) showed antiviral properties, especially against different strains of influenza virus, and might be beneficial to the immune system activa-

tion. Tests demonstrated insulin-releasing and insulin-like activity of these extracts, supporting the traditional use for the treatment of diabetes, and also diuretic activity in rats. A rhizome extract of another European species, *S. ebulus* L., showed antinociceptive and anti-inflammatory effects. Anthocyanins are responsible for the demonstrated antioxidant activity of *S. nigra* fruits. Ribosome-inactivating proteins without in-vivo toxicity have been isolated from several *Sambucus* species.

Botany A perennial herb with creeping rhizome, shrub or small tree up to 7 m tall; stem grooved or smooth. Leaves opposite, (5–)7–13-foliolate (1–3-foliolate below inflorescence); stipules glandular or foliaceous; leaflets oblong, lanceolate or linear-lanceolate, 7–22(–30) cm × 1.5–6.5 cm, base cuneate to cordate, apex acuminate, shallowly serrate with lower teeth glandular swollen, shortly stalked to sessile. Inflorescence a terminal, flat-topped, 3–5(–7)-rayed corymb up to 30 cm in diameter, with urceolate yellow, orange or scarlet nectaries in the outer axils. Flowers bisexual, regular, 4–5 mm in diameter, 5-merous, lemon-scented; calyx lobes minute; corolla rotate, with valvate lobes, white or creamy; stamens spreading, anthers yellow; ovary inferior, 3-celled, stigmas 3. Fruit a globose berry 3–4 mm in diameter, black or rarely scarlet to orange, 3-seeded. Seeds ovoid, often ventrally flattened, verrucose. Seedling with epigeal germination.

S. javanica can be found flowering and fruiting throughout the year. Beetles are the main pollinators, and may provide self- as well as cross-pollination. Dispersal of the juicy berries is most likely effected by frugivorous birds. Germination of seeds takes less than a month in full light.

Sambucus comprises 9 species and numerous subspecies, and occurs throughout the Northern hemisphere, but is of scattered occurrence in the Southern hemisphere. *S. javanica* populations in the northern part of the area of distribution tend to be perennial herbs or shrubs with orange or red fruits, whereas in the Malesian region shrubs or small trees with scarlet or black fruits predominate.

Ecology *S. javanica* is found in relatively moist primary and secondary forest along fringes and in clearings from sea-level up to 2500 m altitude; in South-East Asia it is most common above 1000 m altitude.

Genetic resources *S. javanica* is widespread and well adapted to disturbed habitats. It is not threatened by genetic erosion.

Prospects Little is known about the pharmacological activities of *S. javanica*. Results on pharmacological research on temperate *Sambucus* species are very promising, and further research on *S. javanica* seems therefore worthwhile.

Literature 16, 99, 291, 671, 731, 760, 953, 970.

Other selected sources 247, 559, 732, 952.

J.L.C.H. van Valkenburg

Sapindus L.

Sp. pl. 1: 367 (1753); Gen. pl. ed. 5 :171 (1754).

SAPINDACEAE

x = 11, 15, 18; *S. saponaria*: $2n$ = 22, 28, 30, 36, *S. trifoliatus*: $2n$ = 36

Origin and geographic distribution *Sapindus* comprises 10 species. Continental South-East Asia is richest in species (6). Two species are confined to Central and southern North America, one is endemic to Hawaii and one occurs throughout the tropics and subtropics, partly enhanced by man. In Malesia one species (*S. rarak*) is indigenous, a second (*S. saponaria*) locally naturalized but obviously introduced by man, and a third (*S. trifoliatus* L.) occasionally planted as an ornamental.

Uses Fruits of *Sapindus* are commonly used in traditional medicine, usually for external applications, e.g. to treat pimples and scabies, and as an insecticide and leech repellent. In India the fruits of *S. trifoliatus* are used as a remedy for colic, diarrhoea and cholera; an infusion of the fruits is recommended for the treatment of snakebites. Inserted in the nostrils the fruits are said to be a remedy for fits, and a fumigation remedial for hysteria and melancholy. Externally a plaster may be applied to snakebites and swellings. The root may be used as an expectorant and the fruit pulp as a strong purgative.

It appears that the various *Sapindus* species are more or less used indiscriminately in continental South-East Asia or that they are mutually exchangeable. In Thailand fruits or fruit pulp of *S. trifoliatus*, pounded in water, are applied as a skin wash or shampoo. The fruit pulp is commonly used as a substitute for soap to wash clothes, e.g. the traditional soga batik of Central Java. The fruits are also employed as a fish poison. The timber of *Sapindus* is not durable and mostly used for firewood and charcoal only.

Properties Saponins are found in all plant parts of *Sapindus*, with the highest concentration in the fruits. Saponins as present in the fruit pericarp of several *Sapindus* species show strong mol-

luscicidal activity (LC_{100} after 24 h at 5–13 ppm). Extracts also showed potent insecticidal and antifungal activities as well as ichthyotoxic properties.

An extract of *S. saponaria* totally inhibited the haemorrhagic effect induced by snake venom in a mouse bioassay. The saponins in the fruit pulp of *S. trifoliatus* showed potent antispermatogenic effects in various test animals. Saponins from the fruit pulp of *S. saponaria* are one of the 3 ingredients of a polyherbal cream and pessary that has been developed. These ingredients have synergistic spermicidal properties on human sperm, in vitro and in vivo, and a high contraceptive activity in various mammals. Another interesting property of the saponins is their inhibitory action against a wide range of microorganisms, e.g. *Candida albicans*, *Neisseria gonorrhoea*, Herpes simplex-2 and HIV-1 viruses. Phase-I clinical trials have been successfully completed in several countries.

Saponins isolated from the fruit pulp of *S. rarak* showed in-vitro antibacterial activity against *Staphylococcus aureus* and *Streptococcus pyogenes*, and antifungal activity against *Candida albicans* and *Candida tropicalis*.

The fruit pulp of *S. saponaria* provides a promising biodegradable surfactant for hexachlorobenzene and naphthalene contaminated soils. A methanol extract of *S. rarak* fruits, given as a food additive to sheep significantly increased weight gain and digestive efficiency.

Botany Evergreen, monoecious, small to fairly large trees up to 40 m tall. Leaves arranged spirally, paripinnate, without stipules; leaflets alternate or opposite, entire, herbaceous to leathery. Inflorescence terminal, thyrsoid, widely branched. Flowers unisexual (at least functionally), regular or zygomorphic; sepals 5, free, outer 2 smaller; petals 4–5, equal, as long as or slightly longer than the sepals, short-clawed and with a scale inside; disk annular or semi-annular; stamens 8, free; ovary superior, 3-lobed, 3-celled, strongly reduced in male flowers, style slender. Fruit a 3-lobed schizocarp, but often 1 or 2 parts abortive, breaking up into globular or obovoid drupes, these 1-seeded. Seed globular or ellipsoid, smooth, black.

Ecology In South-East Asia *Sapindus* is predominantly found in forests and thickets in monsoon areas at low to medium altitudes.

Management *Sapindus* is commonly propagated by seed. Pre-treatment with concentrated sulphuric acid or cow-dung slurry is strongly recommended. Chip budding and in-vitro propagation techniques have been practised successfully for *S. saponaria*.

Genetic resources Both *S. rarak* and *S. saponaria* are widespread and well adapted to disturbed habitats. Moreover, they are widely cultivated and locally naturalized, and thus do not seem to be liable to genetic erosion.

Prospects Various tests have corroborated the traditional medicinal uses of South-East Asian *Sapindus*, and most of the activities recorded result from the presence of high concentrations of saponin. *Sapindus* seems to have promising prospects for the development of modern phytomedicines, especially for external application, having antimicrobial and insecticidal activities. Locally the fruits are highly esteemed as a soap substitute because they are considered to prevent fading of locally produced traditional clothing.

Literature 121, 127, 240, 762, 798, 911.

Selection of species

Sapindus rarak DC.

Prodr. 1: 608 (1824).

Vernacular names Indonesia: lamuran (Palembang, Sumatra), rerek (Sundanese), lerak (Javanese). Malaysia: lerak (Peninsular). Thailand: makham dee khwaai (central, peninsular), masak, sompoi thet (northern).

Distribution Eastern India, Burma (Myanmar), Indo-China, Taiwan, Thailand, Peninsular Malaysia, Sumatra, Bangka, Java, Lombok and Sumbawa; widely cultivated elsewhere in Malesia.

Uses An infusion of the fruits is used as a wash for pimples, and the fruit pulp as a remedy for scabies. A decoction is recommended as an insecticide. The fruit pulp is employed as a soap substitute to wash especially batik and coloured clothes, but also jewellery, and as a shampoo, especially to get rid of head lice. Pounded bark may be used in a similar way. The fruits are a very potent fish poison.

Observations A fairly large tree up to 40 m tall, bole up to 100 cm in diameter; leaves (7–)9–13-jugate, up to 50 cm long, glabrous, petiole variably terete, up to 9 cm long, rachis not winged, leaflets subopposite to alternate, lanceolate-ovate, mostly oblique and slightly falcate, 7–16 cm × 2–3.5 cm, base oblique, apex obtuse to acute-acuminate, mucronate; inflorescence up to 35 cm long, densely tomentellous; flowers zygomorphic, white, sepals flat, hardly petaloid, out-

side densely appressed hairy, petals 4, lanceolate-ovate to elliptical, 3 mm × 1–2 mm, scale of about the same shape and size, disk semi-annular, pistil 3.5–4 mm long; drupe subglobular, 2 cm × 1.8 cm in diameter, carinate, red. *S. rarak* is found in forest from sea-level up to 1600 m altitude, with a preference for a pronounced seasonality.

Selected sources 62, 121, 247, 251, 334.

Sapindus saponaria L.

Sp. pl. 1: 367 (1753).

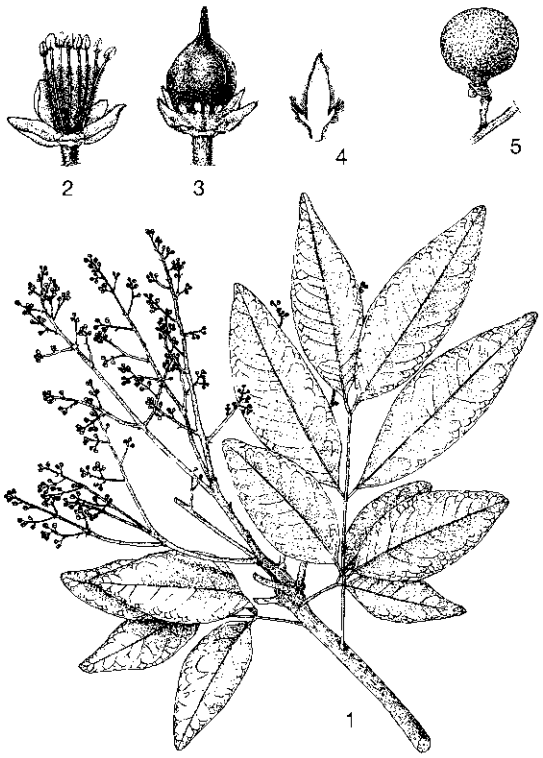
Synonyms *Sapindus mukorossi* Gaertner (1788), *Sapindus vitiensis* A. Gray (1854), *Sapindus microcarpus* Jardin (1857).

Vernacular names Soap-berry tree, soap-nut (En). Philippines: tikastikas (Tagalog), kasibeng (Ibanag, Iloko), malapalitpit (Pampango). Vietnam: b[oof] h[of]n, v[oo] ho[aj]n t[uwr].

Distribution Originating from tropical and subtropical America, widely cultivated and naturalized in the tropics and subtropics, in Asia from India to China and Japan; in Malesia confined to the Philippines, the Lesser Sunda Islands and Papua New Guinea (Central Province).

Uses Roots, bark, leaves, but especially fruits are used as a substitute for soap. The fruits are applied as a fish poison and as a leech repellent. In the Philippines the bark is used for washing the hair, and crushed leaves for removing stains from the skin. In Vietnam a decoction of macerated bark is applied to kill head and body lice. The fruits are employed as a skin wash to remove tan and freckles. The kernel is recommended for bad breath, gum boils and tooth decay. A seed decoction taken internally acts as an expectorant. In Taiwan the flowers are a recommended medication for conjunctivitis and various eye diseases. In South and Central America the fruits are commonly used in traditional medicine, mainly in external applications to treat arthritis, rheumatism, gout, tumours and leprous swellings. Fibre from the inner bark may be used for ropes.

Observations A tree up to 25 m tall, bole up to 55 cm in diameter; leaves 1–5-jugate, up to 40 cm long, glabrous, petiole terete to 3-angular, 1.5–5.5 cm long, rachis variably marginated or winged, leaflets (sub-)opposite, elliptical to lanceolate, mostly slightly oblique and falcate, 6–16 cm × 3–6 cm, base cuneate, apex emarginate or obtuse to acute; inflorescence up to 25 cm long, densely tomentose; flowers regular, cream, sepals concave, mostly with a broad petaloid margin, ciliolate and with some appressed hairs near the base, petals 5, oblong-ovate to ovate, 1.5–2.5 mm × 1–1.2 mm,



Sapindus saponaria L. – 1, flowering branch; 2, male flower; 3, female flower; 4, petal; 5, fruit.

scale represented by a hairy ridge or 2 auricles, disk annular, pistil c. 2 mm long; drupe subglobular, 0.8–1.2 cm in diameter, not carinate. In Malesia three geographically disjunct races can be discerned. *S. saponaria* is found in more or less open, mostly secondary forest up to 500 m altitude.

Selected sources 117, 247, 646, 671, 732, 783, 926.

Lucie Widowati

Saprosma Blume

Bijdr. fl. Ned. Ind.: 956 (1827).

RUBIACEAE

x = unknown

Origin and geographic distribution *Saprosma* comprises about 30 species and is distributed from India and Sri Lanka, through Burma (Myanmar), Indo-China, southern China and Thailand, to the Malesian region.

Uses In traditional medicine in Peninsular Malaysia the leaves of *Saprosma* are cooked with food in case of complaints in the digestive organs.

They are used also internally to treat flatulence and externally as a poultice after childbirth. Probably they serve as a substitute for *Paederia*. Undefined medicinal uses have been mentioned for *S. arboreum* Blume in Java.

Properties Bruised leafy parts of *Saprosma* plants have an offensive faecal smell similar to *Paederia* species, probably caused by similar compounds. A dozen of iridoid glucosides, 8 bis-iridoid glucosides (saprosmosides A–H) and 7 anthraquinones (derivatives of munjistin and lucidin) have been isolated from leaves and stems of *S. scortechinii*.

Botany Shrubs or small trees up to 8 m tall. Leaves opposite or in whorls of 3, simple and entire, pinnately veined, foetid when bruised, sessile or shortly petiolate; stipules interpetiolar, shortly connate into a tube, broadly triangular, with pale stiff bristles along the base on the inner side. Inflorescence a terminal or axillary cyme, sometimes fasciculate, often on short branches having 2 nodes of which the lower is leafless. Flowers bisexual, 4(–5)-merous, usually sessile; calyx campanulate to hypocrateriform, truncate or with minute lobes; corolla infundibular with short tube having a hairy throat, lobes ovate, valvate in bud, whitish or yellowish; stamens inserted at or near the corolla throat, filaments short, exserted; disk annular; ovary inferior, 2-celled, style included, with 2-lobed stigma. Fruit a globose to ellipsoid drupe, thin-walled, ripening crimson, blue or black, usually with a white-waxy bloom, (1–)2-seeded. Seeds ellipsoid or plano-convex.

Saprosma is traditionally classified in the tribe *Psychotrieae*, but is better placed in *Paederieae*, together with e.g. *Paederia*, based on the valvate-induplicate aestivation, pollen morphology, ovary characteristics, and the foetid odour of crushed leaves. The taxonomy of the genus has been poorly studied for South-East Asia. It is, for example, doubtful whether the species named *S. ternatum* in Malaysia is the same as what is called so elsewhere.

Ecology Most *Saprosma* species occur in lowland or lower montane forests.

Genetic resources Although the areas of distribution of *Saprosma* species are still not clearly known, the species treated here seem to have a limited distribution and might easily become endangered or liable to genetic erosion.

Prospects Very little is known about *Saprosma* of South-East Asia, and this refers to all aspects including botany, ecology, phytochemistry and pharmacological properties. Perhaps *Saprosma* may be a substitute for the much better known *Paederia*.

Literature 121, 731.

Selection of species

Saprosma glomerulatum King & Gamble

Journ. As. Soc. Beng. pt. 2, Nat. Hist. 73: 98 (1904).

Vernacular names Malaysia: sekentut, kentut-kentut, chunpong (Peninsular).

Distribution Peninsular Malaysia and Singapore.

Uses In Peninsular Malaysia the leaves have been cooked with food in cases of complaints in the digestive organs.

Observations A shrub up to 3 m tall; leaves elliptical to ovate-elliptical, 10–17.5 cm × 4–7.5 cm, petiole 0.5–1 cm long; flowers in dense head-like clusters. *S. glomerulatum* occurs in lowland and lower montane forest, also in swamp forest.

Selected sources 121, 789, 990.

Saprosma scortechinii King & Gamble

Journ. As. Soc. Beng. pt. 2, Nat. Hist. 73: 99 (1904).

Vernacular names Malaysia: berkerak (Peninsular).

Distribution Northern Peninsular Malaysia.

Uses *S. scortechinii* is used to treat fever.

Observations A shrub up to 2 m tall; leaves elliptical, 9–14 cm × 4–6.5 cm, petiole c. 0.5 cm long; flowers in distinctly branched, usually 3-flowered cymes up to 2.5 cm long, calyx lobes linear to lanceolate, up to 1 mm broad. *S. scortechinii* occurs in lowland and lower montane forests up to 1000 m altitude.

Selected sources 121, 572, 573, 789, 990.

Saprosma ternatum Hook.f.

Fl. Brit. India 3: 193 (1881).

Vernacular names Malaysia: sekentut, kesimbukan, merbuloh paya (Peninsular). Vietnam: ho[aj]i h[uw][ow]ng.

Distribution Eastern India, Burma (Myanmar), Indo-China, southern China, Thailand and northern Peninsular Malaysia.

Uses In Peninsular Malaysia the leaves are used internally to treat flatulence and externally as a poultice after childbirth.

Observations A shrub up to 3 m tall; leaves elliptical to elliptical-lanceolate, 10–25 cm × 4–9 cm,

petiole 1–1.5 cm long; flowers in distinctly branched, several-flowered cymes up to 9 cm long, calyx lobes narrowly triangular, over 1 mm broad. *S. ternatum* occurs in lowland and hill forests.

Selected sources 121, 789, 990.

Dodi Darmakusuma

Sarcolobus globosus Wallich

Asiat. Res. 12: 568 (1818).

ASCLEPIADACEAE

$2n$ = unknown

Synonyms *Sarcolobus banksii* Roemer & Schultes (1820), *Sarcolobus narcoticus* Span. ex Miq. (1857), *Sarcolobus spanoghei* Miq. (1857).

Vernacular names Indonesia: walikambing (Sundanese), lakambing (Javanese), peler kambing (Madurese). Malaysia: akar pelir kambing, buah pitis, pitis-pitis (Peninsular). Thailand: hua ling (Bangkok). Vietnam: d[aa]y c[as]m.

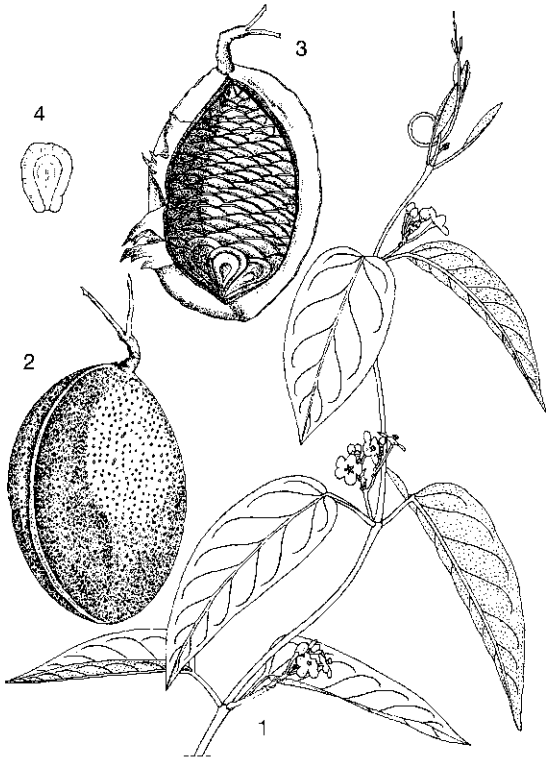
Origin and geographic distribution Eastern India, Burma (Myanmar), Indo-China, Thailand, and throughout Malesia except the Lesser Sunda Islands.

Uses In Peninsular Malaysia, the leaves of *S. globosus* are ground into a paste with nuts of *Aleurites*, and this paste is used for rubbing on the joints to treat rheumatism or dengue fever. The bark and seeds contain a poisonous resin, which is used to poison animals such as dogs, wild pigs and tigers. It has been suggested that the extinction of the Javanese tiger was due to the use of *S. globosus* poison by the local population. The fruit is candied for consumption, but seeds and resin should be removed carefully. The leaves are occasionally eaten with curry.

Properties Some alkaloids and glycosides have been isolated from *S. globosus*; these showed cytotoxic activity against human cervical carcinoma cell lines. The seeds, bark, resin and leaves are toxic in various degrees. The seeds from one fruit are enough to kill large animals such as elephants, buffaloes and cattle. Toxic symptoms such as debility, incoordination, progressive muscular tremors commencing posteriorly, pupil dilation, teeth grinding, blanching of visible membranes, rapid pulse, dyspnoea and coma appeared in cattle within 8 hours after consuming the leaves. Death occurred 20 hours later. Inflammation of the gastro-intestinal tract was the most significant post-mortem lesion. Tests with dogs showed that 5 g of bark powder caused serious intoxication, but the dogs recovered completely after about one week. Fresh coconut water is considered an antidote for humans. The crude toxic resinous constituent has been called sarcolobid.

The results of tests on a crude glycoside extract suggest that the neuromuscular blocking effect of the extract is either dose-dependent or due to a mixture of toxins with presynaptic or postsynaptic actions, and that the inhibitory effect on smooth muscle contractions is mainly due to inhibition of calcium influx.

Botany A small liana; stem up to 5 m long and c. 5 mm in diameter, terete and hollow, with latex and papery bark, lenticellate. Leaves opposite, simple and entire, ovate to elliptical, (5–)6–10(–12) cm × (2.5–)3–5(–6.5) cm, cordate to obtuse or truncate at base, obtuse to acute or acuminate at apex, leathery, glossy green above, pale green below, secondary veins arching, with extrafloral nectaries at base; petiole 1–4 cm long, grooved, with small stipular structures at base. Inflorescence a racemiform to umbelliform cyme up to 3 cm long, appearing at nodes between the leaves, bracteate. Flowers bisexual, regular, 5-merous; sepals c. 2



Sarcolobus globosus Wallich – 1, apical part of flowering stem; 2, fruit; 3, fruit in longitudinal section; 4, seed.

mm long, ciliate, with glands at base; corolla subrotate to campanulate, 1–2 cm in diameter, deeply lobed, lobes ciliate, glabrous to densely pubescent inside, whitish to yellowish-green with reddish-brown longitudinal stripes on the lobes, with or without 5 truncate ridges in the throat alternating with the lobes; stamens inserted at base of corolla tube, connate, with or without staminal corona lobes adnate to the staminal column, anthers each with an incurved terminal appendage, each anther theca with 2 horizontal pollinia; ovaries 2, superior, free except for bases and tips, with short styles, stigma deeply 5-angled, flat, the centre with a papillose spherical knob and 5 narrow ridges. Fruit consisting of 1–2 subglobose follicles up to 10 cm × 7 cm, unequal at base, brown to purplish, smooth to roughly punctured, with fleshy pericarp, many-seeded. Seeds oblong to obovate, 2–2.5 cm long, flat, lacking a coma.

S. globosus can be found flowering throughout the year.

Sarcolobus consists of approximately 18 species, and occurs in India, Burma (Myanmar), Indo-China, Thailand, the Malesian region, northern and eastern Australia and Melanesia to Fiji. In Malesia, 13 species occur (including *Dorystephania*), New Guinea being richest in species (11).

Within *S. globosus*, 2 subspecies are distinguished: subsp. *globosus* from India to Java and Borneo, and subsp. *peregrinus* (Blanco) Rintz from Vietnam, western Sumatra, Borneo, the Philippines, the Moluccas and New Guinea. They differ in the shape of corolla and corona.

Ecology *S. globosus* occurs along the coast, in mangrove forest and tidal swamp forest, and on sand and coral beaches scrambling over the vegetation.

Management Dried and powdered parts of the bark and seeds are mixed with bait to kill animals. After removal of the poisonous seeds, the fleshy pericarp of the fruit is steeped in salt water for 3–4 days and subsequently for 2 days in fresh water; this removes the water-soluble poisonous resin, and the fruit rind can be eaten with curry or after being boiled in syrup.

Genetic resources *S. globosus* has a large area of distribution and is common in many places. It does not seem to be liable to genetic erosion, although it is confined to a habitat which is under high pressure in many regions, i.e. mangrove communities. The variability of the species deserves more attention, as it has resulted in 2 subspecies being distinguished that are not completely separated geographically.

Prospects Little is known about *S. globosus*, and its prospects as a medicinal plant are unclear. The toxicity of various parts of the plant compels caution in human usage, but may allow its more widespread use as a pesticide.

Literature 121, 254, 292, 405, 658, 659, 792.

Other selected sources 255, 334, 731, 809.

H.C. Ong

Sarcotheca laxa (Ridley) Knuth

Engl., Pflanzenr., Heft 95: 422 (1930).

OXALIDACEAE

$2n$ = unknown

Synonyms *Connaropsis sericea* Ridley (1920), *Connaropsis simplicifolia* Ridley (1922).

Vernacular names Malaysia: belimbing cherchek, belimbing hutan, gerinji (Peninsular).

Origin and geographic distribution *S. laxa* occurs in Peninsular Malaysia and northern Sumatra.

Uses On the east coast of Pahang, Peninsular Malaysia, *S. laxa* roots are used for poulticing wounds. The sour fruits of *Sarcotheca* are added to stews, curries and cooked vegetables, and are said to be a good remedy against cough.

Botany A shrub or small to medium-sized tree up to 23 m tall; bole up to 45 cm in diameter; young branches glabrous to densely ferruginous-tomentose. Leaves alternate, 1-foliolate, oblong to lanceolate, (5–)8–23 cm × (2–)3–8.5 cm, base broadly cuneate to truncate, apex acuminate to caudate, entire; petiole jointed, 0.5–2.5 cm long, upper part swollen and wrinkled; stipules absent. Inflorescence an axillary panicle, 1–3 together, up to 30 cm long, erect, pendent in fruit. Flowers bisexual, heterodistylous, 5-merous; sepals unequal, minute, connate at base; petals contorted, free at base but adhering above the claw and falling jointly, 4–7 mm × 1.3–2 mm, whitish to dark red; stamens 10, connate at base, longer and shorter ones alternating; ovary superior, 5-celled, styles free, long or short. Fruit a fleshy, 5-lobed berry 6–13 mm × 4–9 mm, red or black, with persistent sepals. Seeds flat, reddish. Seedling with epigeal germination; cotyledons leafy; hypocotyl elongated; first 2 leaves opposite, subsequent ones alternate.

Growth in *S. laxa* is in flushes. Young leaves are deep violet. Flowering and fruiting occur almost throughout the year. Pollination is by insects (e.g. *Xylocopa* bees) and cross-pollination is regulated by the heterodistylous flowers. The fruits are eat-

en by bats, birds and monkeys which thus disperse the seeds.
Sarcotheca comprises 11 species occurring in Peninsular Malaysia, Sumatra, Borneo and Sulawesi. In the field, it can be confused with *Rourea* (*Connaraceae*), but the latter has free carpels, seeds with an aril, and dry, 1-celled and 1-seeded fruits.

Ecology *S. laxa* is found scattered in primary and secondary forest, forest edges and swamps at low altitudes.

Genetic resources Although *S. laxa* has a limited distribution, it does not appear to be threatened because it has a wide ecological amplitude.

Prospects As nothing is known with respect to the phytochemistry and pharmacological properties of *S. laxa* further research is needed to support its traditional use or indicate its potential in herbal medicine.

Literature 121, 247, 960.
Other selected sources 883, 990.

R.P. Escobin

Sauropus Blume

Bijdr. fl. Ned. Ind.: 595 (1826).
EUPHORBIACEAE
x = unknown; *S. androgynus*: $2n = 50, 52$

Origin and geographic distribution *Sauropus* comprises approximately 40 species and occurs in southern Asia southwards from the Himalayas, and in northern Australia. Indo-China and Thailand are richest in species (each about 20). In the Malesian region 13 species have been found: 7 in Peninsular Malaysia, 6 in Sumatra, 3 in Java, 5 in Borneo, 4 in the Philippines, 3 in central Malesia (the Lesser Sunda Islands, Sulawesi and the Moluccas) and 2 in New Guinea.

Uses Two *Sauropus* species have been used in traditional medicine in South-East Asia, the most important being *S. androgynus*, which is primarily used as a vegetable. A decoction of the roots of the latter is used against fever and urinary problems, and to relieve congestion. The leaves, prepared as a vegetable, are recommended for women after childbirth to stimulate milk production and recovery of the womb. A poultice made of the roots and leaves is applied to ulcerations of the nose and yaws. The leaf-juice is used to treat eye infections and thrush of the tongue in children, and the leaves are reputedly also effective against erythema, measles and dysuria. The young shoots and stripped leaves, often together with the flowers and fruits, are consumed raw as well as cooked. The fruits are sometimes comfited into a sweetmeat. In India, the leaves are also used as a cattle and poultry feed. *S. androgynus* is often planted in home gardens as a living fence. The leaves are also used for dyeing foodstuffs, in particular to transfer a green colour to pastry, rice and preserves. *S. brevipes* is used to treat diarrhoea in a mixture with other plants.

Properties Experiments with laboratory animals in Indonesia showed that *S. androgynus* decreases blood pressure, has a negative chrono- and ionotropic effect on the heart, decreases peristaltic movement of the intestine, causes contraction of the uterus, acts as an abortivum and antipyretic, increases glycogenesis in the liver, and increases milk production. At least some of these activities may be caused by the alkaloid papaverine, the presence of which has been demonstrated; it has spasmolytic activity, relaxing smooth muscle fibres, especially those of cerebral, pulmonary and systemic peripheral blood vessels.
S. androgynus is a very nutritious vegetable with a higher protein content than most other leafy vegetables. It has high vitamin A, B and C contents. It has been a popular uncooked vegetable in Taiwan for weight reduction since 1994, although the effect on weight control is unconfirmed. However, consumption is connected with an outbreak of rapidly progressive obstructive lung disease in Taiwan. Regular consumption can result in moderate to severe obstructive ventilatory defect within 7 months, and the disorder seems irreversible. The lung injury involves alveoli and/or small airways and is manifest as obstructive ventilatory impairment with inhomogeneous aerosol distribution and increased lung epithelial permeability. T-cell mediated immunity, altered cytokine expression and infiltration of eosinophils and neutrophils may be involved in the pathogenesis. It is even indicated that lung transplantation is the only effective form of treatment for patients with end-stage *Sauropus androgynus*-induced bronchiolitis obliterans syndrome. A hospital-based case-control study showed that a larger total amount of *S. androgynus* consumption, preparation without cooking and ingesting food prepared by a vendor were the significant risk factors associated with the syndrome. The alkaloid papaverine has been identified in the vegetable, but is unlikely to be responsible for the full range of toxicity. Tests with rats, however, did not show injuries to the broncheal tubes, alveoli or pulmonary vessels caused by ingestion of high-dose *S. androgynus*.

A methanolic extract of *S. androgynus* exhibited very strong antinematodal activity against the pine wood nematode *Bursaphelenchus xylophilus*.

Botany Monoecious shrubs, sometimes scrambling, shrublets or herbs with a woody base. Leaves alternate, simple and entire, pinnately veined, very shortly petiolate; stipules mostly small, triangular-subulate. Inflorescence an axillary fascicle, sometimes a densely bracteate pseudoraceme, occasionally cauliflorous. Flowers unisexual, with 6 tepals in 2 series of 3 (petals absent), free or variously connate, frequently the distal half of each tepal sharply inflexed, disk absent; male flowers with 3 stamens, the filaments connate into a short column; female flowers with tepals usually accrescent in fruit, ovary superior, 3-celled, styles either short, broad and entire or bifid, or deeply bifid with linear coiled or recurved segments. Fruit a depressed-globose or ovoid, inconspicuously lobed capsule, few-seeded. Seeds triquetrous, without aril.

Sauropus has lateral branches which superficially have the appearance of compound leaves, comparable to *Phyllanthus* species. *S. androgynus* flowers year-round in Java and fruiting is usually abundant.

Ecology *Sauropus* occurs in evergreen and deciduous forests, often also in scrub vegetation and sometimes even in grassland, usually in the lowland, but some species up to 1500 m altitude. In Peninsular Malaysia, many *Sauropus* species have been recorded from limestone.

Management *S. androgynus* can be propagated by seeds, which are usually readily available from established plantings, but propagation from stem cuttings is easier and much more common. Tests in India with micropropagation using nodal explants showed promising results. In commercial plantings the distance is 30–40 cm × 30–40 cm, but in home gardens *S. androgynus* is usually grown as a hedge and planted closely in the row (10 cm). In Vietnam the roots are dried before use; the leaves are used fresh for medicinal purposes.

Genetic resources *S. androgynus* is widely distributed, both in the wild and in cultivation, and is not under pressure from genetic erosion. No germplasm collection and breeding are in progress. *S. brevipes* is uncommon and less widely distributed. Several *Sauropus* species have very small areas of distribution or seem to be rare, and could be easily endangered.

Prospects *S. androgynus*, and perhaps also other *Sauropus* species, shows interesting pharmacological activities, but it has not yet received adequate research attention. Although it is a valuable indigenous leafy vegetable in South-East Asia, recent experiences with consuming large uncooked quantities resulting in lung injuries in Taiwan show the need for a thorough toxicological evaluation.

Literature 374, 565, 853.

Selection of species

Sauropus androgynus (L.) Merr.

Philipp. Bur. For. Bull. 1: 30 (1903).

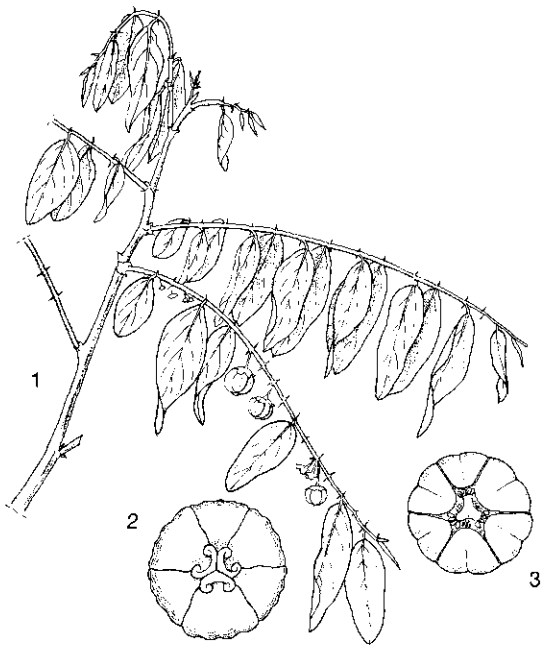
Synonyms *Sauropus albicans* Blume (1826), *Sauropus sumatranus* Miq. (1860).

Vernacular names Star gooseberry (En). Indonesia: katuk (Sundanese), babing (Javanese), simani (Minangkabau). Malaysia: chekup manis, cekur manis (Peninsular). Philippines: binahian (Tagalog). Burma (Myanmar): yo-ma-hin-yo. Cambodia: dom nghob. Laos: hvaan baanz. Thailand: phak waan baan (general), kaan tong (northern), ma yom paa (Prachuap Khiri Khan). Vietnam: rau ng[os]t, b[oof] ng[os]t, ch[uf]m ng[os]t.

Distribution Nepal, India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand and throughout the Malesian region, but possibly absent in New Guinea. It mainly occurs in cultivation and the exact origin is unknown.

Uses In traditional medicine, a decoction of the roots is used against fever and urinary problems, and to relieve congestion. The leaves, prepared as a vegetable, are recommended for women after childbirth to stimulate milk production and recovery of the womb. A poultice made of the roots and leaves is applied to ulcerations of the nose and yaws. The leaf-juice is used in Peninsular Malaysia to treat eye infections and in Vietnam to treat thrush of the tongue in children, and the leaves are reputedly also effective against erythema, measles and dysuria. The young shoots and stripped leaves, often together with the flowers and fruits, are consumed raw as well as cooked. The fruits are sometimes comfited into a sweetmeat. In India, the leaves are also used as a cattle and poultry feed. Star gooseberry is often planted in home gardens as a living fence. The leaves are also used for dyeing foodstuffs, in particular to transfer a green colour to pastry, rice and preserves.

Observations An erect shrub up to 500 cm tall, with flaccid, terete or angled branches; leaves ovate or lanceolate, 2–7.5 cm × 1–3 cm, obtuse or acute; male flowers disk-shaped, entire or nearly



Sauropus androgynus (L.) Merr. – 1, flowering and fruiting shoot; 2, female flower; 3, male flower.

so; fruit subglobose, up to 1.5 cm in diameter, whitish. *S. androgynus* is common in evergreen forest, clearings, scrub vegetation, roadsides and on waste ground, up to 1000 m altitude. It is cultivated up to 1300 m.

Selected sources 19, 20, 21, 22, 23, 24, 62, 121, 214, 374, 565, 584, 671, 745, 853, 990.

Sauropus brevipes Müll. Arg.

Linnaea 32: 73 (1863).

Synonyms *Sauropus parvifolius* Ridley (1911).

Vernacular names Malaysia: merajah santah (Peninsular). Thailand: kraduuk kai dam (Prachuap Khiri Khan). Vietnam: b[oof] ng[os]t ch[aa]n ng[aws]n.

Distribution Burma (Myanmar), Indo-China, Thailand and northern Peninsular Malaysia.

Uses *S. brevipes* has been used in Peninsular Malaysia to treat diarrhoea in a decoction with other plants.

Observations A slender shrub up to 100 cm tall, with very slender, terete branches; leaves ovate, obovate or elliptical, 1–2.5 cm long, broadly cuneate at base, rounded or obtuse at apex, thinly membranous; male flowers star-shaped, perianth about equally 12-dentate; fruit subglobose, c. 6 mm in diameter, whitish. *S. brevipes* occurs in evergreen forest, bamboo forest and scrub vegetation up to 300 m altitude; it is uncommon.

Selected sources 19, 121, 990.

Sriana Azis

Saxifraga stolonifera W. Curtis

Philos. Trans. Roy. Soc. London 64(1): 308, no. 2541 (1774).

SAXIFRAGACEAE

$2n = 32$

Synonyms *Saxifraga stolonifera* Meerb. (1777), *Saxifraga sarmentosa* L.f. ex Schreber (1780), *Saxifraga ligulata* Murray (1781).

Vernacular names Vietnam: h[oor] nh[ix] th[ar]o.

Origin and geographic distribution *S. stolonifera* is indigenous in China, Japan, Korea, and possibly northern Vietnam; it is widely cultivated as an ornamental, also in various parts of South-East Asia, especially in cooler mountainous areas.

Uses In Javanese, Vietnamese and Chinese folk medicine, juice from *S. stolonifera* leaves is dropped into the ear as a remedy for earache. In Japanese folk medicine fresh leaves have been used for burns, frostbite and whooping cough. In Vietnam fresh leaves are externally applied on pimples and wounds. In China heated or burned leaves are externally applied in a steam bath to treat haemorrhoids. Internally the leaves are used against cholera, vomiting, and to relieve feverish lung afflictions and cough. In Korea the entire plant is used to treat meningitis, fever, diarrhoea, neuralgia, frostbite and eczema.

Properties Condensed tannins, flavonol glycosides such as quercetin and saxifragin (= quercetin-5-β-glucoside), bergenin and norbergenin have been isolated from fresh *S. stolonifera* leaves.

The antioxidative activity observed for the ethanolic extract of *S. stolonifera* leaves is considered to be due to cooperation of many (poly)phenolic compounds (e.g. tannins, quercetin, chlorogenic acid and bergenin).

Botany A perennial, stemless, stoloniferous herb up to 50 cm tall (in flower). Leaves in a rosette, simple, suborbicular, shallowly palmatilobed, 2–8 cm wide, base cordate, sparingly long-hairy, green and white-veined above, tinged red beneath; petiole 3–12 cm long. Inflorescence an erect many-flowered panicle. Flowers bisexual, zygomorphic, long-hairy; calyx 3–4 mm long, recurved; both downwards-oriented petals lanceolate or ovate-lanceolate, 9–15 mm long, acute,

white, the other 3 petals ovate, 3–5 mm long, pinkish, darker punctate with a yellow basal spot; stamens 10, filaments clavate; disk opposite the shorter petals, orange-yellow; ovary superior. Fruit a capsule, dehiscent, many-seeded; the longer petals enlarging and stiffening during fruit maturation, pointing upwards. Seeds minute.

Saxifraga is a predominantly temperate genus comprising about 400 species. Recent DNA studies indicate that it is actually composed of two evolutionarily distinct groups. *S. stolonifera* belongs to section *Irregulares*, comprising about 10 species with relatively primitive characters distributed in southern China, Korea and Japan.

Ecology In its natural area of distribution *S. stolonifera* occurs on wet soils and rocks. In South-East Asia it is only cultivated in the mountains.

Management *S. stolonifera* can be easily propagated by the numerous plantlets produced on the slender red stolons of mature plants.

Genetic resources *S. stolonifera* is widespread and common in cultivation in Asia and Europe. Numerous cultivars have been described, those most commonly encountered being 'Tricolor' with pink, white and green markings on the leaves and 'Cuscutiformis' with almost equal petals and ovate to subovate leaves.

Saxifraga stolonifera W. Curtis - 1, plant habit; 2, flower.

Prospects The traditional uses of *S. stolonifera* are probably all related to the tannins present in the leaves. At present its importance as an ornamental by far outweighs its medicinal value.

Literature 42, 62, 731, 732, 918.

Other selected sources 121, 334, 645, 671, 880.

J.L.C.H. van Valkenburg

Scindapsus hederaceus Schott

Bonplandia 5: 45 (1857).

ARACEAE

$2n = 64$

Vernacular names Malaysia: akar lebang aleh, akar ular (Peninsular). Thailand: khokiu (Nakhon Si Thammarat). Vietnam: d[aa]y b[as].

Origin and geographic distribution *S. hederaceus* occurs in Indo-China, southern Thailand, Peninsular Malaysia, Singapore, Sumatra, Java and Borneo; perhaps also in the Philippines.

Uses In Peninsular Malaysia a decoction of the stem of *S. hederaceus* is used as a liniment to treat rheumatism.

S. officinalis Schott, widespread in India, Burma (Myanmar), northern Thailand, Indo-China and south-western China, is more commonly used in traditional medicine. In India, the fruit is credited with stimulant, diaphoretic, aphrodisiac, carminative and anthelmintic properties, and is used to stop diarrhoea and as an expectorant to treat asthma. It also has antiprotozoal activity and is applied externally to treat rheumatism. Fruits and shoots have hypoglycaemic activity.

S. pictus Hassk. is often cultivated as an ornamental, usually juvenile plants with silver spots on the leaves.

Properties There is no information available on the phytochemistry and pharmacological properties of *S. hederaceus*. The seed oil of *S. officinalis* contains an hydroxy fatty acid, cyclopropenoid fatty acids and other fatty acids including palmitic acid, stearic acid, oleic acid and linoleic acid. It has potential as a replacement for cocoa butter. The fruits contain some glucosidic substances called scindapsins. Flavonoids such as chrysoeriol and quercetin have been isolated from the leaves of *S. pictus*.

Botany A large climbing herb up to 20 m long; stem slender, up to 1 cm thick, with clasping

roots. Leaves alternate, simple and entire, elliptical-lanceolate, more or less oblique, 10–16(–21) cm × 3–6(–8.5) cm, obtuse to rounded at base, acuminate at apex, pinnately veined, with marginal vein; petiole up to 9 cm long, winged to near the apex, with broad sheath at base, geniculate at apex; stipules absent. Inflorescence a solitary, cylindrical spadix (2.5–)4–7 cm long, enclosed by a fusiform to boat-shaped yellowish-green spathe 4.5–8 cm long. Flowers bisexual, without perianth; stamens 4; ovary superior, 1-celled, 4–6-angular, with well-developed stylar region. Fruit a red berry, stylar region caducous when mature, 1-seeded. Seed subreniform, compressed, testa thick, endosperm present.

Scindapsus comprises about 35 species and occurs in tropical Asia, north-eastern Australia (Queensland) and the islands of the western Pacific. It belongs to the tribe *Monstereae*, together with e.g. *Amydrium*, *Epipremnum* and *Rhaphidophora*. It is best characterized by the solitary ovule and entire leaves. There is no recent taxonomic account of the genus.

Ecology *S. hederaceus* occurs in lowland and lower montane forests up to 1500 m altitude. It climbs on tree trunks, sometimes also on rocks, and is also found in secondary forest and thickets, and even on wayside trees.

Genetic resources Although the exact area of distribution of *S. hederaceus* is still unclear, it seems to be widespread and at least locally common, also in secondary habitats. Consequently, it does not seem to be threatened by genetic erosion.

Prospects Little is known about the botanical aspects and distribution of *S. hederaceus*, and nothing about its phytochemistry and pharmacological activity. Research seems worthwhile because of the extensive use of the related *S. officinalis* as a medicinal plant in India. A taxonomic revision of *Scindapsus* is badly needed.

Literature 62, 121, 181.

Other selected sources 190, 264, 331, 789.

Dodi Darmakusuma

Scleria P.J. Bergius

Kongl. Vetensk. Acad. Handl. 26: 142 (1765).

CYPERACEAE

x = unknown; *S. pergracilis*: $2n = 10$

Origin and geographic distribution *Scleria* comprises about 200 species and occurs throughout the tropics and subtropics, locally reaching temperate regions, e.g. in Japan and North America. For the Malesian region about 35 species have been recorded, of which only 5 are endemic.

Uses Several *Scleria* species are used in traditional medicine in the Malesian region: the roots to treat cough and gonorrhoea and after childbirth, and the aerial parts to treat fever and as an analgesic. *Scleria* is commonly used in tropical Africa for medicinal purposes, most often to treat dysmenorrhoea and gonorrhoea, and as an analgesic, sometimes also to treat cough.

Scleria can be useful to prevent soil erosion on slopes. The leaves are sometimes used to make mats and for polishing wood. Young plants of *S. biflora* Roxb. are eaten as a vegetable in Java.

Properties The presence of proanthocyanidins has been demonstrated for *S. pergracilis*. The aerial parts of *S. purpurascens* showed slight antibacterial activity against *Staphylococcus aureus*.

Botany Monoecious, perennial, often stout herbs, with short or creeping, often nodose rhizome, or annual herbs with fibrous, reddish roots; stems solitary or tufted, usually erect, trigonous to triquetrous, smooth or scabrid. Leaves alternate, 3-ranked, simple, linear, smooth to very scabrous on the margins, with prominent midrib and 2 lateral veins prominent above; sheath prominent, closed. Inflorescence a terminal panicle, usually together with some lateral panicles, sometimes a cluster or spike. Flowers in (1–) few–many-flowered spikelets, each flower subtended by a bract, unisexual, without perianth; male flowers with 1–3 free stamens, anthers oblong to linear; female flowers with superior, 1-celled ovary, style caducous but base often persistent, stigmas 3. Fruit a variously shaped and sculptured nut seated on a disk. Seed with thin testa, endosperm abundant.

Scleria is classified as the single representative of the tribe *Sclerieae*.

Ecology Most *Scleria* species seem to be indifferent to climate and soil. They are most often found in secondary regrowth, grassland, along roadsides and in open forest, but some species (e.g. *S. poaeformis*) prefer swamps and lake shores. *Scleria* is most common below 1000 m altitude, but a few species may reach 1500(–2200) m. Where it occurs, it is often common and locally dominant. Some species may behave like weeds, e.g. *S. levis* and *S. purpurascens* in rubber plantations.

Genetic resources All *Scleria* species treated here are widely distributed and not liable to genetic erosion, although it is remarkable that some of them occur only very locally or are even rare in

the Malesian region. A few other *Scleria* species are narrow endemics in Malesia.

Prospects Almost nothing is known about pharmacological properties of *Scleria*. More research seems justified because *Scleria* is used in traditional medicine in Asia as well as Africa, and often for similar purposes, e.g. to treat cough and as an analgesic.

Literature 120, 121, 247.

Selection of species

Scleria levis Retz.

Observ. bot. 4: 13 (1786).

Vernacular names Indonesia: jukut ilat (Sundanese), kerisan (Javanese), teteles (Sumatra). Malaysia: sialit dudok (Peninsular). Philippines: daat (Tagalog). Thailand: yaa khom baang (Trat), yaa saam khom (Udon Thani). Vietnam: d[uw]ng l[as]ng, c[uw][ow]ng l[as]ng.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Japan, Thailand, throughout Malesia, New Caledonia, the Caroline Islands and Australia (Queensland).

Uses In Peninsular Malaysia the fruits are used to treat cough; they are added in the betel-quid.

Observations A perennial herb with slender stems up to 90 cm tall; leaves equally distributed along the stem, 3–8 mm wide, scabrous on the margins in the upper part; inflorescence narrow, consisting of a terminal panicle up to 12 cm long and 1–2 smaller lateral ones, spikelets in clusters of 2–4; disk deeply 3-lobed, lobes lanceolate; fruit subglobose, 2–2.5 mm in diameter, pubescent. *S. levis* occurs in open forest, brushwood, savanna and fallow land, up to 1500 m altitude.

Selected sources 121, 247, 731.

Scleria lithosperma (L.) Sw.

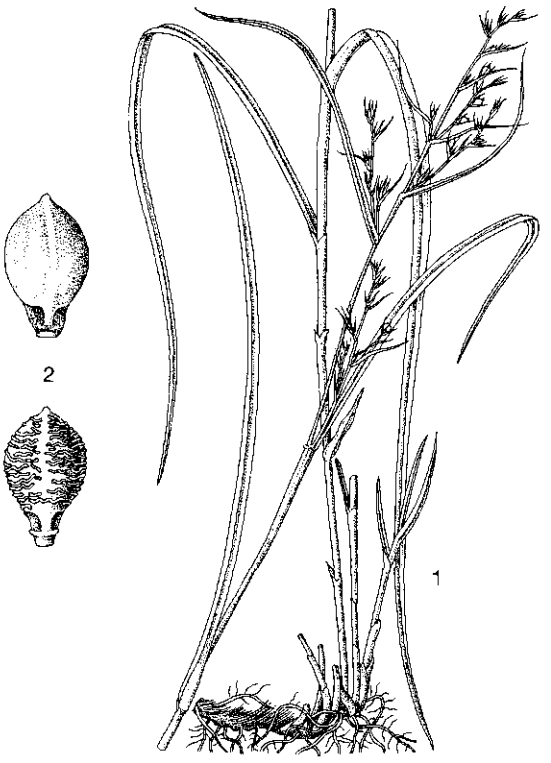
Prodr.: 18 (1788).

Synonyms *Hypoporum lithospermum* (L.) Nees (1842).

Vernacular names Indonesia: rumput luwung (Sumbawa), caka ma gaole (Ternate). Malaysia: salip, senayan hutan, siamit hutan (Peninsular). Papua New Guinea: kabku (Bougainville). Philippines: daat, katabad (Tagalog), talaid (Bagobo). Thailand: yaa khom baang lek (Nakhon Ratchasima). Vietnam: d[uw]ng h[aj]t c[uws]ng.

Distribution Pantropical; throughout South-East Asia including the Malesian region.

Uses In Peninsular Malaysia a decoction of the roots is applied after childbirth. In the Philippines young plant tops are eaten to treat stomach complaints. The leaves are used to treat fever in Bougainville (Papua New Guinea). In East Africa a decoction of the plant is applied internally to treat dysmenorrhoea and threatening miscarriage.



Scleria lithosperma (L.) Sw. – 1, plant habit; 2, different types of fruits.

Observations A perennial herb with slender stems up to 60(–90) cm tall; leaves often somewhat aggregated towards the middle of the stem, 1–4 mm wide, smooth; inflorescence narrow, consisting of a terminal panicle and 2–3 distant lateral ones, spikelets solitary or in clusters of 2–3; disk reduced to a narrow ring; fruit ovoid to oblong-ovoid, 2–3 mm long, smooth and shining or rugulose, at the base with 3 rugulose depressions. *S. lithosperma* occurs in open localities, forest edges and rocky and sandy beaches, up to 600(–1000) m altitude.

Selected sources 120, 121, 247, 347, 731.

Scleria pergracilis (Nees) Kunth

Enum. pl. 2: 354 (1837).

Synonyms *Hypoporum pergracile* Nees (1834).

Vernacular names Indonesia: sajat-sajat jel-

ma (Batak Karo, Sumatra). Papua New Guinea: kamiwa (Manki). Philippines: bangbanglo (Bontok). Thailand: khaa hom (Chiang Mai). Vietnam: c[os]i ba g[aa]n c[uws]ng, d[uw]ng m[ar]nh.

Distribution Tropical Africa, India, Sri Lanka, Indo-China, southern China, Thailand, Sumatra, the Philippines and New Guinea.

Uses In Sumatra a decoction of the plant is used in a mixture to treat fever, and after childbirth. The leaves have an aroma similar to that of lemongrass (*Cymbopogon citratus* (DC.) Stapf), and are used as a mosquito repellent.

Observations An annual herb with very slender stems up to 50 cm tall; leaves 1.5–2 mm wide, scabrous towards the apex; inflorescence a linear, unbranched spike, spikelets in clusters of 2–5; disk obsolete, stipe-like; fruit obtusely trigonous, slightly depressed, c. 1 mm long, glabrous, tuberculate especially towards the apex. *S. pergracilis* occurs on open slopes, edges of swamps and savanna, up to 1500 m altitude; in Malesia it is rare.

Selected sources 121, 247, 334, 731.

Scleria poaeformis Retz.

Observ. bot. 4: 13 (1786).

Synonyms *Scleria oryzoides* Presl (1828).

Vernacular names Indonesia: wlingi (Sundanese), benjen (Sumatra), kara (Dusun, Kalimantan). Malaysia: rumput siku dana (Peninsular). Philippines: agaas (Bikol). Thailand: prue (general), prue naa (Songkhla), waeng (Nakhon Ratchasima). Vietnam: d[uw]ng d[oof]ng th[as]p.

Distribution Eastern Africa, south-eastern India, Sri Lanka, Indo-China, southern China (Hainan), Thailand, Malesia and tropical Australia.

Uses In Peninsular Malaysia a decoction of the infructescence is used in a poultice to treat abdominal complaints. The leaves are used for polishing wood, and in Java for making mats.

Observations A perennial herb with thick, creeping rhizome and robust stems up to 200 cm tall; leaves mainly basal, up to 25 mm wide, smooth or scabrous on the margins; inflorescence usually a compound panicle up to 20 cm × 10 cm, spikelets solitary; disk small, triangular-cordate; fruit ovoid, ellipsoid or subglobose, 2.5–3 mm long, smooth and glabrous. *S. poaeformis* occurs in freshwater swamps, along ditches, in fallow rice fields, grassland and swampy savanna-forest, up to 1000 m altitude, often forming dense, pure stands. In Malesia, it is widespread but occurs locally.

Selected sources 121, 247.

Scleria purpurascens Steudel

Syn. pl. glumac. 2: 169 (1855).

Synonyms *Scleria multifoliata* Boeck. (1874).

Vernacular names Indonesia: sialit tajam, sialit tumpul (Sumatra), tapalakisa (Seram). Malaysia: sesayang (Peninsular). Thailand: yaa khom baang (Trat). Vietnam: d[uw]ng d[or].

Distribution The Andaman and Nicobar Islands, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines and Sulawesi; perhaps also in the Moluccas.

Uses In Sumatra the root sap is drunk to treat cough. In the Moluccas the leaf tips of what is reputedly *S. purpurascens* are mixed with coconut oil and pounded and applied externally as an analgesic.

Observations A perennial herb with usually robust stems up to 200 cm tall; leaves clustered in the middle part of the stem, 3–14 mm wide, scabrous on the margins in the upper part; inflorescence consisting of a terminal panicle and up to 10 lateral ones, ultimately purplish, spikelets in clusters of 2–3; disk 3-lobed, lobes triangular; fruit ovoid, 2–2.5 mm long, glabrescent. *S. purpurascens* occurs in secondary forest, brushwood, swampy grassland and roadsides, up to 1000 m altitude.

Selected sources 79, 121, 247, 295, 296.

Scleria sumatrensis Retz.

Observ. bot. 5: 19, t. 2 (1789).

Vernacular names Indonesia: sesayang (Sumatra), keris-keris, kerisan (Kalimantan). Malaysia: sendayan, sesayang gajah, rumput kumbar (Peninsular). Philippines: pangpayung (Cebu Bisaya), balbalili (Bontok), bulalo (Subanun). Vietnam: c[os]i ba g[aa]n.

Distribution India, Sri Lanka, Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, the Philippines, Sulawesi and northern Australia (Queensland).

Uses In Peninsular Malaysia a decoction of the roots mixed with *Pandanus* and *Areca catechu* L. roots and red chillies (*Capsicum*) is used to treat gonorrhoea.

Observations A perennial herb with robust stems up to 400 cm tall; leaves clustered in the middle part of the stem, up to 13 mm wide, scabrous on the margins in the upper part; inflorescence usually very dense, consisting of a terminal panicle up to 25 cm long and lateral ones 2–3 together, spikelets in clusters of 2–3; disk cup-shaped, very large, 3-lobed; fruit depressed-glo-

bose, c. 2 mm in diameter, glabrescent. *S. sumatrensis* occurs in dry open localities, forest and thickets, but also in swampy sites, up to 500 m altitude; it is often dominant.

Selected sources 121, 247, 731.

Amor T. Karyawati

Scurrula L.

Sp. pl. 1: 110 (1753); Gen. pl. ed. 5: 48 (1754).
LORANTHACEAE
$x = 9$; *S. parasitica*: $2n = 18$

Origin and geographic distribution *Scurrula* consists of some 20 species, and is distributed from India to Indo-China, southern China, Taiwan, and Malesia east to Timor and the Moluccas. In Malesia, 8 species occur with a centre of diversity in Java (7 species).

Uses *Scurrula* is only little used in South-East Asian folk medicine. It is more widely used in Chinese traditional medicine. In the Philippines mention is made of powdered stem bark scrapings of *S. atropurpurea* being boiled and gargled as a mouthwash. In Java dried stems of stem-parasitic *Loranthaceae* (including *Scurrula* and *Dendrophthoe*) enter into traditional prescriptions for the treatment of smallpox, and for a vermifuge for children. Specific applications are often linked with the host plant. More recently they are mentioned as a traditional medicine for cancer.

In Indo-China the leaves of *S. gracilifolia* (Schultes) Danser growing on *Morus* are highly esteemed in folk medicine. A decoction is prescribed against boils and as a mouthwash to strengthen the teeth. It is also prescribed to treat muscular pains and lumbago. The plant is further credited to promote hair growth, and a decoction of the fruit is used for improving eyesight.

Properties *Loranthaceae* in general are rich in tannins. This may well explain their use in poulticing. It is possible that chemical compounds isolated from a particular parasite are in fact derived from its host plant. However, common beliefs concerning specific host plants for a given application are highly questionable.

In a screening experiment for antihepatotoxic activity in primary cultured hepatocytes, *S. parasitica* showed more than 50% inhibition against carbontetrachloride- or D-galactosamine-induced cytotoxicity.

In a screening experiment for antiviral properties, methanol and water extracts of *S. parasitica* (whole plant) showed potent inhibition of avian myeloblastosis virus reverse transcriptase. A water extract of stems and branches of *S. parasitica* exhibited activity against human immunodeficiency virus type-1 (HIV-1) infected MT-4 cells with an ED_{50} value in the range of 4.2–175 µg/ml. The sample also suppressed the formation of syncytia in co-cultures of MOLT-4 (a human leukaemic T-cell line) and MOLT-4/HIV-1 cells. Recent pharmacological studies further demonstrated diuretic and cardiotonic properties. The sesquiterpenes corianin and coriatin were isolated from *S. parasitica* leaves.

A chloroform extract of *S. atropurpurea* stems showed activity in the brine shrimp (*Artemia salina*) assay which indicates toxicity. The chloroform extract contained alkaloids and flavonoids.

Botany Stem-parasitic shrubs, slender to moderately robust, with runners on the bark of the host, bearing secondary haustoria, more or less clothed with a tomentum of stellate and dendritic hairs. Leaves opposite, simple and entire, petiolate; stipules absent. Inflorescence an axillary, 3–10-flowered raceme of decussate flowers, rarely 2-flowered and umbellate, bracteate. Flowers bisexual, 4-merous; calyx reduced to a limb; corolla gamopetalous, zygomorphic, with the tube curved prior to anthesis, deeply split on the inner side of the curve, lobes reflexed to the outer side at anthesis; stamens inserted on the corolla opposite the lobes; ovary inferior, style simple, with a knoblike stigma. Fruit berrylike, obovoid or club-shaped, distinctly stipitate, 1-seeded. Seed covered by a sticky layer.

Pollination in *Scurrula* is by birds or insects and effective seed dispersal is by fruit-eating birds. Fruits may be either swallowed whole and the seeds excreted, or the seeds are rubbed off on branches after feeding on the surrounding fruit pulp.

Scurrula is related to *Dendrophthoe*, differing in fruit structure and the small, more strongly zygomorphic, 4-merous flowers. It is also closely related to, and difficult to delineate from *Taxillus*.

Hybridization and introgression appear to be common features in Malesian *Scurrula* species. This is probably a reflection of recent rapid speciation/diversification. The sympatric species in each island usually differ in corolla length. The differences probably represent coadaptation with different pollinators. The strongest indications of hydridization are in the Javanese uplands, where species occur with broadly overlapping corolla length.

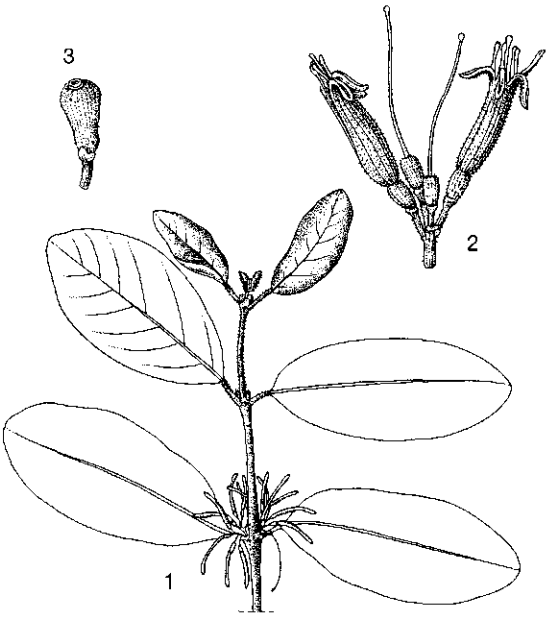
Ecology *Scurrula* occurs in habitats ranging

from humid to open forests, as well as in disturbed sites, from sea-level up to 3000 m altitude. The widespread *Scurrula* species are common in lowland habitats, whereas local endemics occur in the uplands. Host specificity of most *Scurrula* species is generally low and also includes other *Loranthaceae* and *Viscaceae*. In Malesia, some species (e.g. *S. parasitica*) are aggressive, and locally they can be considered a serious pest in tree plantations.

Genetic resources The *Scurrula* species treated here are widely distributed and occur in both primary and disturbed habitats. Therefore they do not appear to be threatened by genetic erosion.

Prospects Apart from the attention given to antiviral properties of *S. parasitica* and toxicity of *S. atropurpurea*, there are relatively few phytochemical investigations of *Scurrula*. Further research is needed to evaluate the potential of the traditional medicinal uses of South-East Asian *Scurrula*.

Literature 73, 247, 519, 671, 709, 731, 732, 1032, 1049.



Scurrula atropurpurea (Blume) Danser – 1, flowering branch; 2, inflorescence; 3, fruit.

Selection of species

Scurrula atropurpurea (Blume) Danser

Bull. Jard. Bot. Buitenzorg, sér. 3, 10: 349 (1929).

Synonyms *Loranthus atropurpureus* Blume (1823), *Scurrula philippinensis* (Cham. & Schlechtendal) G. Don (1834), *Taxillus atropurpureus* (Blume) Bân (1994), *Taxillus philippinensis* (Cham. & Schlechtendal) Bân (1994).

Vernacular names Indonesia: benalu, benalu teh (Javanese). Vietnam: m[ooj]c v[eej] ti[as].

Distribution Indo-China, Thailand, Java, the Lesser Sunda Islands (Bali, Sumbawa), the Philippines and the Moluccas.

Uses In Java the dried whole plant of *S. atropurpurea* is mentioned as a traditional anticancer medicine, especially for treating breast and throat cancer. In the Philippines powdered and boiled stem bark scrapings are gargled as a mouthwash.

Observations A hemiparasitic shrub, young parts with a dense cream or rarely greyish to dark ochre indumentum of stellate hairs, soon becoming sparse on adult stems and leaves; leaves elliptical to obovate, 5–10 cm × 2.3–5 cm, base cuneate to slightly cordate, apex usually rounded, petiole 0.6–1.2 cm long; corolla narrowly clavate, slender, in mature bud (11–)13–20(–24) mm long, acute at apex, anthers c. 1 mm long, about half as long as the free part of the filaments; fruit 8–9 mm long including a thick stipe of 2–3 mm, contracted at apex. *S. atropurpurea* occurs in a wide range of habitats, from sea-level up to 600(–2300) m altitude.

Selected sources 73, 247, 456, 731, 816.

Scurrula ferruginea (Roxb. ex Jack) Danser

Bull. Jard. Bot. Buitenzorg, sér.3, 10: 350 (1929).

Synonyms *Loranthus ferrugineus* Roxb. ex Jack (1820), *Taxillus ferrugineus* (Roxb. ex Jack) Bân (1994).

Vernacular names Malaysia: dedalu api merah, dedalu api gajah, nenalu asap (Peninsular). Philippines: dapong-kahoi (Tagalog). Vietnam: m[ooj]c v[eej] s[es]t.

Distribution India, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, western Java, Flores, Borneo, the Philippines (Palawan) and Sulawesi.

Uses In Peninsular Malaysia a decoction of the whole plant of *S. ferruginea*, alone or in combination with the leaves of *Millettia sericea* (Vent.) Wight & Arnott, is used for bathing to cure malaria. The pounded leaves are used as a poultice to treat wounds and snakebites. A decoction of the leaves is sometimes employed as a protective medicine after childbirth.

Observations A hemiparasitic shrub, young parts with a dense ochre to reddish indumentum of stellate and longer dendritic hairs, becoming sparse on adult stems and upper leaf surfaces; leaves elliptical to ovate or slightly obovate, (3–)5–10 cm × (1.5–)2–5.5 cm, base cuneate to weakly cordate, apex obtuse or rounded, petiole 0.2–0.6(–1) cm long; corolla straight or slightly curved, in mature bud (6–)8–14(–23) mm long, obtuse to truncate at apex, anthers 0.5–1 mm long, about half as long as the free part of the filaments; fruit 8–10 mm long including a stipe of 4–6 mm, rounded at apex. *S. ferruginea* occurs in primary forest and disturbed sites from sea-level up to 1000(–1850) m altitude.

Selected sources 73, 121, 247, 731, 760.

Scurrula parasitica L.

Sp. pl. 1: 110 (1753).

Synonyms *Scurrula fusca* (Blume) G. Don (1834), *Loranthus parasiticus* (L.) Merr. (1919), *Taxillus parasiticus* (L.) Bân (1994).

Vernacular names Indonesia: benalu (Javanese). Vietnam: m[ooj]c v[eej] k[ys] sinh.

Distribution India, Burma (Myanmar), Indo-China, southern China, Taiwan, Thailand, Peninsular Malaysia, Sumatra, Java, the Lesser Sunda Islands (Bali, Timor), Borneo, the Philippines, Sulawesi and the Moluccas.

Uses In China the dried plant is considered a tonic and a galactagogue, and prescribed for pregnant women, quieting the uterus, strengthening the bones and reducing lumbago. It reduces swellings, pains in the back and knees, numbness and soreness of limbs and high blood pressure. Some of the uses mentioned in Vietnam for *S. gracilifolia* may well refer to *S. parasitica*.

Observations A hemiparasitic shrub, young parts with a sparse to dense grey to dark brown or rarely paler indumentum of short stellate hairs, soon becoming sparse on adult stems and leaves; leaves narrowly ovate to obovate, 3–7(–9) cm × 1.5–3.5(–4.5) cm, base cuneate to truncate, apex acute, obtuse or rounded, petiole 0.3–1 cm long; corolla weakly clavate, slender, in mature bud 8–16 mm long, acute at apex, anthers 0.7–1.5 mm long, about two thirds as long as the free part of the filaments; fruit 8–10 mm long including a stipe of 4–8 mm, rounded at apex. *S. parasitica* occurs in a wide range of habitats, from sea-level up to 1800(–2250) m altitude.

Selected sources 73, 247, 671, 698, 731, 1049.

J.L.C.H. van Valkenburg

Senecio scandens Buch.-Ham. ex D. Don

Prodr. fl. Nepal.: 178 (1825).

COMPOSITAE

$2n = 20$

Synonyms *Senecio chinensis* (Sprengel) DC. (1838).

Vernacular names Philippines: lanot (Ilokano). Vietnam: c[uwr]u ly linh, c[us]c h[oof]ng leo.

Origin and geographic distribution *S. scandens* occurs in Nepal, India, Sri Lanka, northern Burma (Myanmar), Laos, northern Vietnam, southern China, Taiwan, Japan, Thailand and the Philippines (Luzon).

Uses In Vietnamese folk medicine the stems are externally applied to treat furuncles. In traditional Chinese medicine the plant is considered slightly poisonous (emetic). In decoction with liquorice (*Glycyrrhiza glabra* L.) it is used as an antipyretic and remedy against jaundice and malaria, and also to treat dog- and snakebites. A decoction of stem, leaves and flowers is used as a treatment for piles, as well as eye diseases. This decoction or simply the fresh leaves are externally applied to treat numerous skin diseases. The sap obtained by pounding aboveground plant parts is considered resolvent, detergent and vulnerary.

Properties An aqueous extract of *S. scandens* strongly inhibited rat erythrocyte haemolysis and lipid peroxidation in rat kidney and brain homogenates. The extract also strongly inhibited the generation of superoxide radicals and hydroxyl radicals. Both water and methanol extracts showed inhibition of human immunodeficiency virus type 1 (HIV-1).

Senecio commonly contains pyrrolizidine alkaloids. The structural types and concentrations of the alkaloids vary among species. Concentrations also vary with environment and location. Many pyrrolizidine alkaloids are toxic, causing blood circulation problems and liver damage, and may be responsible for poisoning in livestock and humans.

Botany A perennial herb up to 5 m tall, with long rhizomes; stems woody at base, scandent, somewhat flexuous, branched in the upper part, branches spreading, densely pubescent when young but glabrescent. Leaves alternate, simple, elongate-deltoid, 7–10 cm × 3.5–4.5 cm, base truncate to hastate, apex acuminate, irregularly dentate to subentire, pubescent on both sides, lower leaves often lobed; petiole 1–2 cm long; stipules absent. Inflorescence consisting of numerous campanulate heads c. 5 mm in diameter, arranged in a terminal, paniculate corymb; peduncle 0.5–1 cm

long; involucral bracts 1-seriate, lanceolate to narrowly oblong, 5–6 mm long, acute. Flowers ligulate at margin of head, tubular in centre; ligulate flowers c. 8, female, corolla c. 9 mm long, yellow; tubular flowers bisexual, corolla 5–6 mm long, 5-lobed, yellow; stamens 5, anthers fused; ovary inferior, 1-celled, style 2-armed. Fruit a cylindrical achene c. 3 mm long, 5-ribbed, shortly pilose; pappus consisting of capillary bristles 5–6 mm long, white.

Senecio comprises some 1250 species, most of them found in South America (about 500) and Africa (about 350). *S. scandens* is variable throughout its natural range and several varieties can be distinguished.

Ecology In the Philippines *S. scandens* is found in thickets at 1300–2200 m altitude.

Genetic resources *S. scandens* is widespread and commonly encountered in disturbed habitats, and not threatened by genetic erosion.

Prospects Until now little research has been done on the pharmacological properties of *S. scandens*, but the few studies performed showed promising results.

Literature 175, 574, 608, 731, 732, 760.

Other selected sources 112, 544, 782.

L.B. Cardenas

Setaria palmifolia (J. König) Stapf

Journ. Linn. Soc., Bot. 42: 186 (1914).

GRAMINEAE

$2n = 54$

Synonyms *Panicum palmifolium* J. König (1788).

Vernacular names Palm grass, broadleaved bristlegrass (En). Indonesia: sauheun (Sundanese), luluwan kebo (Javanese), jang-mejang-an (Madurese). Malaysia: lachang (Peninsular). Papua New Guinea: pitpit (Pidgin), leat (Enga), kugla (Western Highlands). Philippines: agusais (Bikol), asahas (Cebu Bisaya), lalasa (Igorot). Thailand: yaa kaap phai (Loei), kong kaai, yaa kong kaai (Chiang Mai). Vietnam: c[or] l[as] d[uwf]a, t[ow] v[ix] tre.

Origin and geographic distribution *S. palmifolia* is widely distributed in Asia, from India and Sri Lanka to Indo-China, China, Japan, Thailand and throughout the Malesian region. Although primarily Asiatic, secondary centres of distribution are recorded around the Caribbean and in West Africa. Elsewhere, it is sometimes cultivated, e.g. in tropical and subtropical America.

Uses In Java young shoots are eaten after childbirth, apparently to promote lochia and lactation. In Peninsular Malaysia a compound decoction of the leaves is drunk in cases of irregular menses. The boiled pith is used in New Guinea to treat stomach-ache, diarrhoea, fever and colds. In Papua New Guinea leaves are applied externally to relieve toothache.

In several regions, e.g. New Guinea, Java and Borneo, young shoots and the fleshy leaf sheaths, which are sweet tasting, are popular as a vegetable, often eaten with rice. In New Guinea the shoots are eaten raw or prepared in earth-stone ovens with other vegetables. The grain is locally used as a substitute for rice, e.g. in the Philippines. *S. palmifolia* is a good forage when not too old, with good nutritional value and fair production, especially suitable for horses and cattle. It is also planted in agroforestry systems in India and Vietnam to prevent soil erosion on slopes. *S. palmifolia* has ornamental value.

S. italica (L.) P. Beauv. (foxtail millet), which is cultivated as a cereal all over the world, is credited with diuretic, astringent and emollient properties, and is used in traditional medicine in China to treat vomiting, diabetes, diarrhoea and rheumatism. In Madura (Indonesia) a decoction of pounded grains has been applied internally against fever.

S. viridis (L.) P. Beauv. is primarily important as forage, but is also used medicinally in China: culms and leaves are applied externally to carbuncles, boils, ringworm and psoriasis. A decoction of the inflorescence is used to treat diarrhoea and of the culms and grains to treat eye diseases. It is a noxious weed worldwide, and has locally been introduced in South-East Asia.

In Indonesia whole plants of a *Setaria* species, possibly *S. parviflora* (Poir.) Kerguélen (synonym: *S. pallide-fusca* (Schumach.) Stapf & C.E. Hubb.) are used, fresh or dried, to treat toothache, rubella and allergy complaints. Insecticidal activity has also been recorded for this species.

Properties The nutritive value of *S. palmifolia* as a forage has been determined in a metabolism trial in goats in India. It contained 48% total digestible nutrient and 8% digestible crude protein, but the intake was considered inadequate to meet the maintenance requirements of goats. In cattle, the results were better, with 58% total digestible nutrient and 9% digestible crude protein, and positive balance for N, Ca and P; *S. palmifolia* is considered good for maintenance and production of cattle.

Botany A perennial, strongly tufted herb up to 150(–300) cm tall, with short rhizome; culms erect-ascending, solid or with narrow cavity. Leaves alternate, simple, lanceolate, 15–70 cm × 5–10 cm, narrowed at base, acute at apex, rather rigid and hard, strongly plicate, rough, glabrous or with long, whitish hairs; sheath firm and leathery, long-ciliate at margins, often also with long, stiff, caducous hairs, ligule 1–2 mm long, divided into hair-like slips. Inflorescence a loose panicle up to 60 cm tall, usually nodding, with very rough branches; ultimate branches at base with up to 5 bristles up to 7 mm long, each with a spikelet near the base, above them 3–15 spikelets without bristles, spikelets 2-seriate, crowded. Spikelets elliptical-oblong, 3.5–4 mm long, 2-flowered, with lower glume c. 2 mm long and 3–5-veined, upper glume c. 3 mm long and 5–7-veined, lower lemma c. 3.5 mm long and 5–7-veined, lower palea c. 2 mm long and indistinctly veined, upper lemma c. 3 mm long, transversely rugose, and upper palea c. 3 mm long; flowers with 3 stamens, a glabrous ovary with 2 free styles and plumose stigmas. Fruit a plano-convex caryopsis enclosed between the upper lemma and palea.

Setaria palmifolia (J. König) Stapf – 1, part of culm; 2, top of sheath with ligule; 3, inflorescence; 4, part of inflorescence with spikelets.

Setaria is a large genus of approximately 100 species. It is distributed all over the tropics and subtropics, but several species can also be found in temperate regions. *Setaria* is heterogeneous, the most characteristic feature being the tips of the panicle branches, which are modified into bristles subtending the spikelets. *S. palmifolia* belongs to a difficult complex of about 6 perennial plicately-leaved species. Var. *blepharoneuron* (A. Braun) Veldkamp (synonym: *S. plicata* (Lamk) T. Cooke) differs from typical *S. palmifolia* in its narrower leaves and usually more contracted panicle; it has been recorded from India and Sri Lanka to China and Japan, and also from Malesia (Sulawesi).

Ecology *S. palmifolia* occurs on light soils with good water-holding capacity, in moderately shaded localities, often in open secondary forest and old clearings, up to 2000 m altitude. It is common in many regions.

Management In the highlands of New Guinea *S. palmifolia* is cultivated as a garden vegetable. There, the plants do not produce flowers and fruits, and are only propagated vegetatively, using young shoots. *S. palmifolia* can be a serious weed locally, e.g. in tea, wheat and ginger plantings. Grown as a forage under irrigation, *S. palmifolia* can be harvested after 3 months, with 3 further cuts at intervals of 2 months. In India yields of 110 t/ha of fresh fodder in 4 cuts have been recorded in naturally growing *S. palmifolia*.

Genetic resources *S. palmifolia* is a variable species with an extremely wide and erratically disjunct distribution, which seems to indicate a large genetic variation. Even in the vegetatively propagated *S. palmifolia* plants cultivated as a vegetable in New Guinea, the genetic diversity is recorded as large: landraces with very distinct morphological characters can be found, and about 10 of these have been given names.

Prospects *S. palmifolia* is a multipurpose grass that may serve as a valuable vegetable and forage, as well as a useful medicinal plant and auxiliary plant in agroforestry. It deserves more attention in research, particularly concerning the pharmacological properties and its qualities as a vegetable.

Literature 301, 334, 347, 749, 961.

Other selected sources 62, 121, 731, 760, 991.

Praptiwi

Smithia sensitiva Aiton

Hort. kew. 3: 496 (1789).
LEGUMINOSAE
$2n = 32, 38$

Synonyms *Smithia javanica* Benth. (1852).

Vernacular names Malaysia: pokok tangki bukit (Peninsular). Thailand: sano lek (south-eastern). Vietnam: r[us]t roi, d[aaj]u m[is]t.

Origin and geographic distribution *S. sensitiva* is found throughout tropical Asia westward to India and Sri Lanka, throughout South-East Asia, to northern Australia.

Uses In Java the whole plant of *S. sensitiva* is boiled and eaten cold to treat difficulty in urination and bladder stones. In India the leaves are considered refrigerant and a galactagogue. The leaves are eaten as a pot herb. Cattle will eat the plant. In India *S. conferta* J.E. Smith is credited with laxative and tonic properties, and given to cure biliousness and rheumatism; it also used to cure sterility in women.

Botany An annual or perennial herb up to 30–90(–150) cm tall, much-branched, with strong taproot; branches decumbent-ascending to erect, glabrous. Leaves paripinnate, 1–3 cm long, slightly sensitive to the touch, covered with long white hairs; stipules ovate-acuminate, 8–10 mm long with a basal extension; leaflets 3–10(–12) pairs, narrowly oblong, 4–15 mm × 2–3 mm, obliquely truncate at base, rounded or obtuse at apex; stipels absent. Inflorescence an axillary raceme, 1–10-flowered, with distinct bracts and bracteoles, peduncle 6–30 mm long. Flowers bisexual; pedicel 3 mm long; calyx 2-lipped from the base, 6–9 mm long, glabrous or with a few hairs at the tip; corolla papilionaceous, standard obovate, 8–9 mm long, bright yellow, tinged red at the base or not, wings obovate, bright yellow, keel pale yellow; stamens in 2 bundles of 5; ovary superior, glabrous, 1-celled; style curved. Fruit a jointed pod 7 mm × 1 mm, with up to 7 orbicular segments 1-seeded each, indehiscent. Seeds reniform, 1 mm long, brown, shiny.

S. sensitiva can be found flowering and fruiting throughout the year. It has nodulating ability. *Smithia* comprises some 30 species found in the Old World tropics, most of them in Asia and Madagascar.

Ecology *S. sensitiva* is found in not too dry open grassy localities, ranging from abandoned fields and embankments of waterways to swamps, from sea-level up to 1200 m altitude.

Genetic resources The risk of genetic erosion is limited because *S. sensitiva* is widely distributed and common in disturbed habitats.

Prospects Research on the phytochemistry and pharmacological activity of *S. sensitiva* has not been done, but is needed to determine its prospects as a medicinal plant for wider use.

Literature 181, 334, 731.

Other selected sources 35, 62, 121, 250, 308.

L.J.G. van der Maesen

Sonerila Roxb.

Fl. ind. 1: 180 (1820).
MELASTOMATACEAE
$x = 9$

Origin and geographic distribution *Sonerila* comprises approximately 175 species and is restricted to tropical and subtropical Asia. The number of species occurring within the Malesian region is unknown but undoubtedly considerable.

Uses *Sonerila* is used in traditional medicine in Malaysia, mainly for poulticing and after childbirth, as a protective medicine for the mother, but possibly also for the child, e.g. to treat jaundice of the newborn. Some species other than the ones treated here may also be used for these purposes, notably *S. moluccana* Roxb. (synonym: *S. begoniaefolia* Blume) and *S. obliqua* Korth. (synonym: *S. heterostemon* Naudin).

Properties The presence of ellagitannins has been recorded for several *Sonerila* species, and of alkaloids for *S. obliqua* roots.

Botany Small herbs or undershrubs, erect or ascending, often with a rhizome. Leaves opposite, those of a pair often unequal, simple, entire to serrate, 3–7-veined from the base; stipules absent. Inflorescence fasciculate, umbellate or a scorpioid cyme, or flowers solitary. Flowers bisexual, usually 3-merous; hypanthium (calyx tube) campanulate, tubular or turbinate, sepals often triangular, caducous; petals free, usually ovate or obovate, white to pink; stamens 3, occasionally 6, equal, anthers dehiscent by apical pores; ovary inferior, adnate to hypanthium, 3-celled, style filiform. Fruit a capsule, opening by 3(–6) apical valves.

Sonerila belongs to the tribe *Sonerileae*, together with e.g. *Phyllagathis*, and is characterized by its habit (much smaller than *Phyllagathis*) and the usually 3-merous flowers. However, it is not always clearly delimited from allied genera.

Ecology Many *Sonerila* species occur in shady

forest, but some prefer more open habitats, e.g. grassland or mossy rocks in the mountains. Several species are restricted to higher altitudes, up to 2500 m.

Genetic resources Many *Sonerila* species appear to be narrow endemics, although this may be partly due to the very incomplete knowledge of the taxonomy of the genus. This is illustrated, for instance, by the rather recent account of the Flora of Ceylon (Sri Lanka), where the 22 species treated are all endemic, many of them being rare or even possibly extinct. This makes the genus very liable to genetic erosion.

Prospects As in many other *Melastomataceae*, the medicinal activities ascribed to *Sonerila* may be due to the presence of tannins, but research is needed to confirm this. Taxonomical studies are badly needed for this poorly-known genus.

Literature 121, 331, 731, 782.

Selection of species

Sonerila gimlettei Ridley

Journ. Roy. As. Soc. Straits Br. 61: 5 (1912).

Vernacular names Malaysia: akar batu (Peninsular).

Distribution Peninsular Malaysia (Kelantan).

Uses Bruised leaves are applied as a poultice to boils.

Observations A small herb up to 15 cm tall; leaves unequal, smaller ones c. 10 cm × 5 cm, larger ones 15–20 cm × 7.5 cm, petiole winged; inflorescence a many-flowered scorpioid cyme on peduncle up to 5 cm long, in the axil of small leaf; fruit turbinate, smooth. *S. gimlettei* occurs very locally in forest.

Selected sources 121, 789.

Sonerila nidularia Stapf

Ann. Bot. 6: 312 (1892).

Vernacular names Malaysia: serengan kerbau, kachit fatimah (Peninsular).

Distribution Peninsular Malaysia (Perak).

Uses A decoction of whole plants is given to women after childbirth as a protective medicine. The plant ash is administered to children to treat stomach-ache.

Observations A small herb up to 15 cm tall; leaves very unequal, smaller ones orbicular-reniform, c. 0.5 cm in diameter, larger ones 7.5–11 cm × 2.5–5 cm, petiole stout, not winged; inflorescence a few- to many-flowered, sessile cyme, axillary or terminal; fruit turbinate, muricate. *S. nidularia* occurs locally in forest in the mountains.

Selected sources 121, 789.

Praptiwi

Spatholobus Hassk.

Flora 25, 2 (Beibl.): 52 (1842).

LEGUMINOSAE

x = unknown

Origin and geographic distribution *Spatholobus* consists of 29 species and is restricted to tropical Asia, from India to southern China and western Malesia, east to the Philippines and Sulawesi. In the western Malesian region 22 species occur, with Borneo and Peninsular Malaysia richest, having about 15 and 10 species, respectively.

Uses In South-East Asia traditional medicinal use of *Spatholobus* is often linked to the reddish colour of the sap that flows from the stem; it is used in the treatment of wounds and haemorrhages, but also to treat colic. Various *Spatholobus* species are employed for their astringent properties and as a remedy in fever. In Peninsular Malaysia (Pahang) mention has been made of the leaves of an unidentified *Spatholobus* used for poulticing broken bones. *S. parviflora* (Roxb.) O. Kuntze (synonym: *S. roxburghii* Benth.), which is confined to continental tropical Asia, is widely used in traditional medicine in India. A decoction of the bark is applied to treat dropsy and bowel complaints; roots and bark are credited with insecticidal and piscicidal properties. The rhizome of *S. suberectus* Dunn is used as a traditional antifever remedy in China. An extract of *S. suberectus* has been patented in Japan for skin lightening and as an anti-aging cosmetic. The slender stems of various *Spatholobus* species are employed for rough cordage.

Properties A phytochemical survey of the dried leaves of *S. ferrugineus* revealed the presence of flavonoids, triterpenoids and steroidal saponins. The methanol extract of the rhizome of *S. suberectus* elicited a significant in-vitro inhibition (> 90%) of human immunodeficiency virus type-1 (HIV-1) protease at a concentration of 200 µg/ml. Rotenone has been isolated from *S. parviflora*; this compound, better known from *Derris*, is very toxic to insects.

Botany Lianas, stems usually with a reddish-brown exudate. Leaves alternate, pinnately 3-foliolate, petiolate; stipules usually early caducous, sometimes persistent; leaflets usually elliptical, lateral ones asymmetric or symmetric; stipels

usually early caducous. Inflorescence a terminal or axillary panicle or pseudo-panicle, often many- and condensed-flowered. Flowers bisexual, small, pedicellate; calyx campanulate, 4(–5)-lobed or -dentate; corolla papilionaceous, usually glabrous; standard emarginate, not reflexed during anthesis; wings usually adherent to the keel by lateral pockets; keel petals connate along the ventral margin; stamens 10, 9 connate and alternately longer and shorter, shorter ones often with reduced anthers, 1 free; ovary superior, pubescent or woolly, 1-celled, with 2(–4) ovules. Fruit a flat, samara-like pod, with 1 apical seed, indehiscent. Seed rounded to oblong-reniform, laterally flattened. Seedling with hypogeal germination; hypocotyl not enlarging; cotyledons enclosed, succulent; first 2 leaves opposite, simple, next leaves arranged spirally.

Spatholobus is usually placed in the tribe *Phaseoleae* and is most closely related to *Butea* and *Meizotropis*.

Ecology *Spatholobus* can be found in most forest types in South-East Asia, but it prefers evergreen forest and mixed dipterocarp forest. Usually it is found near open locations, along rivers or roadsides, from the seashore to over 2000 m altitude. It occurs on sandy, laterite and clay soils, limestone, sandstone, ultrabasic soils, peaty soils or soils with siliceous scales.

Genetic resources In view of their wide distribution the *Spatholobus* species treated here do not appear to be threatened by genetic erosion. However, several other *Spatholobus* species are very restricted in their distribution and may easily become endangered.

Prospects Very little research has been done on the phytochemistry and pharmacological properties of *Spatholobus*, and the prospects as a medicinal plant can only be determined after further research.

Literature 35, 525, 786, 787, 788, 1003.

Selection of species

Spatholobus ferrugineus (Zoll. & Moritzi) Benth.

Miq., Pl. jungh.: 238 (1852).

Synonyms *Butea ferruginea* (Zoll. & Moritzi) Blatter (1929).

Vernacular names Indonesia: akar sarikan lanang (Palembang), areuy ki sambangan (Sundanese), aka kelesi (Kenyah, East Kalimantan). Malaysia: akar sejangat, akar skuet, akar gueh (Peninsular). Thailand: chaang haek (central).

Distribution From southern Thailand, through Peninsular Malaysia to Sumatra, Java, Borneo and Sulawesi.

Uses In Java the astringent reddish-brown sap from the stem is drunk to treat colic, and after childbirth. Juice or a decoction of the pounded stem and leaves is drunk in case of irregular menstruation, and a decoction of the sap from the stem to treat uterine haemorrhages. An infusion of the stem is drunk as a remedy for cough and fever. In East Kalimantan (Indonesia) sap from the young stems is rubbed on insect bites and stings to relieve itch. The strong young stems make rough cordage for binding.

Observations A large liana up to 50 m long, stem up to 15 cm in diameter, branches rusty-brown velutinous; leaves with lateral leaflets asymmetric, terminal leaflet elliptical, elliptical-ovate, elliptical-obovate or nearly circular, 7–49 cm × 5–30 cm, stipules recurved, caducous, 3–6 mm × 4–6 mm; inflorescence up to 45 cm long, with flowers arranged in fascicles; flowers with red or purple petals, standard with decurrent base, wing and keel petals with a lateral pocket and a dorsal auricle; fruit 4–6 cm × 1.3–2 cm, pale brown, puberulous; seed 10 mm × 5–10 mm. *S. ferrugineus* is found in various habitats ranging from mixed dipterocarp forest to 'kerangas' forest, secondary forest and scrub and roadside vegetation, from sea-level up to 1000 m altitude.

Selected sources 62, 121, 334, 534, 731, 787, 788, 1003.

Spatholobus littoralis Hassk.

Flora 25, 2 (Beibl.): 79 (1842).

Synonyms *Butea littoralis* (Hassk.) Blatter (1929).

Vernacular names Indonesia: areuy bajur, areuy munding jalu, manyiritan (Sundanese).

Distribution South-eastern Sumatra, Java, south-eastern Borneo and the northern Philippines.

Uses In Java the juice is drunk and used to wash the feet, as a remedy for languor and difficulty in moving the legs.

Observations A large liana up to 25(–50) m long, branches yellow-green or dull brown pubescent; leaves with lateral leaflets slightly asymmetric, terminal leaflet elliptical to narrowly elliptical-ovate, 7–21 cm × 2–7.5 cm, stipules straight, caducous, 4–8 mm × 1.5–4 mm; inflorescence up to 15 cm long, with flowers arranged in short-stalked fascicles; flowers with white petals, standard with

truncate to emarginate base, wing petals sometimes with a lateral pocket and a small dorsal auricle, keel petals with a lateral pocket; fruit 7.5–10.5 cm × 2–3 cm, glabrous; seed c. 22 mm × 18 mm. *S. littoralis* is found in thickets, forest margins and mixed forest at 150–1200 m altitude.

Selected sources 35, 62, 334, 731, 787, 788.

J.W.A. Ridder-Numan

Sphenodesme Jack

Malayan Misc. 1(1): 19 (1820).

VERBENACEAE

x = unknown

Origin and geographic distribution *Sphenodesme* comprises about 15 species and occurs in tropical and subtropical Asia.

Uses A few *Sphenodesme* species are used in traditional medicine in Malaysia, especially a root decoction to treat rheumatism.

Botany Climbing shrubs or lianas; young stems lenticellate. Leaves opposite, simple and entire, shortly petiolate; stipules absent. Inflorescence a head-like cyme subtended by a whorl of (5–)6 prominent involucral bracts, 3–7-flowered. Flowers bisexual, regular or slightly zygomorphic, 5(–7)-merous; calyx funnelform, dentate, sometimes enlarged in fruit; corolla with short cylindrical tube and imbricate, narrowly lanceolate to ovate-oblong lobes; stamens inserted on corolla tube, alternate with corolla lobes, free; ovary superior, imperfectly 2-celled, style simple, stigma 2-cleft. Fruit drupe-like, obovoid to globose, small, indehiscent, with leathery endocarp, included in calyx, 1(–2)-seeded.

Sphenodesme has been placed in the subfamily *Symphorematoideae*, together with *Symphorema* and *Congea*, and it has been suggested recently that this group be raised to family level, i.e. *Symphoremaceae*, based on morphological as well as anatomical evidence.

Ecology *Sphenodesme* occurs mainly in lowland forest up to 1000 m altitude, but sometimes up to 1500 m, often in the edges of forest, sometimes in scrub vegetation.

Genetic resources Too little is known about the distribution of *Sphenodesme* in South-East Asia to judge the risk of genetic erosion for the different species.

Prospects It is unlikely that the use of *Sphenodesme* as a medicinal plant will increase.

Literature 121, 640, 641.

Selection of species

Sphenodesme pentandra Jack

Malayan Misc. 1(1): 19 (1820).

Vernacular names Malaysia: akar subang, akar lintang ruas, akar tanak rimau (Peninsular). Thailand: khaa pia (Chiang Mai), yaan duuk (Pattani), nuai sut (Nakhon Si Thammarat). Vietnam: b[ooj]i tinh ng[ux] h[uf]ng.

Distribution India, Bangladesh, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Singapore and Borneo.

Uses In Peninsular Malaysia a decoction of the roots is used to treat rheumatism.

Observations A climbing shrub or liana up to 10 m long; leaves elliptical-oblong to lanceolate, 5–18 cm × 2.5–9 cm, glabrous to slightly pubescent, petiole 0.5–1.5 cm long; inflorescence 5–7-flowered, bracts up to 3 cm long; flowers with pale bluish to purplish corolla; fruit globose, c. 4 mm in diameter. *S. pentandra* is locally common in edges of lowland forest.

Selected sources 121, 789, 1013.

Sphenodesme racemosa (C. Presl) Moldenke

Rev. Sudamer. Bot. 10: 230 (1956).

Synonyms *Sphenodesme barbata* Schauer (1847).

Vernacular names Malaysia: akar lumut, akar chabang lima, lilimbo (Peninsular).

Distribution Peninsular Malaysia, Riau and Lingga Archipelago, and Borneo.

Uses In Peninsular Malaysia a decoction of the roots is used to treat rheumatism.

Observations A climbing shrub or liana up to 8 m long; leaves ovate to elliptical-oblong, 4–14 cm × 2–5.5 cm, brown villous especially on the veins, petiole 0.5–1 cm long; inflorescence 5–7-flowered, bracts c. 2 cm long; flowers with greenish-white or greenish-yellow corolla; fruit globose, small. *S. racemosa* is locally common in lowland forest.

Selected sources 121, 789.

Sphenodesme triflora Wight

Icon. pl. Ind. orient. 1: t. 1478 (1849).

Vernacular names Malaysia: akar bisa, akar memali, akar katup-katup (Peninsular). Thailand: hat khruea (Lampang).

Distribution Burma (Myanmar), Thailand, Peninsular Malaysia, Sumatra and Borneo.

Uses In Peninsular Malaysia the plant (it is not stated which part) is used to treat fever.

Observations A climbing shrub or liana; leaves

lanceolate, 7–13 cm × 2.5–5 cm, glabrous, petiole 0.5–1.5 cm long; inflorescence 3-flowered, bracts c. 0.5 cm long; flowers with dark purple corolla; fruit ovoid. *S. triflora* is locally common in forest up to 1000 m altitude.

Selected sources 121, 789.

R.H.M.J. Lemmens

Spigelia anthelmia L.

Sp. pl. 1: 149 (1753).

LOGANIACEAE

$2n = 32$

Vernacular names Worm weed, worm grass (En). Brinvillière, herbe à vers (Fr). Indonesia: jukut puntir (Sundanese), platikan (Javanese).

Origin and geographic distribution *S. anthelmia* originates from tropical and subtropical America, but is naturalized in Africa and South-East Asia (Sumatra, Java and the Lesser Sunda Islands).

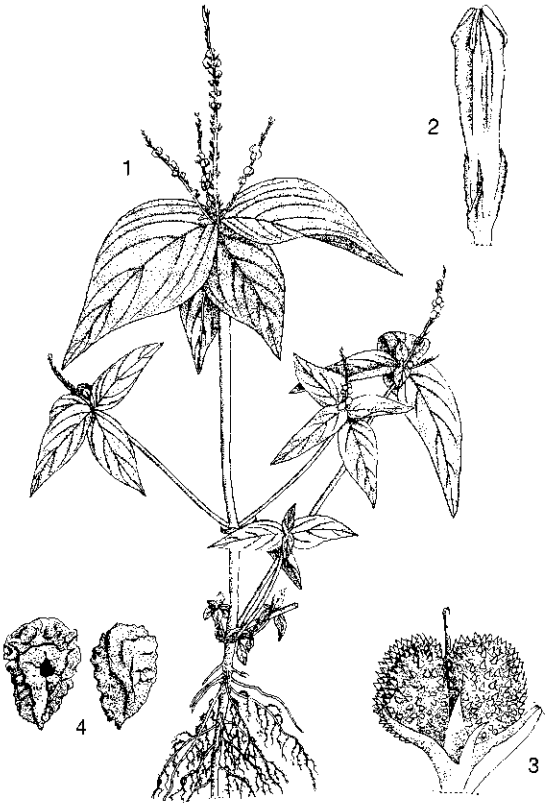
Uses In Java the root has some reputation as an effective vermifuge. In tropical America and Africa whole plants, roots and seeds, separately or together, are widely employed to expel intestinal worms, especially tapeworms. In smaller doses the roots are used to relieve stomach-ache. When used as a vermifuge it is often combined with a purgative that is taken a little later. In South America the plant is further employed as a fish poison and for intentional poisoning. The leaves are used to repel flies and cockroaches.

Properties Several fractions of an ethanol extract of aerial parts of *S. anthelmia* were tested in general screening tests using various animal models. The intraperitoneal LD_{50} in mice was found to be 222 mg/kg. Contractions of isolated guinea-pig and rat ileums were observed, as well as hypotensive and bradycardic effects in anaesthetized cats and rats. An intravenous infusion in rats produced a dose-dependent, prompt, more or less short-lasting hypertension or led to acute lethal intoxication with signs of cardio-respiratory depression. Using an ethanol extract in a guinea-pig heart model revealed that the alkaloids spiganthine and ryanodine are the main cardioactive principles. Their biological effect is characterized by a delay in contraction development of the heart muscle.

Spiganthine, ryanodine and structurally related compounds demonstrated significant antifeedant activity against some test beetles. In addition, considerable insecticidal activities were observed.

All parts of the plant contain the toxic alkaloid spigeline, but the concentration is highest in the roots. Reports of fatal poisoning in cattle are somewhat contradictory. Effects of an overdose in humans include excitement, dizziness, delirium, dilation of the pupils, vomiting and convulsions.

Botany An annual herb up to 90 cm tall, unbranched or with some pairs of strong branches at the base; stems erect, terete, hollow, glabrous. Leaves opposite, with an apical pseudowhorl of 4 larger ones, simple, ovate-oblong to ovate-lanceolate, 3–15 cm × 1–6 cm, base obtuse or cuneate, apex acuminate, scabrous above; petiole 0–1 cm long; stipules interpetiolar, forming a ridge. Inflorescence a terminal or axillary spike 3–15 cm long. Flowers bisexual, regular, 5-merous, sessile; sepals somewhat unequal, ovate-linear-lanceolate, 2–4 mm long, outside glabrous or slightly hairy, green, persistent; corolla salver-shaped, glabrous, tube 6–15 mm long, lobes triangular, 2–2.5 mm long, white to red or purplish; stamens inserted on the corolla tube, alternating with lobes, included;



Spigelia anthelmia L. – 1, plant habit; 2, flower; 3, fruit; 4, seeds.

ovary superior, glabrous, 2-celled, style cylindrical, stigma ovate-lanceolate. Fruit a 2-lobed capsule 4–5 mm × 5–6 mm, lobes globose, explosively dehiscent, with 4 valves, few-seeded. Seeds obliquely ellipsoid or ovoid, 2–3 mm × 1.5–2 mm, dull brown, tuberculate.

S. anthelmia can be found flowering and fruiting throughout the year. Flowers open in the afternoon and are self-pollinating. The seeds are dispersed by animals.

Spigelia comprises some 50 species. Its natural distribution is confined to tropical America and it has its centre of diversity in the highlands of eastern Brazil.

Ecology In South-East Asia *S. anthelmia* is a weed of sandy seashores, riverbanks, arable land, gardens, roadsides and waste places, from sea-level up to 600 m altitude. It is locally sometimes abundant, but on the whole rare.

Genetic resources In view of its large distribution and its preference for anthropogenic habitats, *S. anthelmia* does not appear to be threatened by genetic erosion.

Prospects Some of the alkaloids present in *S. anthelmia* are promising leads for a potential new generation of target-oriented insecticides. However, further research is needed to evaluate their potential.

Literature 4, 247, 287, 334, 381, 973.

Other selected sources 120, 646, 879.

J.L.C.H. van Valkenburg

Staurogyne Wallich

Pl. asiat. rar. 2: 80 (1831).

ACANTHACEAE

x = unknown

Origin and geographic distribution *Staurogyne* comprises about 80 species and occurs in all tropical regions. The greatest diversity is found in South-East Asia with about 50 species; Peninsular Malaysia, Sumatra and Borneo are richest. Africa is least rich, with only 5 species.

Uses Some applications of *Staurogyne* in traditional medicine in South-East Asia have been recorded: the roots and leaves are used as a diuretic and to treat diarrhoea, and whole plants to treat sore mouth and cough. In Sumatra (Riau Province) a maceration of an unidentified *Staurogyne* species crushed in water is rubbed over the body as a post-medication treatment for chronic fever. The leaves are sometimes eaten as a vegetable or chewed with betel.

Properties Whole plants of an unidentified *Staurogyne* species from Sumatra showed slight in-vitro antimicrobial activity. Sweet-tasting oleanane-type triterpene glycosides named strogins, have been isolated from a water extract of *S. merguensis* leaves.

Botany Small herbs or undershrubs. Leaves opposite, simple and entire, without cystoliths; petiole distinct, not connected by a transverse ridge; stipules absent. Inflorescence a terminal or seemingly axillary raceme, spike or head; upper bracts arranged spirally. Flowers bisexual, 5-merous; bracteoles similar to the calyx segments or narrower; calyx deeply 5-fid, with narrow, equal or unequal segments; corolla with tube gradually widened above the narrow base, lobes subequal, patent and flat; stamens 4, inserted below the middle of the corolla tube, didynamous, included; ovary superior, 2-celled, style with 2 stigmatic lobes. Fruit a narrowly ovoid or fusiform capsule, many-seeded. Seeds small, subglobose, reticulate-ribbed.

Staurogyne has been placed in the subfamily *Nelsonioideae* together with 4 other smaller genera. This group has been proposed for inclusion in the *Scrophulariaceae*, mainly based on fruit and seed characters, but this is not generally followed.

Ecology Most *Staurogyne* species occur in lowland and lower montane forest, up to 1800 m altitude, often under shady and humid conditions, but some grow in more open and disturbed localities such as fallow rice fields, roadsides and open forest.

Genetic resources In general, *Staurogyne* seems liable to genetic erosion due to the preference of most species for humid lowland forest, a type of habitat under increasing pressure.

Prospects Information on phytochemistry and pharmacological properties of *Staurogyne* is almost completely lacking, which makes it impossible to judge its prospects as a medicinal plant. However, research seems useful because the recorded applications in local medicine (as a diuretic and antimicrobial) concur with several better investigated *Acanthaceae* that have a reputation as important medicinal plants. The sweetening activity of *S. merguensis* leaves is remarkable and might offer possibilities as an alternative for sugar.

Literature 295, 296.

Selection of species

Staurogyne elongata (Blume) O. Kuntze

Revis. gen. pl. 2: 497 (1891).

Vernacular names Indonesia: reundeu (Sundanese), godong keji (Javanese).

Distribution Sumatra and Java.

Uses The roots and leaves are used as a diuretic. Young leaves are eaten raw as a vegetable.

Observations An erect or ascending herb up to 60 cm tall; leaves oblong to oblong-obovate, 6–15 cm × 2–5 cm, more or less pubescent, petiole 2–6 cm long, pubescent; inflorescence 7–30 cm long, slender, often with a few branches at base, rachis dark red; flowers with c. 2 cm long corolla, white with pink; fruit c. 1 cm long, acute. *S. elongata* occurs in humid forest at 200–1000 m altitude.

Selected sources 62, 109, 334.

Staurogyne merguensis (T. Anderson) O. Kuntze

Revis. gen. pl. 2: 497 (1891).

Vernacular names Malaysia: lemba batu (Peninsular). Thailand: taan oi (Krabi).

Distribution Southern Burma (Myanmar), southern Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia *S. merguensis* is used in Chinese medicine to treat cough. The dried leaves are chewed with betel, to which they give a sweet flavour.

Observations An ascending herb up to 25 cm tall; leaves usually oblong, 4–12 cm × 2.5–7 cm, pubescent below, petiole 0.5–4.5 cm long, pubescent; inflorescence 9–20 cm long, usually simple; flowers with 1.5–2 cm long corolla, white with purplish limb; fruit c. 0.5 cm long. *S. merguensis* occurs in lowland forest and is uncommon in Peninsular Malaysia.

Selected sources 109, 343.

Staurogyne setigera (Nees) O. Kuntze

Revis. gen. pl. 2: 497 (1891).

Synonyms *Staurogyne malaccensis* C.B. Clarke (1908).

Vernacular names Malaysia: pokok serawan kubang, rumput kerak rimba, pokok cheret murai (Peninsular).

Distribution Thailand, Peninsular Malaysia, Singapore, Sumatra, Bangka, Borneo and the southern Philippines (Palawan).

Uses In Peninsular Malaysia *S. setigera* plants are chewed with betel to treat a sore mouth. A decoction of the roots and leaves is given against diarrhoea.

Observations An ascending herb up to 30 cm tall; leaves oblong-ovate to elliptical-lanceolate, 2–14 cm × 1–4 cm, glabrous or slightly pubescent, petiole 0.5–3.5 cm long; inflorescence 1.5–3.5 cm long, dense; flowers with c. 1.5 cm long corolla, white with a dull pink spot in the mouth; fruit c. 0.5 cm long. *S. setigera* occurs in lowland forest and is locally common.

Selected sources 109, 121, 312.

Dodi Darmakusuma

Stenotaphrum helferi Munro ex Hook.f.

Fl. Brit. India 7: 91 (1896).

GRAMINEAE

$2n$ = unknown

Vernacular names Malaysia: rumput dada lipan (Peninsular). Thailand: yaa lin krabue (Nakhon Si Thammarat). Vietnam: c[or] quai ch[ef]o, c[or] d[es], c[or] n[us]c.

Origin and geographic distribution *S. helferi* occurs in southern Burma (Myanmar), Vietnam, southern China including Hainan, Thailand and Peninsular Malaysia.

Uses A decoction of whole *S. helferi* plants is applied in Peninsular Malaysia during childbirth to arrest haemorrhage and as a protective medicine. It may serve as a forage, but is not deliberately planted for this purpose.

S. secundatum (Walter) O. Kuntze (St. Augustine grass) is widely planted as a lawn and pasture grass, but rarely in South-East Asia.

Properties There is no information on the phytochemistry of *S. helferi*, but some flavones, quercetin and orientin glycosides have been isolated from *S. secundatum*.

Botany A perennial herb up to 50 cm tall; culms rooting at lower nodes and with 2 shoots arising from each node, suberect, flattened. Leaves alternate, simple, oblong-lanceolate to broadly linear, 5–20 cm × 7–12 mm, slightly cordate at base, abruptly acute at apex, margins scaberulous, plicate when young, rough below; sheath flattened, glabrous but scabrous on the keel, ligule membranous, less than 0.5 mm long, with a minutely hairy margin. Inflorescence a usually terminal spike 8–15 cm long, with strongly flattened main axis having a flexuous midrib between pockets bearing short racemes on one side; racemes 1–1.5 cm long, each with 3–8 spikelets on a membranous rachis. Spikelets c. 4.5 mm long, 2-flowered, lower floret male or sterile, upper floret bisexual, awn-

less, lower glume 2–3 mm long and 5–7-veined, upper glume c. 4 mm long and up to 9-veined, lower lemma 4–4.5 mm long and 5–7-veined, upper lemma and paleas c. 3 mm long, indurated; florets with 3 stamens; ovary with 2 feathery stigmas. Fruit an ovoid caryopsis c. 2.5 mm long.

Stenotaphrum comprises 7 species, several of which are widely distributed coastal pioneers, 3 others being endemics of Madagascar and vicinity. *Stenotaphrum* is classified in the tribe *Paniceae*. Its closest relative is *Paspalidium*, from which it is derived by a reduction of the racemes and expansion of the central axis.

Ecology *S. helferi* occurs in shady, damp habitats, e.g. on stream banks, in ravines, but also along forest paths, roadsides, in plantations and gardens. In Peninsular Malaysia it has often been recorded at the foot of limestone hills, and it is locally common.

Genetic resources *S. helferi* is not as widely distributed as several other *Stenotaphrum* species, but it does not seem easily liable to genetic erosion because it is locally common even in anthropogenic habitats.

Prospects It is unlikely that the importance of *S. helferi* as a medicinal plant will increase. It may be useful as an auxiliary plant, e.g. to prevent erosion and as a forage, but experiments are still needed. Its tolerance to shade make it interesting for farm systems with integrated livestock and plantations, like *S. secundatum*, but *S. helferi* has the advantage of being native to South-East Asia and consequently probably better adapted to the prevailing climatic conditions.

Literature 121, 281, 824.

Other selected sources 908.

R.H.M.J. Lemmens

Stichoneuron caudatum Ridley

Journ. Straits Branch Roy. Asiat. Soc. 57: 107 (1911).

STEMONACEAE

$2n = 18$

Vernacular names Malaysia: kayu mati hidup (Peninsular).

Origin and geographic distribution *S. caudatum* occurs in southern Thailand and Peninsular Malaysia.

Uses In Peninsular Malaysia the leaves of *S. caudatum* are eaten with betel as a tonic in convalescence. The vernacular name indicates that it may be abortifacient.

Properties The presence of alkaloids has been demonstrated in *S. caudatum* leaves.

Botany A slender, erect herb up to 60 cm tall, with short rhizome, sparingly branched; branches hairy. Leaves alternate, simple and entire, elliptical, 7–12 cm × 2–5.5 cm, cuneate or rounded at base, acuminate at apex, hairy below, lateral veins curved; petiole 0.5–1 cm long, slightly sheathing at base; stipules absent. Inflorescence an axillary cincinnus, raceme-like, with densely set stiff pedicels, few to many-flowered but usually only 1–2 flowers in anthesis; bracts c. 2 mm long, hyaline. Flowers apparently bisexual (but possibly functionally unisexual), 4-merous; pedicel filiform, stiff, 3–10 mm long, hairy; tepals 5–6 mm long, acute to long-acuminate, spreading, margins recurved, dirty white to reddish-purple; stamens adnate to the base of the tepals, free; ovary semi-inferior, 1-celled, style minute. Fruit a spindle-shaped, 2-valved capsule 1–2 cm × 0.5 cm, slightly flattened and curved, 1–2-seeded. Seeds broadly ellipsoid, 5–7 mm long, ridged, with flimsy, hairy-lobed aril up to halfway and distinct funicle.

Stichoneuron comprises 2 species. *S. membranaceum* Hook.f., which is closely related to *S. caudatum*, is only known from few collections in eastern India. *Stichoneuron* is most closely related to, and perhaps congeneric with *Croomia*, another small genus of 3 species from eastern China, southern Japan and the south-eastern United States.

Ecology *S. caudatum* grows on the forest floor, in moist localities in swamp forest, along streams and on river banks, up to 200 m altitude. Overall it is rare, although locally abundant.

Genetic resources Its comparatively small area of distribution, scarcity and habitat preference mean that *S. caudatum* may easily become endangered. Moreover, the scantiness of fruits under natural conditions suggests poor fertility.

Prospects It is unlikely that *S. caudatum* will gain importance as a medicinal plant because it is uncommon and apparently little used.

Literature 121, 247.

Other selected sources 804.

R.H.M.J. Lemmens

Streptocaulon Wight & Arnott

Wight, Contr. bot. India: 64 (1834).

ASCLEPIADACEAE

x = unknown

Origin and geographic distribution *Strepto-*

caulon comprises approximately 5 species, which all occur in tropical Asia. Thailand seems richest, with 3 species.

Uses *Streptocaulon* roots are fairly widely used in Indo-China, southern China and Thailand, mainly to treat fever and dysentery, as a rejuvenating drug and as a tonic for kidneys and liver. The leaves are applied to snake bites and abscesses, whereas the latex is used as a vulnerary in the Philippines. *S. baumii* is in demand as raw material for baskets and other handicrafts in the Philippines.

Properties General screening of *S. juventas* roots showed the presence of starch and alkaloids.

Botany Lianas or shrubs with twining stems; white latex present. Leaves opposite, simple and entire, herbaceous to leathery, glabrous to densely hairy, with pinnate venation, with minute trichomes, often shortly petiolate; stipules absent. Inflorescence an extra-axillary or terminal, often lax and irregularly forked, paniculiform cyme. Flowers bisexual, regular, 5-merous, small; calyx small, with minute glands at base of the lobes; corolla rotate, with short tube and large lobes overlapping to the right in bud; corona lobes inserted on the corolla, adnate to the filaments, slender, inflexed; stamens inserted at base of corolla, shortly connate at base, alternating with minute teeth, anthers connivent and adnate to the stigma head, with short, apical membrane, with pollen tetrads in solitary masses in each anther cell; ovaries 2, free, superior, 1-celled, stigma head convex, angular. Fruit consisting of 2 divaricate follicles, cylindrical to ovoid, finely warty, many-seeded. Seeds oblong, comose.

Ecology *Streptocaulon* usually occurs in lowland forest, often at edges and in open localities, and in thickets.

Management *Streptocaulon* is rarely cultivated. The tuberous roots of *S. juventas* are usually collected from the wild. In Vietnam they are harvested year-round, but preferably in autumn. After collecting, they are well washed, sliced and dried in the sun or in ovens.

Genetic resources In most regions where *Streptocaulon* occurs it is collected from wild populations for medicinal applications and sometimes also for basketry. The plants are often killed during collection and therefore *Streptocaulon* may become threatened in the near future.

Prospects *Streptocaulon* is fairly widely used in traditional medicine in Vietnam, southern China, as well as Thailand, but almost no research has been done on the phytochemistry and pharmacological properties. This should be given more attention, and if suitable cultivation methods can be developed, *Streptocaulon* may have prospects as a valuable medicinal plant for wider use in South-East Asia, including the Malesian region.

Literature 172, 760, 1008.

Selection of species

Streptocaulon baumii Decne.

DC., Prodr. 8: 496 (1844).

Vernacular names Philippines: hinggiu-kalabau, sibot-sibotan (Tagalog), maraipus (Iloko).

Distribution Endemic to the Philippines (Luzon, Mindoro).

Uses The latex is used as a vulnerary. *S. baumii* is in demand as raw material for the manufacture of baskets and other handicrafts.

Observations A liana with slender stem; leaves elliptical to elliptical-ovate, 7–15 cm × 4–8 cm, rounded to cordate at base, acuminate at apex, hairy; inflorescence 4–9 cm long; flowers with purple corolla, c. 5 mm in diameter, with ovate to oblong-ovate lobes; follicle cylindrical, 5–9 cm long, hairy. *S. baumii* is locally common in thickets and secondary forest at low altitude.

Selected sources 229, 285, 760.

Streptocaulon juventas (Lour.) Merr.

Trans. Amer. Philos. Soc., n.s., 24(2): 315 (1935).

Synonyms *Streptocaulon tomentosum* Wight & Arnott (1834), *Streptocaulon griffithii* Hook.f. (1883).

Vernacular names Thailand: tamyan hak hom (Nakhon Sawan), chukka rohini (Chumphon), thao prasong (Prachin Buri). Vietnam: h[af]th[ur] [oo] tr[aws]ng, c[ur] v[us] b[of], h[af] th[ur] [oo]nam.

Distribution India, Burma (Myanmar), Indo-China, southern China, Thailand and Peninsular Malaysia (rare).

Uses In Thailand the roots are considered antipyretic, a decoction of the stem or roots is used orally as an antiseptic in a mixture with other plants, and the boiled stem is taken as a tonic and against diarrhoea. In Vietnam the roots have a considerable reputation as a rejuvenating drug. They are considered tonic for kidneys and liver, and effective against anaemia, dyspepsia, insomnia, neurasthenia, hypogalactia, malaria, rheumatism, ostalgia, menstrual disorders, leucorrhoea, bloody stool, prurigo and snakebites. The leaves are also prescribed against senility in a

mixture with 5 other medicinal plants in the form of pills. In China the roots are used to treat dysentery and stomach-ache, whereas the leaves are applied externally to treat snakebites and abscesses.

Observations A liana up to 8 m long; leaves obovate to broadly elliptical, 7–15 cm × 3–9.5 cm, rounded to cordate at base, acute to rounded and apiculate at apex, densely hairy; inflorescence 4–20 cm long; flowers with corolla yellow-green outside, yellow-brown inside, c. 5 mm in diameter, with ovate lobes; follicle oblong to oblong-lanceolate in outline, 7–13 cm long. *S. juventas* occurs in thickets and forest up to 1000 m altitude.

Selected sources 172, 671, 789, 1008, 1013.

Wongsatit Chuakul, Noppamas Soonthornchareonnon & Orawan Ruangsomboon

Striga asiatica (L.) O. Kuntze

Revis. gen. pl. 2: 466 (1891).

SCROPHULARIACEAE

2n = 24, 40

Synonyms *Striga lutea* Lour. (1790).

Vernacular names Witchweed (En). Indonesia: baruwang, jukut cancang (Sundanese), rajatawa (Javanese). Malaysia: rumput siku-siku (Peninsular). Papua New Guinea: hometa kasu kavu (Kami, Eastern Highlands). Thailand: ya mae mot (central). Vietnam: vo[of]ng ph[as] v[af]ng.

Origin and geographic distribution *S. asiatica* has an extremely large area of distribution: from tropical and southern Africa and Madagascar, through western Asia and India, to Burma (Myanmar), Indo-China, southern China, Thailand and the Malesian region (recorded in Peninsular Malaysia, Java, the Philippines and New Guinea, probably also occurring elsewhere). It has been introduced in North America.

Uses In Peninsular Malaysia *S. asiatica* is used externally to treat sores and ulcers. In Papua New Guinea it is eaten fresh with traditional salt as a contraceptive.

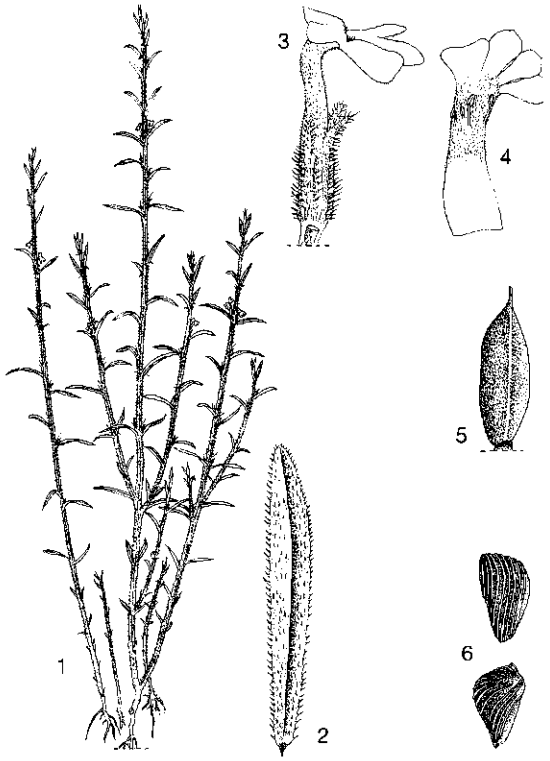
In India *S. asiatica* is considered to improve appetite, whereas in China it is used as a stomachic and vermifuge, and to treat intestinal obstructions. In tropical Africa it is also applied in traditional medicine, e.g. to treat headache; an ointment is made from the plant-ash with cow- or sheep-fat, to treat gout. Some other *Striga* species are used as well, e.g. *S. hermonthica* (Delile) Benth., which is applied in African traditional medicine to treat dermatological complaints such as leprosy.

Properties The flavonoids acacetin, apigenin and luteolin have been isolated from whole *S. asiatica* plants. They showed dose-dependent anti-implantation activity on rats when administered orally during day 1–4 of pregnancy, at a mean effective dose of 25 mg/kg body weight. In another study, a single oral dose of these compounds (10 mg/kg body weight) on day 1, 2 or 3 of pregnancy resulted in 100% prevention of implantation. Significant antifertility activity of petroleum ether and chloroform extracts of whole plants has also been reported for mice.

The ethanolic extract of whole plants of *S. gesnerioides* (Willd.) Vatke (synonym: *S. orobanchioides* (Endl.) Benth.) from India given for 7 days to immature male rats at a dose of 200 mg/kg body weight caused a significant decrease in the weight of the testes, epididymis, seminal vesicles and the ventral prostate. It also produced a significant decrease in the number of spermatocytes and spermatids. Ethanolic and aqueous extracts showed antihistaminic and mast cell stabilizing activities in rats. The flavones apigenin and luteolin have been isolated from *S. gesnerioides*.

Botany A small, annual, erect herb up to 40 cm tall; stem simple or sparsely branched, quadrangular. Leaves opposite in lower part of the plant, alternate in upper part, simple, linear, 5–15 mm × 1–1.5 mm, entire, hirsute on both surfaces, sessile; stipules absent. Inflorescence an axillary bracteate spike, sparsely flowered. Flowers bisexual, with 2 bracteoles at the base of the calyx; calyx tubular, 5–6 mm long, with 5 stout ribs, subequally 5-lobed; corolla with 10–13 mm long tube abruptly incurved at apex, shortly glandular-pilose outside, limb spreading, 2-lipped, upper lip obtriangular, emarginate, lower lip 3-lobed, yellow, often scarlet inside; stamens 4, inserted near the top of the corolla tube, didynamous, included, with short filaments; ovary superior, ellipsoid, 2-celled, style filiform, stigma capitate. Fruit an ovoid or subglobose capsule, 3–5 mm long, many-seeded. Seeds broadly fusiform, c. 0.3 mm long, striate. Seedling underground for 4–6 weeks and then white, rounded and bearing scale-like leaves, after emergence above the ground green, 4-angular, densely hairy, with opposite to alternate leaves.

Only 3–4 months are needed to complete the life cycle of the plant. As a hemiparasite, *S. asiatica* attaches itself through haustoria to the roots of a host plant. The seedling grows below the soil surface for 4–6 weeks, during which time it depends upon the host plant for food and water, and is par-



Striga asiatica (L.) O. Kuntze – 1, plant habit; 2, leaf; 3, flower; 4, corolla opened, showing stamens; 5, fruit; 6, seeds.

ticularly injurious to the host plant. After this period the plant emerges above the soil and becomes green. About one month after emergence the flowers open, and seeds may be mature again one month later. The minute seeds are dispersed by wind and rain.

Striga comprises about 40 species and occurs in Africa, Madagascar, tropical Asia and Australia. Africa is by far the richest in species (over 30), whereas in tropical Asia about 7 species occur. About half of the species are annuals, the others are perennials with rhizomes or tuberous roots.

Ecology *S. asiatica* is a hemiparasite on the roots of grasses. It may be a serious pest in crops, e.g. upland rice, maize and sorghum in Africa, and upland rice, maize, millet and sugar cane in India. Under more natural conditions it occurs in deciduous forest, grasslands, along roadsides and in abandoned fields, up to 2000 m altitude. *S. asiatica* does not succeed well in high rainfall areas. It prefers sandy and well-drained soils, but can also grow on clayey soils.

Management *S. asiatica* can produce immense quantities of seeds. These may be dormant in the soil for many years, reportedly sometimes over 30 years. The seeds can germinate only when close to a suitable host.

S. asiatica is a major pest in field crops. Locally in India, it may reduce yields in rice to such an extent that cultivation has been given up. There is little crop loss in the early stages of an infestation, but the loss increases considerably with the years. The leaves of the attacked crop plants wilt. In South-East Asia *S. asiatica* is usually not a very serious pest except in a few localities like northern Thailand, where it is noxious in maize, sometimes also in sorghum.

The control of this pest is very difficult, and is often done by spraying hormone weed-killers such as 2,4-D on plants before the flowering stage.

Genetic resources There seems to be much genetic variation in *S. asiatica*. Its growing habit varies from one crop to another, in different environmental conditions, and between geographical areas. It is obvious that such a widespread species is not under threat of genetic erosion.

Prospects The eradication of *S. asiatica* as a problematic parasite of crops has received much more attention than research on pharmacological properties. The antifertility activity in particular deserves more attention, and it is striking that one of the recorded uses in South-East Asia is as a contraceptive. Other recorded activities, e.g. anti-inflammatory and antispasmodic, are possibly also attributable to flavonoids such as luteolin and apigenin, but research is needed for confirmation.

Literature 340, 341, 342, 347, 362, 879.

Other selected sources 62, 120, 121, 181, 249, 250, 318, 731.

Noorma Wati Haron

Strobilanthes Blume

Bijdr. fl. Ned. Ind.: 781, 796 (1826).

ACANTHACEAE

$x = 8$; *S. cusia*: $n = 8$, $2n = 32$

Origin and geographic distribution *Strobilanthes* is one of the largest genera in *Acanthaceae*, with approximately 200 species, and is distributed in tropical and subtropical Asia. Some species are cultivated within this region or elsewhere.

Uses The leaves and sometimes the roots of *S. cusia* are important in traditional medicine in Indo-China and China. They are used internally to treat irregular menstruation, bleeding after abor-

tion, fever, vomiting, tonsillitis and haemoptysis, and in cases of eruptive epidemic diseases such as influenza, meningitis and erysipelas, and externally against eczema, impetigo, haemorrhagic gingivitis, and snake and insect bites.
In traditional medicine in Indonesia *S. crispa* leaves are used to treat kidney stones and diabetes. The tubers of *S. acrocephala* T. Anderson are used in Vietnam as a blood tonic, sexual stimulant, sedative, to treat cough and to promote lactation of women after childbirth. In India, pounded leaves of *S. auriculata* Nees are rubbed on the body to treat intermittent fever.

Properties Leaves of *S. crispa* contain high amounts of minerals including potassium (51%), calcium (24%), sodium (13%), iron (1%) and phosphorus (1%), and of water-soluble vitamins (B1, B2 and C). They also contain catechins, alkaloids, caffeine and tannin. They showed high antioxidant activity, and it has been suggested that a daily dose of a herbal tea prepared from the leaves could contribute to the additional nutrients and antioxidants needed in the body to enhance the defence system, especially toward the incidence of degenerative diseases. An extract of *S. crispa* leaves showed potent inhibitory activity on avian myeloblastosis virus reverse transcriptase, and no cytotoxicity. A leaf infusion of *S. crispa* showed dissolving capacity on calcium stones. Verbascoside (an iridoid-glucoside), caffeic acid derivatives and flavonoids have been isolated from *S. crispa*.
The quinazolinone alkaloids 4(3H)-quinazolinone and 2,4(1H,3H)-quinazolinedione were isolated from *S. cusia* in China. The first compound showed antitumour, antiviral and immunomodulating activities, and the second compound hypotensive action. The indoloquinazolinone alkaloid tryptanthrin, also isolated from *S. cusia*, showed potent activity against resistant strains of mycobacteria, whereas a 1% tryptanthrin solution in alcohol showed good activity against some skin fungi, without being toxic. Indoles, which are the main compounds in *S. cusia*, have noticeable action on the womb; they showed contractive effect on isolated uterus of guinea-pigs. The indole derivatives indigo and indirubin (indigo-red, the red-coloured natural isomer of indigo) have been isolated from whole *S. cusia* plants. The latter compound showed anticancer activity, and is an official drug in China for the treatment of chronic granulocytic leukaemia. Clinical tests showed that the therapeutic efficacy of indirubin was comparable to that of busulfan, yet without bone marrow suppression, and with few side effects, which are mainly gastro-intestinal. Indirubin is now produced synthetically.
Other compounds isolated from *S. cusia* include the triterpenes lupeol, betulin and lupenone.
S. cusia extracts induce abortion in animals in the early stages of gestation.

Botany Erect or decumbent herbs or much-branching shrubs. Leaves opposite, often those of a pair unequal, simple, entire to dentate or crenate, with cystoliths; petioles connected by a transverse ridge; stipules absent. Inflorescence a spike or head, terminal or in the axil of a bract, aggregated in erect or nodding racemes or panicles, or composed of solitary flowers. Flowers bisexual, rather large, 5-merous, subsessile; calyx deeply cleft or parted, with linear, equal or unequal segments; corolla with funnel-form tube, curved or straight, narrow below, much broader above, hairy in 2 rows inside, lobes unequal, spreading; stamens 4, didynamous, exserted or included, sometimes 2 rudimentary, filaments more or less connected at base; ovary superior, 2-celled, style slender, recurved, with 2 unequal stigmatic lobes. Fruit an oblong or linear capsule, 2–4-seeded. Seeds papillate or short-hairy.
Several *Strobilanthes* species are monocarpic, i.e. they take some time, often about 12 years, to flower and then die after fruit setting. This may result in mass flowering and dying off, comparable to bamboos.
Strobilanthes has an enormous range of variation and has been subdivided into numerous smaller genera, which are, however, often ill-defined. It is one of the poorly understood *Acanthaceae* genera.

Ecology *S. crispa* occurs in anthropogenic habitats in the lowland of Java, whereas *S. cusia* is only occasionally planted in the Malesian region. The latter is hydrophilic and often grows in the shade.

Management *S. cusia* can be propagated by root cuttings, and plants are pruned 2–3 times a year when cultivated for dye production. Harvesting of leaves can start 6 months after planting.
Cell suspension cultures of *S. dyeriana* Masters (apparently only known from cultivation) initiated from leaf tissue have been maintained on agar and solid B5 Gamborg media. One of the callus lines produced the anthocyanins cyanidin-3,5-diglucoside and peonidin-3,5-diglucoside in the presence of indole-3-acetic acid. These anthocyanins are also present in intact plants. The cultures produce the glucoside of p-methoxyphenethylamine when this latter compound is used as the substrate.

Genetic resources *S. cusia* has been much collected for medicinal purposes and as a dye plant, and has become rare in the wild. Conservation measures are desirable for wild populations. *S. crispa* seems less vulnerable. It is striking that in regions where *Strobilanthes* is comparatively well studied the occurrence of endemic species is high, e.g. in Sri Lanka where over 80% of the species are endemic. This indicates that *Strobilanthes* is in general liable to genetic erosion.

Prospects Some of the compounds isolated from *S. cusia*, such as indirubin, and their pharmacological activities have greatly stimulated interest in antitumour agents from natural resources, and show that plants are still a considerable source of compounds active against important diseases. Recent findings also show that *S. crispa* may have prospects as a modern medicinal plant with stimulatory activity on the defence system of the body against diseases. However, still more research is needed to develop the potential applications of *Strobilanthes* in medicine.

Literature 338, 731, 876.

Selection of species

Strobilanthes crispa (L.) Blume

Bijdr. fl. Ned. Ind.: 798 (1826).

Synonyms *Sericocalyx crispus* (L.) Bremek. (1944).

Vernacular names Indonesia: daun picah beling (Jakarta), enyoh kelo, keci beling (Javanese).

Distribution Java.

Uses In Indonesia the leaves of *S. crispa* are used to treat kidney stones and diabetes.

Observations An erect herb up to 100 cm tall, branches acutely quadrangular at top; leaves of a pair subequal, oblong-lanceolate, 9–18 cm × 3–8 cm, decurrent at base, acuminate at apex, shallowly crenate-crispate, very scabrid; inflorescence a short and dense spike, with imbricate bracts; flowers with yellow corolla 1.5–2 cm long; fruit fusiform, c. 11 mm long. *S. crispa* occurs in brushwood, on river banks and in abandoned fields, up to 1000 m altitude.

Selected sources 62, 334, 519, 612, 731.

Strobilanthes cusia (Nees) O. Kuntze

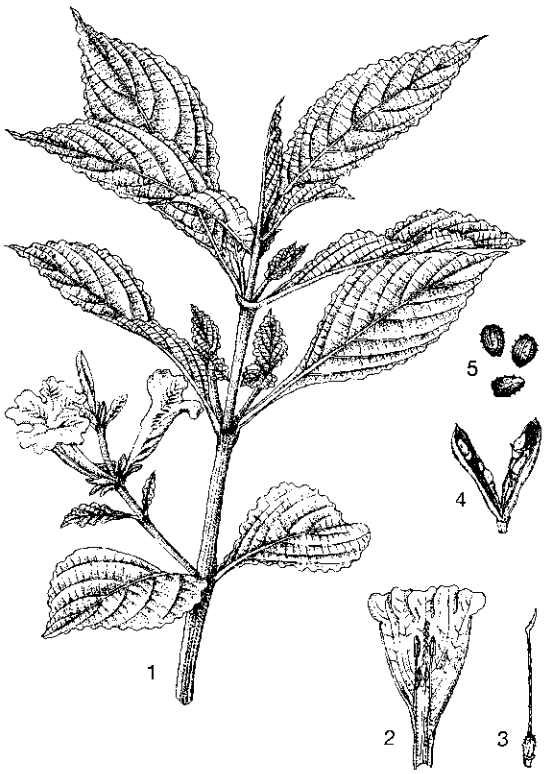
Revis. gen. pl. 2: 499 (1891).

Synonyms *Strobilanthes flaccidifolia* Nees (1847), *Baphicacanthus cusia* (Nees) Bremek. (1944).

Vernacular names Assam indigo, room (En). Malaysia: tarom, tarom siam (Peninsular). Laos: hoomz baanz. Thailand: khraam (general), sanyao (Karen, Mae Hong Son), hom (northern). Vietnam: ch[af]m nhu[ooj]m, ch[af]m m[ef]o, thanh d[aj]i.

Distribution Bhutan, eastern India, Burma (Myanmar), Indo-China, southern China and Thailand. *S. cusia* is, or was, cultivated and sometimes naturalized elsewhere, e.g. in Peninsular Malaysia.

Uses In Peninsular Malaysia pounded leaves are applied as a poultice to treat ague. In Vietnam the leaves, usually as an extract, are used internally to treat irregular menstruation, bleeding after abortion, fever, vomiting, tonsillitis and haemoptysis, and externally against eczema, impetigo, haemorrhagic gingivitis, and snake and insect bites. In China leaves and roots are additionally used in cases of eruptive epidemic diseases such as influenza, meningitis and erysipelas. In Japanese traditional medicine *S. cusia* is applied externally to tinea pedis. The twigs are used to prepare a dark blue dye for dyeing cloth. *S. cusia* is plant-



Strobilanthes cusia (Nees) O. Kuntze – 1, flowering branch; 2, opened corolla; 3, pistil; 4, dehisced fruit; 5, seeds.

ed as a dye plant in the mountains of northern Vietnam.

Observations An erect shrub or perennial herb up to 100 cm tall, branches 4-angled; leaves of a pair subequal, elliptical-ovate, 8–20(–25) cm × 3–8 cm, acutely tapering into petiole at base, acuminate at apex, dentate; inflorescence an elongate spike of more or less remote heads, with foliaceous bracts; flowers with violet, rose or white corolla 3.5–4 cm long; fruit fusiform, c. 25 mm long. *S. cusia* grows under natural conditions in Vietnam and southern China on stream banks and valleys in forest, at altitudes of 500–1600 m.

Selected sources 121, 217, 542, 546, 631, 671, 731, 974.

Nguyen Kim Bich & Nguyen Tap

Styphelia Sm.

Spec. bot. New Holland 4: 45 (1795).
EPACRIDACEAE
x = unknown

Origin and geographic distribution *Styphelia* comprises about 150 species and is distributed in tropical Asia (from Indo-China, Burma (Myanmar) and Thailand to Malesia), Australia, Tasmania, New Zealand, New Caledonia, and islands in the Pacific Ocean. Australia is richest in species (about 130), whereas in the Malesian region 8 species have been found.

Uses In Peninsular Malaysia, a decoction of leaves and roots of *S. malayana* is drunk to treat stomach-ache and dysmenorrhoea. It is one of the ingredients in 'rempah ratus', a traditional herbal concoction administered after childbirth. The roots of *S. suaveolens* have been used in the Philippines to treat haemorrhage. The fruits of *S. malayana* are edible, and in Bangka (Indonesia) its fibrous inner bark has been used to make canoes waterproof.

Properties The flavonoids in bark, leaves, flowers and fruits of several Australian *Styphelia* species have been investigated. Cyanidin-3-glycosides are the main pigments, whereas kaempferol, quercetin and myricetin have also been demonstrated.

Botany Shrubs or small trees. Leaves arranged spirally, simple and entire, xeromorphic, stiff and leathery, finely longitudinally veined, often whitish on the underside between the veins, subsessile to shortly petiolate; stipules absent. Inflorescence a terminal and/or axillary spike or spike-like raceme, bracteate. Flowers bisexual, polygamous or unisexual (and then plants dioecious), 5-merous, with 2 bracteoles inserted immediately below the calyx; sepals free, imbricate, persistent, ciliate; corolla with cylindrical tube and spreading or recurved lobes hairy inside; stamens inserted near the top of the corolla tube, filaments short and filiform; ovary superior, (2–)5(–10)-celled, style usually short with obtuse stigma. Fruit a baccate drupe, pulp around the central stone usually rather dry, covered by the persistent sepals at base, stone with 1 seed per cell.

Both species treated here can be found flowering and fruiting throughout the year. The flowers are pollinated by insects, like bees. The slightly fleshy fruits are probably dispersed by animals such as birds. Mycorrhizas have been demonstrated to be present in several Australian *Styphelia* species, but it is not known whether these occur in South-East Asian species.

There is some disagreement among taxonomists on the status of *Leucopogon*: some consider it a subgenus of *Styphelia* (as is adopted here), others a separate genus.

Ecology *Styphelia* often occurs gregariously in open sunny locations, on the seashore as well as in mountains upwards to alpine heights, but can also be found as undergrowth in forest. It shows a preference for acid, sandy or peaty soils.

Genetic resources The large area of distribution of the *Styphelia* species treated here is remarkable. Such widespread species are not in danger of genetic erosion, but several other *Styphelia* species occur only very locally and may easily become endangered by habitat destruction.

Prospects The uses of *Styphelia* in traditional medicine deserve more attention. Research on phytochemistry and properties of the South-East Asian species is still lacking.

Literature 121, 247, 331.

Selection of species

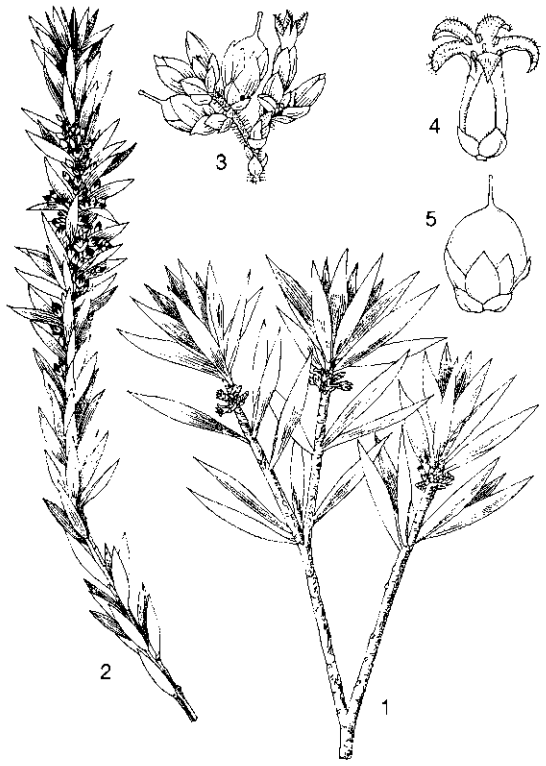
Styphelia malayana (Jack) Sprengel

Syst. veg. 4(2), Cur. Post.: 67 (1827).

Synonyms *Leucopogon malayanus* Jack (1820).

Vernacular names Brunei: ambok gobang (Dusun), ludang-ludang (Tutong), terindak ati (Malay, Kedayan). Malaysia: maki china (Peninsular, Sarawak), chuchur atap (Peninsular, Sarawak), melamut (Iban, Sarawak). Vietnam: m[ax] k[yf].

Distribution Southern Burma (Myanmar), southern Indo-China (southern Vietnam), south-



Styphelia malayana (Jack) Sprengel – 1, flowering branch; 2, flowering and fruiting twig; 3, inflorescence with flowers and fruits; 4, flower; 5, fruit.

ern Thailand, Peninsular Malaysia, Singapore (now extinct), Sumatra, the Riau Archipelago, Bangka, Belitung, Anambas Island, Borneo, New Guinea (Cycloop Mountains) and Australia (north-eastern Queensland).

Uses In Peninsular Malaysia, a decoction of leaves and roots is drunk to treat stomach-ache and dysmenorrhoea. It is one of the ingredients in 'rempah ratus', a traditional herbal concoction administered after childbirth. The fruits are edible. In Bangka, the fibrous inner bark has been used to make canoes waterproof.

Observations A shrub or small tree up to 7 m tall, sparingly branched; leaves lanceolate, (2.5–)3–5(–8) cm long, spine-pointed at apex, with numerous equally faint veins, sessile; flowers bisexual, corolla c. 5 mm long, white, sometimes pinkish; fruit globose, 4–5 mm in diameter, yellowish-white to red. The populations from New Guinea and Australia have been described as a distinct variety (or subspecies): var. *novoguineensis* Sleumer (or *Leucopogon malayanus* Jack subsp. *novoguineensis* (Sleumer) Pedley). *S. malayana* occurs on or behind the beach, on exposed cliffs and rocks, open spots in heath forest, and in mossy forest up to 2750 m altitude. It is found on nutrient-poor, acid soils such as sandy and peaty soils, often also on volcanic soils, sometimes as a pioneer species, and occurs locally gregariously.

Selected sources 121, 247, 249, 877, 990.

Styphelia suaveolens (Hook.f.) Warb.

P. & F. Sarasin, Reisen in Celebes 2: 329 (1905).

Synonyms *Leucopogon suaveolens* Hook.f. (1852), *Styphelia philippinensis* Merr. (1922), *Leucopogon philippinensis* (Merr.) Hosok. (1940).

Vernacular names Philippines: gaing, sadumdum (Bagobo).

Distribution Northern Borneo (Mount Kinabalu), the Philippines (Luzon, Negros and Mindanao), Sulawesi, Timor, New Guinea, the Solomon Islands, Australia, Tasmania and New Zealand.

Uses The roots have been used in the Philippines (Negros) to treat haemorrhage.

Observations A small, erect or prostrate, diffuse or bushy shrub up to 2(–3) m tall; leaves linear to linear-oblong or lanceolate-oblong, (0.5–)1–1.5(–2) cm long, blunt-pointed at apex, with 3–5 inner veins more conspicuous than fan-like branched outer ones, shortly petiolate; flowers unisexual (plants dioecious), corolla c. 4 mm long, white, creamy or pinkish-red; fruit subglobose (3–)4–5 mm in diameter, yellowish-white to red. *S. suaveolens* occurs in the undergrowth of montane forest, and in exposed locations in alpine grassland and on rocks, at (1800–)2000–4000(–4700) m altitude. It is locally common to even subdominant.

Selected sources 247, 877.

Stephen P. Teo

Suregada Roxb. ex Rottl.

Ges. Naturf. Freunde Berlin Neue Schriften 4: 206 (1803).

EUPHORBIACEAE

x = unknown; *S. multiflora*: $2n = 22$

Origin and geographic distribution *Suregada* comprises about 30 species: 8 in Africa, 13 in Madagascar and the Comoros Islands, and the remainder in tropical Asia and northern Australia (1 species). About 5 species seem to occur in the Malesian region, 2 widespread, the other 3 local.

Uses A decoction of *Suregada* roots is used in Peninsular Malaysia and Thailand to treat fever,

and the bark in Cambodia for strengthening the gums and as purgative in liver complaints. The wood is used to treat fever, venereal diseases and beri-beri, and the stem bark as anthelmintic, laxative, and externally as fungicide. The wood is sometimes used for construction, e.g. for rafters, and as firewood. *Suregada* is occasionally planted as an ornamental in gardens.
In eastern Africa, the roots of *S. zanzibariensis* Baillon are used in decoction as a purgative, and they are also used to treat snakebites.

Properties The diterpenes glomomulides A–F and diol ent-kaurene-3β,15β-diol, and the flavones kanugin, desmethoxy kanugin and pinnatin have been isolated from the roots of *S. multiflora*. Gelonin, a ribosome-inactivating and immunoreactive protein, has been isolated from the seeds. An antiretroviral protein (GAP31) with activity against herpes simplex virus infection in vitro has also been identified. This protein also inhibits human immunodeficiency virus type 1 (HIV-1) infection and replication, and exhibits DNA topoisomerase inhibitor and RNA N-glycosidase activities.
A leaf extract of *S. zanzibariensis* showed a distinct in-vitro antiplasmodial activity against chloroquine-sensitive and chloroquine-resistant *Plasmodium falciparum* strains.

Botany Dioecious shrubs or small to medium-sized trees, completely glabrous. Leaves alternate, simple, elliptical, entire or slightly toothed, pinnately veined, pellucid-dotted, shortly petiolate; stipules small, connate, early caducous, often leaving a conspicuous scar. Inflorescence leaf-opposed, fasciculate or very shortly cymose, often gummy when young. Flowers unisexual, tiny, tepals (petals absent) 5, suborbicular, strongly imbricate; male flowers with numerous free, exserted stamens and numerous small glands between the filaments; female flowers with annular disk and superior, 2–3-locular ovary, styles 2–3, very short, bifid. Fruit capsule- or drupe-like, globose or shallowly 2–3-lobed, mostly smooth, tardily dehiscent, few-seeded. Seeds subglobose, with fleshy testa.
Suregada is a distinctive genus in the tribe *Gelonieae*, but the species of the Malesian region are still insufficiently circumscribed. *S. glomerulata* and *S. multiflora* seem to be separable only by the larger size of flowers and fruits in the latter, but it is almost impossible to establish a clear dividing line between them. The leaves in *S. glomerulata* are mostly smaller and often rounded or obtuse at apex. The traditional division of the material in the Malesian region into 2 entities, based on larger, fleshy fruits on the one hand and smaller, capsular fruits on the other hand, seems inadequate. Moreover, 3 endemic species seem to exist in the Philippines and Borneo. There is much need of ecological-morphological field work on the genus.

Ecology In South-East Asia *Suregada* occurs in a wide variation of habitats, from lowland forest, primary as well as secondary, to scrub vegetation and montane forest up to 1500 m altitude.

Genetic resources Both *Suregada* species treated here are widespread and, at least locally, common. The genetic variation is still unknown.

Prospects Some compounds from *Suregada* show interesting pharmacological activities, e.g. immunotoxic and anti-HIV, which merit further research, and may have potential in the development of future medicines. The antipyretic activity observed for Asia as well as Africa is notable. A taxonomic study of the species in South-East Asia is needed to unravel the species delimitation.

Literature 101, 189, 703, 817.

Selection of species

Suregada glomerulata (Blume) Baillon

Étude Euphorb.: 396 (1858).

Synonyms *Gelonium glomerulatum* (Blume) Hassk. (1844).

Vernacular names Malaysia: limau-limau, penawar puteh (Peninsular). Vietnam: k[ej]n son ch[uj]m.

Distribution Vietnam, throughout the Malesian region and in Australia (Northern Territory).

Uses A decoction of the roots is used against fever in Peninsular Malaysia. The wood is sometimes used for construction, e.g. for rafters, and as firewood.

Observations A shrub or small to medium-sized tree up to 21 m tall; leaves eliptical-oblong to obovate, 5–15 cm × 2–5.5 cm, usually broadly rounded to obtuse at apex; fruit depressed-globose, c. 13 mm in diameter, capsular. *S. glomerulata* occurs in scrub vegetation, margins of mangrove, secondary forest, primary mixed dipterocarp forest, on river banks and the seashore, up to 150 m altitude, in Borneo up to 1500 m; it is locally common.

Selected sources 20, 21, 22, 23, 24, 62, 121, 990.

Suregada multiflora (A.Juss.) Baillon

Étude Euphorb.: 396 (1858).

Synonyms *Gelonium multiflorum* A.Juss. (1824).

Vernacular names Malaysia: limau-limau (Peninsular). Thailand: khan thong phayabat (central), kraduk (peninsular), maduk lueam (northern). Vietnam: m[aaf]n m[aa]y.

Distribution India, Burma (Myanmar), Indo-China, Thailand, Peninsular Malaysia and Sumatra; possibly also in Java and the Lesser Sunda Islands.

Uses In Thailand a decoction of the stem, mixed with *Casearia grewiaefolia* Vent. and *Siphonodon celastrineus* Griffith stems, is taken against beriberi. In India the seeds are used to treat liver diseases and as a tonic for the gums. The wood is used to treat fever and venereal diseases, and the stem bark as an anthelmintic, laxative, and externally as a fungicide. In Thailand and Cambodia the bark is used for strengthening the gums and teeth, and as a purgative in liver complaints. The wood is sometimes used for construction, e.g. for rafters, and as firewood.

Observations A shrub or small tree up to 9 m tall; leaves elliptical-oblong to elliptical-lanceolate, 10–19 cm × 3–8 cm, acuminate or acute at apex; fruit globose, c. 15 mm in diameter, somewhat fleshy-leathery. *S. multiflora* occurs in deciduous, mixed or evergreen forest, also in montane rain forest, up to 1500 m altitude.

Selected sources 19, 22, 23, 101, 121, 170, 189, 537, 817, 990.

Wongsatit Chuakul, Noppamas Soonthornchareonnon & Orawan Ruangsomboon

Swinglea glutinosa (Blanco) Merr.

Journ. Arn. Arb. 8: 131(1927).

RUTACEAE

$2n$ = unknown

Synonyms *Limonia glutinosa* Blanco (1837), *Aegle glutinosa* (Blanco) Merr. (1904), *Chaetospermum glutinosum* (Blanco) Swingle (1913).

Vernacular names Tabog, swinglea (En). Philippines: tabog, malakabuyau, boyag (Tagalog).

Origin and geographic distribution *S. glutinosa* originates from the Philippines (Luzon). It has been introduced in Central and South America, and in the United States (Florida).

Uses In the Philippines fruit juice of *S. glutinosa* is a folk remedy for various skin diseases. It is also used as a hair tonic, and rubbed into dog fur to cure itch or to get rid of ticks. The trunk is used in house building, often as a pillar. In Colombia *S. glutinosa* is cultivated for live fences.

Properties Methanol and methylene chloride extracts of *S. glutinosa* bark showed promising antiprotozoal activity against both chloroquine-sensitive and chloroquine-resistant strains of *Plasmodium falciparum*. The cytotoxicity against human promonocytic U-937 cells showed an LD_{50} value of over 400 µg/ml after 96 h, with a selectivity index well over 10, indicating that the antiprotozoal activity is not based on cytotoxicity. Several acridone alkaloids isolated from the stem bark also showed promising antiplasmodial activity. The one with the highest antiplasmodial activity was, however, still 5 times less active than chloroquine against the chloroquine-resistant *P. falciparum* strain, and it showed a high cytotoxicity against HeLa cells.

Botany A small to medium-sized, evergreen tree; twigs angled and pubescent when young, soon becoming terete and glabrous, with 1–2 spines in the leaf axils. Leaves alternate, 3-foliolate; petiole 0.5–5 cm long, very narrowly winged; stipules absent; leaflets cuneate at base, acuminate to rounded at apex, terminal leaflet oblanceolate, 8–12 cm × 3–5 cm, lateral leaflets ovate to obovate, 2.5–5 cm × 1.2–2.5 cm. Flowers solitary or in clusters in leaf axils, sometimes on short twigs leafy at base, bisexual, regular, 5-merous, fragrant, pedicellate; calyx cup-shaped, 2.5–3.5 mm × 1.5–2 mm, with obtuse lobes; petals free, linear, 12–14 mm × 3–3.5 mm, white; stamens 10; ovary superior, short-stalked, obovate, 8–10-celled, pilose, style slender, twice as long as the ovary. Fruit an oblong-ovoid berry 5–10 cm × 3–6 cm, green or yellow, with several seeds in each cell. Seeds woolly, surrounded by glutinous pulp. Seedling with epigeal germination; cotyledons emergent.

Swinglea is monotypic and differs from other *Rutaceae* genera with hard-shelled fruits (subtribe *Balsamocitrinae*) in having ellipsoid or ovoid ribbed fruits, with a leathery outer shell showing very long, pointed, radially arranged oil glands in the peel and thick, tissue-containing mucilage glands lining the radial walls of the segments surrounding the seeds.

Ecology In the Philippines *S. glutinosa* is widely distributed at low and medium altitudes, occurring in thickets and in secondary forest. In Central and South America it can be found from sea-level up to 1500 m altitude.

Management *S. glutinosa* is usually propagated by seed.

Genetic resources *S. glutinosa* has been introduced in the tropics of Central and South America as a potential rootstock for *Citrus*. As such it is represented in regional germplasm collections focusing on tropical fruits as well as germplasm collections in the United States and Spain, specializing in *Citrus*. Its natural distribution being confined to just a single island makes it potentially vulnerable to genetic erosion. However, its preference for disturbed forest and thickets reduces this risk.

Prospects Little is known about the pharmacological activities of *S. glutinosa*. The provisional results of research on its antimalarial activity deserve further attention.

Literature 760, 987, 988.

Other selected sources 117, 907.

Gilmour Panggabean

Symplocos Jacq.

Enum. syst. pl. 5: 24 (1760).

SYMPLOCACEAE

$x = 11, 12$; *S. cochinchinensis*: $2n = 22, 24$

Origin and geographic distribution *Symplocos* comprises about 250 species and is distributed from tropical and subtropical Asia to eastern Australia and Fiji in western Polynesia, and in Central and South America, with a few species extending to temperate regions (to Japan and the United States). Approximately 60 species occur in the Malesian region. Borneo is richest with about 25 species, followed by Peninsular Malaysia, Sumatra and the Philippines, each with about 20 species. Indo-China and southern China have no less than about 30 species, Thailand has slightly less than 20.

Uses Some *Symplocos* species are used in traditional medicine in South-East Asia, mainly to treat stomach-ache and thrush. In Peninsular Malaysia the bark of *S. ophirensis* C.B. Clarke was used internally as a vermifuge. An infusion of *S. racemosa* Roxb. leaves is used in Vietnam to treat stomach-ache and diarrhoea, and a decoction of *S. glomerata* King ex C.B. Clarke leaves to treat scabies. In China leaves of *S. sumuntia* Buch.-Ham. ex D. Don (synonym: *S. caudata* Wallich ex G. Don) are used in traditional medicine to treat pulmonary tuberculosis, dysentery, acute tonsillitis and otitis media, and eye infections. In Vietnam roots and leaves of *S. paniculata* (Thunberg) Miq. (synonym: *S. chinensis* (Lour.) Druce) are used to treat colds, fever, backache and burns, and in India the bark is considered a tonic and used to treat ophthalmia.

The inner bark and leaves of some species (mainly *S. cochinchinensis* and *S. fasciculata* Zoll.) are used as a mordant and yellow to red dye in the batik industry. Young leaves are sometimes eaten raw or steamed as a vegetable. The wood of *Symplocos* is used for light and temporary construction, posts, turnery, inlay work, furniture, matches, carving and wrapping paper.

Properties Leaves and stems of *S. cochinchinensis* (of Sumatran origin) showed in-vitro antimicrobial activity, moderate against *Staphylococcus aureus*, *Escherichia coli* and *Fusarium oxysporum*, and strong against *Saccharomyces cerevisiae*. In tests in New Guinea, methanol extracts of *S. cochinchinensis* leaves, roots and stem bark showed a broad spectrum of antibacterial activity, that was enhanced on fractionation, but the extracts showed no activity on the moulds tested. Matairesinol and harman (and derivatives of the latter compound) isolated from *S. lucida* (Thunberg) Sieb. & Zucc. (occurring from India to Japan and western Malesia) were found to inhibit human immunodeficiency virus (HIV) replication in H9 lymphocyte cells. Ethanolic extracts of *S. lucida* leaves produced hypoglycaemic activity in rats, and anti-cancer activity against Friend virus leukaemia in mice, and leaf and stem extracts showed activity against human epidermoid carcinoma of the nasopharynx in tissue culture. The flavan-glycoside symposide, isolated from *S. racemosa* stem bark, showed anti-fibrinolytic activity. Water extracts of *S. racemosa* stem bark exhibited analgesic and antidiarrhoeal activities when intraperitoneally administered to mice.

Symplocos contains large amounts of aluminium, up to 50% of the ash, and this is responsible for the action as a mordant. Gallic and ellagic acid are common. Leucoanthocyanins occur in various amounts, and quercetin and caffeic acid have also been demonstrated. A mixture of triterpenoid saponins has been obtained from *S. cochinchinensis*.

Botany Evergreen shrubs or small to medium-sized, rarely large trees up to 30(–45) m tall. Leaves alternate or arranged spirally, simple, often with vesicular or toothlike glands at margins, pinnately veined, petiolate; stipules absent. Inflorescence usually an axillary spike, raceme or panicle. Flowers bisexual, regular, 3–5-merous; calyx with very short tube; corolla sympetalous but often divided nearly to the base, whitish, bluish or purplish; stamens 4–many, connate into a tube or

only at the very base and then sometimes in 5 bundles; ovary inferior, 2–5-celled, style 1. Fruit a drupe with hard stone, crowned by the persistent calyx lobes, 1-seeded. Seed with copious endosperm. Seedling with epigeal germination, cotyledons very short and linear, green; hypocotyl elongated; first 2 leaves opposite or alternate.
Growth is continuous or in flushes. Within a given tree all flowers open more or less at the same time. Pollination is probably by insects such as bees and bumblebees, but self-pollination already in the bud is also suggested. Although birds and bats may sometimes eat the fruits, fruit dispersal is unlikely to be abundant.

Ecology *Symplocos* occurs most abundantly in the tropical highlands up to 4000 m altitude, but many species have a fair altitudinal range and are also found in the lowlands. In general, it is a component in mixed, mostly evergreen rain forest.

Management *Symplocos* can be propagated by seed. For *S. cochinchinensis* there are about 27 500 dry fruits/kg, and sown fruits show only about 15% germination in 4–7 months.

Genetic resources It seems that *Symplocos* is not particularly threatened because it is little used, either for medicinal purposes or for timber, dye or mordant, and often occurs in more or less inaccessible mountainous locations.

Prospects Although relatively little research has been done on the phytochemistry and pharmacological properties of *Symplocos*, the few studies available show interesting results, e.g. concerning antimicrobial activity. More research seems worthwhile, also in the light of the rather common application in traditional medicine in India and China.

Literature 398, 542, 671, 685, 883, 1030.

Selection of species

Symplocos cochinchinensis (Lour.) S. Moore

Journ. Bot. 52: 148 (1914).

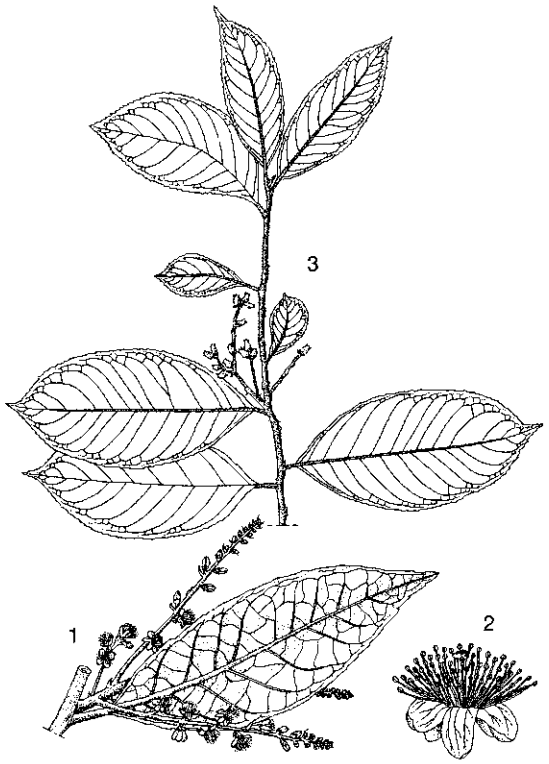
Synonyms *Symplocos spicata* Roxb. (1832), *Symplocos laurina* Wallich ex G. Don (1837), *Symplocos javanica* Kurz (1871).

Vernacular names Indonesia: jirak (Sundanese), jirek (Javanese), kandueng (Minangkabau). Malaysia: medang hitam, pokok api-api (Peninsular). Philippines: agosip puti (Tagalog), balok-bok (Sambali), upunan (Igorot). Cambodia: louôt chom' (Kandal), seu meut (Stung Treng), trom préi. Thailand: lot, luut, pan (peninsular). Vietnam: dung b[ooj]p (southern), ba th[uw]a.

Distribution India, Burma (Myanmar), Indo-China, China, Japan, Thailand, throughout Malesia, the Solomon Islands, eastern Australia, Vanuatu and Fiji.

Uses In Sumatra young leaves soaked in water are chewed to treat madness. In India powdered bark is given with honey to cure biliousness, haemorrhages, diarrhoea, gonorrhoea and eye diseases. A paste of the leaves, boiled in oil, is applied to diseases of the scalp. The inner bark and leaves were often used as a mordant and yellow to red dye in the batik industry. The wood is used for house posts, furniture, frames of houses and matches. Rosaries are made from dried fruits.

Observations A shrub to medium-sized, rarely large tree up to 22(–45) m tall; leaves 12–25 cm × 3–10 cm, petiole 5–17 mm long; inflorescence usually a spike; flowers with glabrous, whitish corolla; fruit flask-shaped to globose, 5–7 mm long. *S. cochinchinensis* is very variable and 4 subspecies and numerous varieties have been distinguished. It occurs in many different habitats up to 3000 m



Symplocos cochinchinensis (Lour.) S. Moore – 1, part of flowering branch; 2, flower; 3, fruiting branch.

altitude, most commonly in the understorey of primary and secondary rain forest.

Selected sources 121, 247, 249, 250, 295, 296, 334, 466, 542, 883.

Symplocos crassipes C.B. Clarke

Hook.f., Fl. Brit. India 3(9): 580 (1882).

Synonyms *Symplocos brandiana* King & Gamble (1906), *Symplocos monticola* King & Gamble (1906), *Symplocos penangiana* King & Gamble (1906).

Vernacular names Malaysia: ganchek kechil (Peninsular).

Distribution Peninsular Thailand, Peninsular Malaysia and Borneo.

Uses In Peninsular Malaysia the leaf juice is administered to treat stomach-ache.

Observations A shrub to medium-sized tree up to 18 m tall; leaves 6–27 cm × 1–8.5 cm, petiole 1–10 mm long; inflorescence a short spike; flowers with glabrous corolla; fruit cylindrical, 13–18 mm long, often bright blue. *S. crassipes* is variable and 7 varieties have been distinguished. It occurs in different forest types up to 1500 m altitude.

Selected sources 121, 247, 249.

Symplocos odoratissima (Blume) Choisy ex Zoll.

Syst. Verz. 2: 136 (1854).

Synonyms *Symplocos pulverulenta* King & Gamble (1906), *Symplocos wenzelii* Merr. (1915).

Vernacular names Indonesia: ki sariawan (Sundanese), sarigintung (Sumatra), udu (Bali). Philippines: duung (Filipino), himamaliu (Tagalog), mangkunai (Panay Bisaya).

Distribution Throughout Malesia except for New Guinea.

Uses In Java pulped inner bark, known as 'kulit seriawan', is rubbed on the gums to cure thrush; a leaf infusion is used for the same purpose. Pulped leaves are applied externally and internally (as a decoction) after childbirth. They are also part of a mixture to treat sprue. Young leaves are eaten as a vegetable. The wood is occasionally used in house building.

Observations A shrub to medium-sized tree up to 30 m tall; leaves 7–20(–40) cm × (2.5–)5–10(–20) cm, petiole stout, 1–5 cm long; inflorescence an up to 30 cm long panicle; flowers with hairy corolla; fruit usually ovoid, 8–25 mm long. *S. odoratissima* occurs in primary and secondary rain forest up to 2500 m altitude, often near streams.

Selected sources 121, 247, 334, 542, 883.

Inggit Puji Astuti

Tacca J.R. Forster & J.G. Forster

Char. gen. pl.: 35 (1775).

TACCACEAE

x = unknown; *T. leontopetaloides*: $2n = 30$

Origin and geographic distribution *Tacca* comprises 11 species, 8 of which occur in South-East Asia. Australia has 2 species, Africa, Madagascar and South America 1 each. *T. leontopetaloides* (L.) O. Kuntze has the largest area of distribution, ranging from Africa and Madagascar to tropical Asia, Australia and Polynesia.

Uses *Tacca* comprises some important and commonly used medicinal plants. Usually the rhizome is used, externally to treat wounds, swellings, sores, snakebites, skin complaints and rheumatism, and internally to treat menstrual disorders, fever and digestive upsets.

T. leontopetaloides is mainly used for its edible starch in the rhizome, but has also medicinal uses throughout its area of distribution. The rhizomes and their starch are used against dysentery, diarrhoea and oedemas.

T. plantaginea (Hance) Drenth is used in Vietnam to treat diarrhoea, jaundice, high blood pressure, irregular menses and as an anodyne, and in China as an analgesic, antipyretic, anti-inflammatory and to treat wounds. Rhizomes of some *Tacca* species are used in Vietnam for the extraction of diosgenin and are considered to be of economic importance. Diosgenin is used as starting material for the production of oral contraceptives, sex hormones and corticosteroids, and is often commercially isolated from *Dioscorea* species.

Leaves and young inflorescences are sometimes eaten as a vegetable after cooking, and *Tacca* is sometimes cultivated in gardens as an ornamental.

Properties The presence of steroidal sapogenins has been recorded for several *Tacca* species. Rhizomes of *T. integrifolia* contain up to 3.3% diosgenin, those of *T. chantrieri* about 1.2%. Stigmasterol and daucosterin have also been isolated from *T. chantrieri* rhizomes. A number of taccalonolides (bitter-tasting steroids) have been isolated from *T. plantaginea*. *T. leontopetaloides* contains a number of potent molluscicidal steroidal sapogenins.

An aqueous extract of *T. leontopetaloides* showed distinct toxic activity against *Schistosoma mansoni*. In India an extract of *T. plantaginea* showed significant in-vitro antimalarial activity. The taccalonolides isolated from *T. plantaginea* exhibited weak cytotoxicity against P388 leukaemia cells.

Botany Perennial herbs, with tuberous, solid, starchy rhizome. Leaves usually in a rosette, simple and entire or pinnatifid, palmatipartite to palmatisect, sometimes with pinnately divided segments, long-petiolate with a sheathing base. Inflorescence umbellate, with involucral bracts, with long, erect scape (peduncle). Flowers bisexual, regular, 3-merous; perianth consisting of fused tepals in 2 whorls; stamens inserted on the tepals, outer ones slightly larger than inner ones, filaments short and flattened; ovary inferior, 1-celled, style provided with 3 incised wings, stigma 3-lobed. Fruit berrylike, 6 ribbed, usually irregularly disintegrating, occasionally dehiscent, many-seeded. Seeds strongly ribbed, usually with distinct raphe.

The flowers are possibly pollinated by carrion-flies attracted by the dull colour of the flowers and their sweetish musky odour. Two kinds of fruit development in relation to dispersal have been distinguished. The first type comprises fruits maturing with a dull colour, fleshy walls and sweet taste, possibly dispersed by small mammals such as rodents. The peduncle bends over and the developing infructescence is situated on the ground. Examples include *T. chantrieri* and *T. integrifolia*. In the second type the fruits are brightly coloured and thin-walled, and the peduncle remains in an upright position. Examples include *T. leontopetaloides* and *T. palmata*.

Tacca is the only genus of the family *Taccaceae*. Its affinity is still unclear, but *Dioscoreaceae* have been most often suggested as related, also on phytochemical grounds.

Ecology Most *Tacca* species occur in humid lowland forest, primary as well as secondary forest, rarely up to 2100 m altitude. Some species (e.g. *T. palmata*) are more indifferent to climate and also occur under seasonal climatic conditions, e.g. in teak forest, whereas *T. leontopetaloides* even occurs in grassland and beach vegetation.

Management *T. leontopetaloides* is widely cultivated for its edible tubers. In Vietnam some other *Tacca* species, e.g. *T. chantrieri*, are cultivated under half-natural conditions for medicinal purposes. Rhizomes are dug up all the year round, well washed and dried in the sun or in ovens.

Genetic resources Most *Tacca* species, including the ones treated here, are widespread and occur in primary as well as secondary forest. These do not seem to be in danger of genetic erosion. However, some other Malesian species (e.g. *T. bibracteata* Drenth from Borneo and *T. celebica* Koord. from Sulawesi) are only known from a few collections in a limited region and may be endangered. Locally, collecting rhizomes from wild populations may put much pressure on some species.

Prospects *Tacca* is widely used in traditional medicine and deserves more attention in pharmacological research, especially for external applications. It is a possible alternative for *Dioscorea* grown for diosgenin, but more research is needed on propagation and management of *Tacca* as a crop.

Literature 156, 230, 245, 510, 957.

Selection of species

Tacca chantrieri André

Rev. Hort. 73: 541 (1901).

Synonyms *Tacca paxiana* H. Limpr. (1928).

Vernacular names Thailand: di ngu wa (northern), neraphusi thai (central), wan phangphon (peninsular). Vietnam: r[aa]u h[uf]m, c[aar]m dia la, pinh d[or].

Distribution Eastern India, Bangladesh, Burma (Myanmar), Indo-China, southern China, Thailand and northern Peninsular Malaysia.

Uses In Vietnam the rhizome is macerated in alcohol and used externally to treat rheumatism. In Thailand the rhizomes are used as an antipyretic, whereas cooked young leaves and inflorescences are eaten as a vegetable.

Observations A perennial herb with cylindrical rhizome up to 10 cm × 1.5 cm; leaves elliptical to ovate or lanceolate, 17–60 cm × 4.5–22 cm, entire, petiole 11–43 cm long; inflorescence with scape up to 65 cm long, 4 large, decussate involucral bracts, many filiform bracts and up to 25 flowers; flowers up to 2 cm in diameter, green to blackish-violet; fruit 1.5–4 cm × 1–2 cm, green to deep orange-red or purple; seeds reniform. *T. chantrieri* occurs in primary and secondary forest, up to 1400(–2100) m altitude.

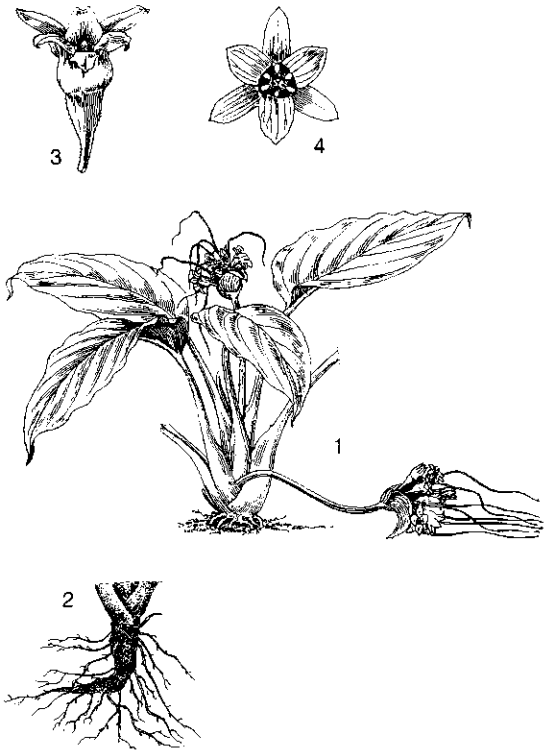
Selected sources 247, 249, 1008.

Tacca integrifolia Ker Gawl.

Bot. Mag. 35: t. 1488 (1912).

Synonyms *Tacca cristata* Jack (1821), *Tacca laevis* Roxb. (1832).

Vernacular names Indonesia: puar lilipan (Sumatra), kumis ucing, curug lukur (Java). Malaysia: keladi murai, kelemoyang ayer (Peninsular). Thailand: man phlaen, wan phangphon, nilaphusi (peninsular). Vietnam: ng[ar]i r[owj]m.



Tacca integrifolia Ker Gawl. – 1, plant habit; 2, rhizome; 3, flower in side view; 4, flower in upper view.

Distribution India, Bangladesh, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, western Java and Borneo.

Uses In Peninsular Malaysia pulped rhizomes are applied to the skin to treat rash. In Thailand a decoction of the rhizome is used to treat hypotension and as an aphrodisiac, and in Vietnam to treat irregular menses. *T. integrifolia* is sometimes planted in gardens as an ornamental.

Observations A perennial herb with cylindrical rhizome up to 12 cm × 3 cm; leaves oblong to lanceolate, 7.5–65 cm × 3–24 cm, entire, petiole 4.5–41 cm long; inflorescence with scape up to 65(–100) cm long, 4 large, non-decussate involucral bracts, many filiform bracts and up to 30 flowers; flowers up to 3.2 cm in diameter, green to blackish-violet; fruit 2.5–5 cm × 1–2.5 cm, green to black; seeds ovoid to oblong-ovoid. *T. integrifolia* occurs in primary and secondary forest, up to 1200(–1500) m altitude.

Selected sources 121, 173, 247, 249.

Tacca palmata Blume

Enum. pl. Javae 1: 83 (1827).

Vernacular names Indonesia: gadung tikus (general), kumis ucing (Sundanese), kemendulan (Javanese). Philippines: payung-payungan (Tagalog), kanalong, tungang-basing (Bisaya). Thailand: buk ruesi (south-eastern), khot din (peninsular). Vietnam: n[uw]a ch[aa]n v[ij]t.

Distribution Indo-China, Thailand and throughout the Malesian region except New Guinea.

Uses In Indonesia the rhizome is applied externally to swellings, cuts, sores, pimples and snakebites. Scrapings of the rhizome are used as a stomachic and to treat menstrual disorders in the Philippines. In Thailand the rhizome is used as a poultice to treat wounds.

Observations A perennial herb with globose to ellipsoid rhizome up to 5(–8) cm × 3 cm; leaves 4–8-palmatipartite, 7–36 cm × 7.5–40 cm, petiole (12–)15–60(–75) cm long; inflorescence with scape up to 80 cm long, 4 large, decussate involucral bracts, without filiform bracts and up to 30 flowers; flowers up to 1 cm in diameter, green to blackish-violet; fruit globose, up to 1 cm in diameter, bright red; seeds pyramidal with a rounded base. *T. palmata* often occurs in secondary forest and forest margins, also in teak forest and bamboo groves, up to 1000 m altitude.

Selected sources 117, 121, 247, 249, 334, 760.

R.H.M.J. Lemmens

Tapeinochilos ananassae (Hassk.) K. Schumann

Bot. Jahrb. Syst. 27: 349 (1899).

COSTACEAE

$2n$ = unknown

Synonyms *Tapeinochilos pungens* (Teijsm. & Binnend.) Miq. (1868).

Vernacular names Indonesia: bunga kasturi, hamuki, mamori (Moluccas).

Origin and geographic distribution *T. ananassae* originates from the Moluccas, New Guinea and Australia (Queensland), but is grown as an ornamental in other tropical and subtropical regions (known as 'Indonesian wax ginger').

Uses In the Moluccas roots, leaves and the stem pith have been used internally as well as externally to treat snakebites, and the leaves have been used as a poultice on wounds. The leaves were also eaten as a vegetable. It is unknown whether the plant is still used for these purposes. *T.*

ananassae is cultivated as an ornamental, especially for cutflowers.

Botany A very large herb up to 4 m tall, with fleshy rhizome; stems branched. Leaves arranged spirally, simple and entire, oblong to oblong-obovate, 11–14 cm × 5–6 cm, cuneate at base, acuminate at apex, glabrous, subsessile, with truncate ligule and tubular sheath at base. Inflorescence terminal on leafy shoot or on an erect leafless peduncle up to 2 m tall and arising from rhizome, cone-like, 7–20 cm long, with large, leathery, bright red bracts having recurved tips. Flowers barely exceeding bracts, bisexual, zygomorphic, 3-merous, c. 5 cm long, subsessile; calyx tubular, unequally lobed, red; corolla with 3 subequal lobes, yellow; stamen 1, with broad filament and apical connective crest, staminode (labellum) opposite the stamen, adnate to corolla tube, with 2 lateral teeth; ovary inferior, 2(–3)-celled, style filiform, upper part enclosed by the thecae, stigma flattened triangular. Fruit a capsule, longitudinally dehiscent, many-seeded. Seeds angular, with short lobed aril.

Tapeinochilos ananassae (Hassk.) K. Schumann – 1, habit of flowering plant; 2, inflorescence; 3, flower.

Tapeinochilos comprises about 12 species and is restricted to the Moluccas, New Guinea and north-eastern Australia. It is included in the family *Costaceae*, which is closely related to *Zingiberaceae*, together with 2 small South American genera and the large, pantropical genus *Costus*.

Ecology *T. ananassae* occurs in lowland and lower montane forest, often in clearings.

Management Propagation of cultivated *T. ananassae* is usually done by division, sometimes by stem cuttings or seed. Seeds start to germinate about 6 weeks after sowing, and a germination rate of 60% has been recorded.

Genetic resources Little is known about wild populations of *Tapeinochilos* and the threat of genetic erosion for these. No germplasm collection are known to exist, but commercial plant breeders offer *T. ananassae*, and occasionally other species, for sale, e.g. in the United States.

Prospects Pharmacological research is needed to assess the true value of the medicinal uses of *T. ananassae*. Locally *T. ananassae* has become a popular ornamental for its large, brilliant red, stiff inflorescences, which can be used as long-lasting cutflowers. However, it has lost some popularity because after some years of growth the inflorescence stalks decrease in length.

Literature 248, 334.

Other selected sources 386, 510.

Amor T. Karyowati

Taxus sumatrana (Miq.) de Laub.

Kalikasan 7: 151 (1978).

TAXACEAE

$2n$ = unknown

Synonyms *Taxus wallichiana* auct. non Zucc.

Vernacular names Indonesia: tampinur batu, kayu taji (Sumatra). Philippines: amugauen (Igorot).

Origin and geographic distribution *T. sumatrana* occurs scattered in the Malesian region. It has been found in Sumatra, the Philippines and Sulawesi. It is also recorded for the eastern Himalayas, northern Burma (Myanmar), Vietnam, southern China and Taiwan, but it depends on the taxonomic interpretation whether this concerns the same species or a closely related one.

Uses *T. sumatrana* is not used in traditional medicine. Like other *Taxus* species, it is notorious for the substantial toxicity of all its parts, except the seed aril, for humans and animals (especially horses). However, branchlets and leaves of *Taxus*

are used in Chinese traditional medicine to treat kidney diseases and diabetes. In India bark and leaves of *Taxus* are considered a remedy for cough, and in Nepal twigs and leaves are used as an emmenagogue.

The discovery in 1971 that *Taxus* is a source of taxol (paclitaxel), a compound with anticancer activity, increased the scientific interest dramatically and resulted at the beginning of the 1990s in the development of important drugs.

Taxus wood is highly valued and is used for decorative woodwork, such as chests and coffins, flooring, fence posts, mallots and bows. *Taxus* is an important ornamental, its dense growth and ability to withstand regular clipping making it suitable for hedges.

Properties The most interesting compounds isolated from *Taxus* are diterpenes with a taxane nucleus. Some of these are strictly diterpenoids, e.g. baccatins, whereas others have an amide function, e.g. taxol. Taxol was first isolated from the bark of *T. brevifolia* Nutt. from the United States, but it is present only in traces, requiring enormous amounts of material for commercial exploitation. It appeared also possible to isolate taxol from the leaves of *Taxus* cultivars, and to prepare it from structural analogs present in substantial quantities (e.g. 10-desacetylbaccatin III). Taxol and related taxoids (e.g. baccatin III) have also been isolated from *T. sumatrana* leaves of Sumatran origin. Recently, good methods for producing taxol in in-vitro cell cultures have been developed, e.g. by adding methyl jasmonate, producing about 1 g of taxol in 10 l solution after 2 weeks.

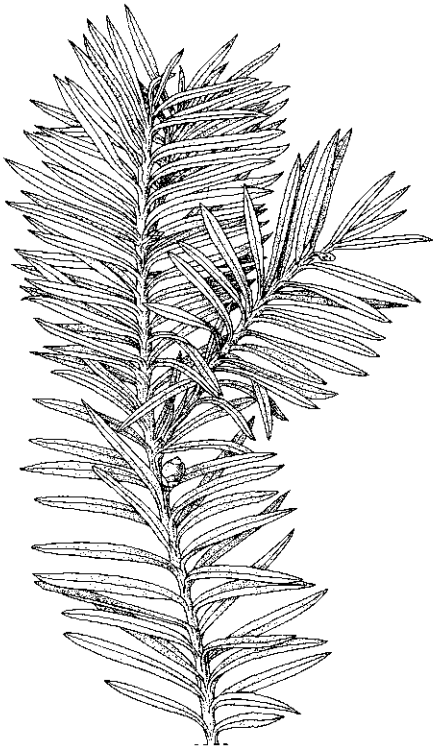
Taxol is a mitotic spindle poison with very specific mode of action. It promotes the formation of microtubules and inhibits their disassembly into tubulin. Moreover, it inactivates the protein Bcl-2, which prevents apoptosis (programmed cell death). Taxol is given intravenously and is used to treat different types of tumours, including advanced ovary and breast cancer and certain lung cancers (non-small cell lung cancer) in patients who cannot have surgery or radiation therapy. It may also be used to treat AIDS-related Kaposi's sarcoma. Taxol may prolong the life of patients with advanced cancer (on average by 3 months in patients with advanced breast cancer). Side effects include reduction in white and red blood cell counts often resulting in infections, hair loss, nausea and vomiting, joint and muscle pain, nerve pain, numbness in the extremeties and diarrhoea. Taxotere (docetaxel) is another compound of special interest isolated from *Taxus*. Phase II/III clinical trials have established this compound as the most active single agent in the treatment of advanced metastatic breast cancer.

The constituents implicated in animal and human poisonings are taxines, alkaloids active on cardiac myocytes, resulting in heart failure and death in some instances.

The heartwood is reddish-brown and clearly distinct from the pale yellowish sapwood.

Botany A dioecious, evergreen, large tree up to 45 m tall, with a bole diameter of over 100 cm; bark thin, smooth, purplish-red, peeling in large flakes. Leaves arranged spirally, but usually twisted into a single plane, simple and entire, linear-lanceolate to linear, 1.5–2.5 cm × 1.5–2 mm, distinctly constricted at base, acute at apex, decurrent. Pollen cones axillary, solitary, small, globular, with a basal cluster of sterile scales. Seed solitary in axil of leaf, with keeled scales at base, flask-shaped, c. 6 mm × 5 mm × 4 mm, covered by a fleshy, bright red aril when ripe.

Seeds germinate readily in moist and shady localities. *T. sumatrana* grows slowly. Seedlings grown



Taxus sumatrana (Miq.) de Laub. – twig with fruit.

in nurseries in Taiwan reached a maximum average height of 57 cm after 3 years. Pollination takes place by wind, whereas seeds are dispersed by birds, which eat the aril.

Taxus comprises about 7 closely related species, and occurs predominantly in temperate regions of the Northern hemisphere; only 1 species reaches highland regions of Malesia. Taxonomic studies of *Taxus* resulted in different classifications, one of them being a single, very widespread species with different subspecies. There are conflicting opinions concerning the taxa occurring in South-East Asia. Three species are recorded for this region: *T. sumatrana*, *T. wallichiana* Zucc. and *T. chinensis* (Pilger) Rehder, the latter 2 occurring in Vietnam. They are all very closely related, possibly conspecific, and more detailed studies are needed to clarify their taxonomy.

Ecology *T. sumatrana* occurs in montane forest and mossy forest at 1400–2300 m altitude, and is locally the dominant canopy species.

Genetic resources *T. sumatrana* has very scattered occurrence and in several regions is considered endangered, e.g. in Taiwan. This is due to its low reproduction rate and its highly valued wood. Its exploitation for taxol has been considered a serious danger to natural *Taxus* populations because of the enormous amounts of material needed and the slow growth rates, but this has been overcome by collecting prunings from cultivated plants and the development of techniques for in-vitro production of active compounds.

Many cultivars are planted as an ornamental in e.g. the United States, Canada and Europe. There is an excellent *Taxus* collection of various cultivars of most species at the Secrest Arboretum in Wooster, Ohio, United States.

Prospects It is unrealistic to expect that Malesian populations of *T. sumatrana* will play a role in the production of taxol or related compounds interesting for drug production. The species is too scarce in the region, cultivation is difficult because of altitudinal requirements, and other means of taxol production are becoming available, e.g. through in-vitro cell culture. Although *T. sumatrana* is an excellent timber tree, its occurrence is too scattered and it grows too slowly to be of future importance.

Literature 118, 247, 484.

Other selected sources 250, 461, 564, 599, 1001, 1046.

F.C. Pitargue

Tecoma stans (L.) Juss. ex Kunth

Humb., Bonpl. & Kunth, Nov. gen. sp. 3: 144 (1819).

BIGNONIACEAE

$2n = 36$

Synonyms *Bignonia stans* L. (1763), *Stenolobium stans* (L.) Seem. (1862).

Vernacular names Yellow bells, trumpet bush (En). Indonesia: tetu lang (Timor), dufa dufa (Ternate). Malaysia: ai funan (Peninsular). Thailand: dok lakhon (northern), thong urai, soi thong (Bangkok). Vietnam: hu[yf]nh li[ee]n.

Origin and geographic distribution *T. stans* is indigenous in the southern United States and Central America, but is widely cultivated as an ornamental in the tropics and subtropics worldwide. It has naturalized in several parts of South-East Asia and the Pacific, and locally become a cumbersome weed, hampering regeneration of the indigenous vegetation.

Uses *T. stans* is a well-known medicinal plant in Central America and official in e.g. the Mexican Pharmacopoeia. A decoction of the leaves is a popular diuretic, and taken to treat gastro-intestinal disorders. It is also credited with antidiabetic properties. A decoction of various plant parts is further taken as a general tonic and to treat gastritis. A decoction of the root is considered a strong diuretic and taken as a treatment for syphilis. In South-East Asia *T. stans* is only planted as an ornamental.

Properties Various parts of *T. stans* are rich in alkaloids. Flavonoids have been found in the flowers, iridoids in the leaves. In a general screening for antimicrobial activity, a methanol extract of leaves was found to be effective against *Candida albicans*. In an experiment to substantiate the traditional use of *T. stans* in Mexican folk medicine to control diabetes mellitus, an extract showed evident hypoglycaemic action in rabbits. Intravenous administration of a *T. stans* infusion in dogs produced an early hyperglycaemic response and arterial hypotension followed by a slow decrease of the glucose blood values. Heart frequency was gradually increased after the first hour of drug administration and persisted for several hours. The effects observed on blood parameters seem to be related to hepatic glycogen metabolism, involving activation of glycogenolysis.

Botany A much-branched shrub up to 4 m tall. Leaves opposite, (1–)3–7(–9)-foliolate; petiole and rachis slender; stipules absent; leaflets ovate-lanceolate, 3–10 cm × 1–4 cm, base acute, apex

acuminate, irregularly serrate, slightly hirsute on midrib and in vein axils beneath, subsessile. Inflorescence an axillary or terminal, few-flowered raceme. Flowers bisexual, 5-merous, faintly scented; pedicel short, irregularly curved or twisted; calyx narrowly cylindrical-campanulate, 5–7 mm long, with subequal teeth, glabrous; corolla narrowly campanulate, 3.5–5 cm long, tube dorsiventrally compressed, lobes orbicular, subequal, bright yellow, with red stripes at the throat; stamens 4, in 2 unequal pairs, included, c. 6 mm long, sterile fifth stamen much reduced; ovary superior, narrowly cylindrical, 2-celled, lepidote, style filiform, glabrous, stigma flat. Fruit a linear, compressed capsule 10–25 cm × 0.5–0.8 cm, smooth, brown when ripe, tardily dehiscent, many-seeded. Seeds oblong, flat, c. 20 mm × 6 mm, with a membranous transparent wing on each end. Seedling with epigeal germination.

T. stans flowers and fruits profusely throughout the year in South-East Asia. The flowers are frequently visited by humming birds and sunbirds.

Tecoma comprises 13 species and occurs naturally almost exclusively from the southern United States to Argentina, but 1 species is indigenous in southern Africa, which is sometimes considered to belong to a segregate genus *Tecomaria*.

Ecology In South-East Asia *T. stans* can be found as a garden escape and naturalized from sea-level up to 1000 m altitude.

Management *T. stans* is easily propagated by seed, suckers or cuttings.

Genetic resources In view of its large natural distribution, its popularity as a garden ornamental and its preference for anthropogenic habitats, *T. stans* is not threatened by genetic erosion.

Prospects Little is known about the pharmacological activities of *T. stans*. Further research is needed to evaluate the potential of the traditional medicinal uses, especially the use for the treatment of diabetes mellitus.

Literature 247, 576, 646, 760, 797.

Other selected sources 94, 386.

Mindarti Harapini

Tetrastigma (Miq.) Planchon

A.DC. & C.DC., Monogr. phan. 5(2): 320, 423 (1887).

VITACEAE

x = unknown; *T. leucostaphylum*: $2n = 44$

Origin and geographic distribution *Tetrastigma* comprises about 100 species and occurs in tropical and subtropical Asia and northern Australia. The Malesian region is richest in species (about 60), followed by Indo-China (about 20) and Thailand (about 15).

Uses Some *Tetrastigma* species are used in traditional medicine in Indonesia and Malaysia, mainly in the form of a leaf poultice to treat pussy inflammations, boils and fever. *Tetrastigma* is also used in traditional medicine in the Philippines and Vietnam, but the identity of the species is uncertain. In the Philippines a plant decoction is taken as a diuretic and applied externally to treat scabies. In Vietnam sap from crushed leaves is used internally as well as externally to treat headache and fever. The fruits of some species are edible, and the stems are occasionally used for binding purposes.

Properties A water extract of *T. planicaule* (Hook.f.) Gagnep. from China inhibited tumour necrosis factor α-induced degradation of NF-κ B, which is related to immune and inflammatory responses.

Daucosterol, 6'-O-benzoyldaucosterol and β-sitosterol have been isolated from the Chinese *T. hemsleyanum* Diels & Gilg.

Botany Large dioecious lianas with terete to flattened stems, conspicuously lenticellate, climbing by usually simple, leaf-opposed tendrils. Leaves alternate, palmately or pedately compound, with up to 7(–11) leaflets, occasionally simple; leaflets usually slightly toothed; stipules caducous. Inflorescence an axillary, umbellate, corymbose or dichotomous cyme, pedunculate. Flowers unisexual, regular, small, 4(–5)-merous; calyx cupuliform to disciform; petals free, reflexed, greenish; disk present; male flowers with free stamens opposite petals and rudimentary ovary; female flowers with superior, 2-celled ovary having a short, thick style and large, 4-lobed stigma, and filiform staminodes. Fruit a pear-shaped to globose berry, 1–4-seeded. Seeds with dorsal side convex and ridged or furrowed, ventral side convex or carinate, endosperm present.

Tetrastigma differs from all other *Vitaceae* genera by its unisexual (dioecious) flowers and its 4-lobed stigma.

Ecology The trailing stems of *Tetrastigma* may be found draping trees and shrubs along roads, river banks and in forest edges, especially at higher altitudes, but also in the lowland. *Tetrastigma* is well known as the exclusive host of the parasitic *Rafflesia* with its spectacular flowers.

Management *Tetrastigma* plants have been successfully propagated by stem cuttings.

Genetic resources Many *Tetrastigma* species are known from few collections in a limited area (e.g. *T. lawsonii*), and these may be liable to genetic erosion. Some other species are widely distributed (e.g. *T. leucostaphylum*) and not threatened. In India types of *T. leucostaphylum* with white patches on the leaves have been discovered, which can be grown in pots as an ornamental.

Prospects Too little is known about the pharmacological properties of *Tetrastigma* to predict its possibilities for future use in phytomedicine. However, its leaves have interesting external applications, which merit further research, e.g. on anti-inflammatory and antimicrobial activities.

Literature 529, 671, 760, 1031, 1054.

Selection of species

Tetrastigma lawsonii (King) Burkill ex Suess.

Engl., Nat. Pflanzenfam. ed. 2, 20d: 325 (1953).

Synonyms *Vitis lawsonii* King (1896).

Vernacular names Malaysia: akar noh papan, akar papan, akar noh kroh (Peninsular).

Distribution Western Peninsular Malaysia.

Uses A leaf poultice is applied to the body to treat fever. The fruits are edible.

Observations A liana with flattened stems up to 3 cm wide; leaves 3-foliolate, terminal leaflet elliptical to lanceolate, 10.5–14 cm × 5–6 cm, decurrent at base; female flowers with pointed and glabrous stigma lobes; fruit globose, 1.5–2 cm in diameter. *T. lawsonii* occurs at edges of lowland dipterocarp forest.

Selected sources 121, 529.

Tetrastigma leucostaphylum (Dennst.) Alston ex Mabb.

Taxon 26: 539 (1977).

Synonyms *Vitis lanceolaria* (Roxb.) Wallich (1834), *Tetrastigma lanceolarium* (Roxb.) Planchon (1887), *Tetrastigma kunstleri* (King) Craib (1926).

Vernacular names Indonesia: areuy ki barera (Sundanese), bantengan, oyod gepeng (Javanese). Malaysia: akar chabang limah, kankong gajah, akar papan (Peninsular). Thailand: khruea khao nam (Phrae).

Distribution Bhutan, India, Burma (Myanmar), Indo-China, Thailand and western Malesia (at least Peninsular Malaysia and Java, probably also elsewhere).

Uses In Java a leaf poultice is applied to pussy inflammations, and the juice is taken to treat cough. In Peninsular Malaysia a leaf poultice is applied to boils and in cases of ague.

Observations A large liana with flattened stems up to 11 cm wide; leaves 3–7-foliolate, terminal leaflet lanceolate, 13.5–21 cm × 4–9.5 cm, acute at base; female flowers with rounded and ciliolate stigma lobes; fruit globose, 1.5–2 cm in diameter. *T. leucostaphylum* occurs at edges of lowland and hill dipterocarp forest, sometimes also in brushwood. It is locally common.

Selected sources 121, 334, 529, 845.

R.H.M.J. Lemmens

Tiliacora triandra (Colebr.) Diels

Engl., Pflanzenr., Heft 46 (IV 94): 62 (1910).

MENISPERMACEAE

$2n$ = unknown

Synonyms *Cocculus triandrus* Colebr. (1822), *Limacia triandra* (Colebr.) Hook.f. & Thomson (1855).

Vernacular names Malaysia: akar kunyit-kunyit, berkunyit, akar kusin (Peninsular). Thailand: choi nang (northern), thao wan khieo (central), yat nang (peninsular). Vietnam: xanh tam.

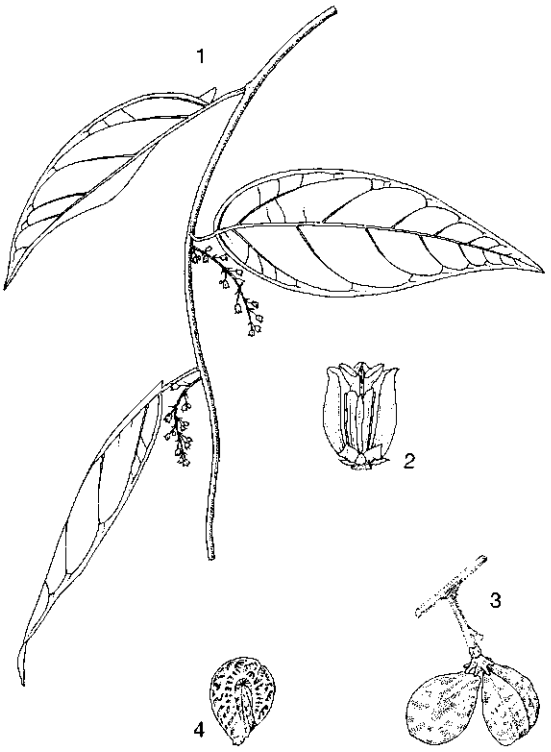
Origin and geographic distribution *T. triandra* occurs in India (Assam), southern Burma (Myanmar), Indo-China, Thailand and Peninsular Malaysia.

Uses In Thailand aerial parts of *T. triandra* are widely used as an antipyretic. In Cambodia the leafy shoots enter into a prescription for the treatment of dysentery. They are also used as a flavouring in cooking in Thailand. In Indo-China the flexible stems are used for rough cordage, thatching and basketry.

T. acuminata (Lamk) Hook.f. & Thomson, an Indian-Burmese species, appreciated for its ornamental foliage and fragrant flowers and mentioned as a remedy for snakebites, is cultivated in the botanical garden in Bogor, Indonesia.

Properties More than 15 alkaloids have been identified from *T. triandra* including the bisbenzylisoquinolines tiliacorinine, nortiliacorinine and tiliacorine. These alkaloids act as cardiac and respiratory poisons when injected into frogs. A crude ethanol extract of *T. triandra* leaves showed strong antifeedant activity against the green leafhopper *Nephotettix virescens*. A methanol extract of roots exhibited antimalarial activity in vitro.

An ethanol extract of *T. acuminata* showed strong



Tiliacora triandra (Colebr.) Diels – 1, flowering branch of male plant; 2, male flower with front inner sepal removed; 3, fruit; 4, endocarp.

antibacterial activity. Tiliacorinine isolated from a crude extract showed promising antifungal activity against *Alternaria tenuissima*, a causal agent of leaf blight in pigeon pea (*Cajanus cajan* (L.) Millsp.).

Botany A dioecious liana with puberulous to glabrous and striate stems. Leaves alternate, simple and entire, elliptical, lanceolate or sometimes subovate, 6.5–11(–17) cm × 2–4(–8.5) cm, base cuneate to rounded, apex usually acuminate, with 3–5 basal veins and 2–6 pairs of lateral veins; petiole 0.5–2 cm long; stipules absent. Inflorescence an axillary or cauliflorous pseudo-raceme, up to 2–8(–17) cm long, composed of 1–few-flowered peduncled cymes. Flowers unisexual, yellowish; sepals 6–12, the outermost smallest, innermost up to 2 mm long; male flowers with 3 or 6 petals c. 1 mm long and 3 stamens; female flowers with 6 petals c. 1 mm long and 8–9 carpels inserted on a gynophore. Fruit consisting of several drupes borne on a branched carpophore; drupes obovoid, 7–10 mm × 6–7 mm, red, glabrous, endocarp transversely and irregularly ridged.

In Indo-China *T. triandra* can be found flowering and fruiting throughout the year, but in Thailand from December–July only. As in other *Menispermaceae*, the pollinators are probably small insects, which are undoubtedly attracted by the scent of the flowers.

Tiliacora consists of 19 species in Africa, 2 in tropical Asia and 1 in Australia.

Ecology *T. triandra* occurs in forest and scrub vegetation up to 1300 m altitude. It is found on rocky or clayey soils, and also on limestone hills.

Genetic resources Although relatively widespread and locally common in old forest clearings in Thailand, *T. triandra* is largely confined to lowland forest. Therefore, it may be liable to genetic erosion.

Prospects Little is known about the pharmacological activities of *Tiliacora* in comparison with other *Menispermaceae*. Since many bisbenzylisoquinoline alkaloids show interesting activities, further research on *T. triandra* is desirable to judge its full potential as a medicinal plant, also for the Malesian region.

Literature 121, 247, 514, 712, 713, 723, 864.
Other selected sources 181, 249, 253.

Wongsatit Chuakul,
Noppamas Soonthornchareonnon
& Orawan Ruangsomboon

Tournefortia L.

Sp. pl. 1: 140 (1753); Gen. pl. ed. 5: 68 (1754).
BORAGINACEAE
x = unknown

Origin and geographic distribution *Tournefortia* comprises about 150 species, the majority of which are native to the American tropics, but about 15 species occur in the Old World. In the Malesian region 7 species are found.

Uses Leaves, and occasionally roots, of *T. sarmentosa* are used in traditional medicine in the Philippines and Papua New Guinea to treat various complaints, externally as well as internally. Leaves of *T. argentea* are used in Vietnam and New Caledonia as a poison antidote; they are eaten as a vegetable, and smoked like tobacco.

In Indo-China the leaves of *T. montana* Lour. are used as a febrifuge. The roots are employed in complex preparations as a remedy for tuberculosis with haemoptysis, and to treat rheumatism.

Properties The efficacy of *T. argentea* leaf extracts, used traditionally in New Caledonia to treat ciguatera fish poisoning, has been demon-

strated in an experiment. Ciguatoxins produced by a dinoflagellate and transferred by fish are responsible for this type of poisoning. Leaf extracts of *T. argentea* counteract the neurocellular effects of the toxin, and have beneficial action on the characteristic gastro-intestinal and neurological disturbances. Several pyrrolizidine alkaloids have been isolated from *T. argentea* twigs.

Several phenolic compounds, including salicylic acid and tournefolin A–C, have been isolated from *T. sarmentosa* stems.

Antihyperglycaemic effects have been demonstrated for *T. hirsutissima* L., which is used in traditional medicine in Mexico to treat diabetes mellitus.

Botany Herbs, shrubs, lianas or small trees. Leaves usually alternate, sometimes opposite, simple and entire, petiolate; stipules absent. Inflorescence terminal or lateral, usually dichotomously branched and composed of unilateral cymes without bracts. Flowers bisexual, regular, (4–)5-merous; calyx shortly to deeply lobed; corolla with a short or elongate, cylindrical to campanulate tube and spreading lobes; stamens alternating with corolla lobes, included, with very short filaments; ovary superior, style almost lacking. Fruit a drupe with juicy or corky mesocarp, endocarp breaking up into two 2-seeded or four 1-seeded pyrenes.

The corky tissue in the fruits of *T. argentea* is an adaptation to dispersal by water. *Tournefortia* species with corky endocarp are often placed in a separate genus *Argusia*.

Ecology *T. sarmentosa* prefers dry areas and is often found in thickets, whereas *T. argentea* occurs in coastal habitats such as sandy beaches. Several other Malesian species are often found along rivers, some in mountains.

Genetic resources Both *Tournefortia* species treated here are widespread and not in danger of genetic erosion. However, some other *Tournefortia* species are only known from a few collections in Malesia.

Prospects Although very little is known about the phytochemistry and pharmacological activities of *Tournefortia*, the few tests available from different parts of the world generate clues on the efficacy of extracts used in traditional medicine. This makes research in South-East Asia interesting.

Literature 30, 81, 247, 732, 760.

Selection of species

Tournefortia argentea L.f.

Suppl. pl.: 133 (1782).

Synonyms *Messerschmidia argentea* (L.f.) I.M. Johnst. (1935), *Argusia argentea* (L.f.) Heine (1976).

Vernacular names Velvet leaf (En). Indonesia: babakoan (Sundanese), karpo (Ternate), moral babulu (Ambon). Philippines: kapal-kapal (Tagalog), salakapo (Ilocano), bukabuk (Bisaya). Vietnam: b[aj]c bi[eer]n, phong ba.

Distribution Eastern Africa, Madagascar, Sri Lanka, Vietnam, Hainan, Taiwan, the Ryukyu Islands, throughout Malesia (except Peninsular Malaysia), northern Australia, Polynesia and New Caledonia.

Uses In Vietnam the leaves are used as an antidote against bites of sea snakes. In New Caledonia a leaf extract is used in traditional medicine to treat fish poisoning. Leaves are eaten raw as a vegetable. They are also dried and smoked like tobacco.

Observations A shrub or small tree up to 10 m tall; branches densely greyish-white hairy; leaves oblanceolate to obovate, 10–20 cm × 3–8 cm; flowers with corolla 3–4 mm long and 4–7 mm in diameter, white to pinkish-white; fruit depressed-globose, 5–8 mm in diameter, with spongy wall. *T. argentea* occurs along the coast, often on sandy beaches.

Selected sources 62, 81, 121, 247, 692, 853, 877, 1013.

Tournefortia sarmentosa Lamk

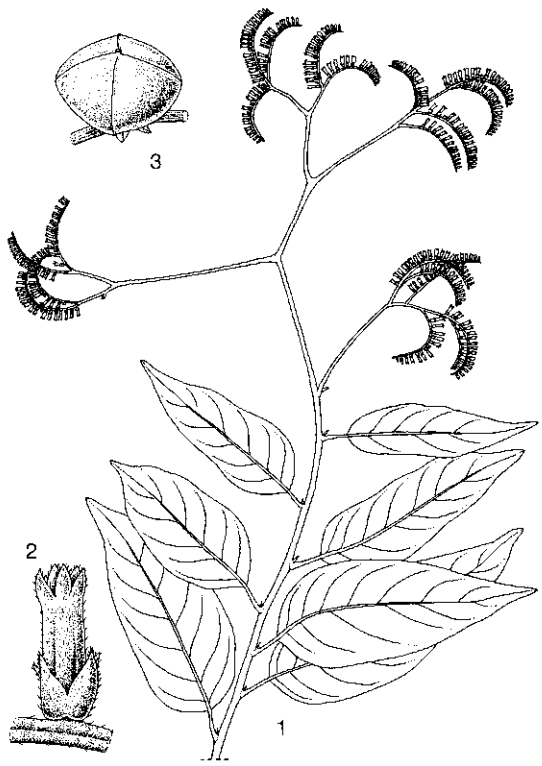
Tabl. encycl. 2(1): 416 (1792).

Vernacular names Papua New Guinea: kapu (Hula, Central Province), kisikiri (Gaikorovi, East Sepik Province). Philippines: salakapo (Iloko), patayud (Bisaya), tanara-daganan (Bikol). Vietnam: b[oj] c[aj]p tr[uw][owf]n.

Distribution Vietnam, Taiwan, throughout the Malesian region and northern Australia (Queensland).

Uses In the Philippines a decoction of the roots is given internally after childbirth, to hasten the expulsion of the placenta. The leaves are applied as a poultice to the forehead to treat headache. In veterinary medicine, the leaves are employed to kill maggots in ulcers of cattle. In Papua New Guinea the leaves are chewed by people suffering from malaria. They are also chewed, or eaten mixed with food, to give relief in stomach-ache.

Observations A creeper or liana; young



Tournefortia sarmentosa Lamk – 1, flowering branch; 2, flower; 3, fruit.

branches densely brown hairy; leaves oblong-lanceolate to ovate-lanceolate, 4–15 cm × 2–7 cm; flowers with corolla 6–10 mm long and 4 mm in diameter; fruit depressed ovoid-subglobose, c. 5 mm in diameter, with fleshy wall. *T. sarmentosa* occurs in secondary forest and thickets at low elevations, especially in dry localities near the sea.

Selected sources 62, 121, 247, 347, 349, 351, 354, 569, 731, 760, 1013.

N.O. Aguilar

Toxocarpus villosus (Blume) Decne.

DC., Prodr. 8: 506 (1844).
ASCLEPIADACEAE
$2n$ = unknown
Synonyms *Secamone villosa* Blume (1826).
Vernacular names Indonesia: serut rambat (Javanese). Laos: mok khan ngue. Thailand: thao wan daeng (Ratchaburi), khruea sut (Loei), khruea ma taek (northern). Vietnam: d[aa]y g[as]o v[af]ng, ti[eex]u qu[ar] l[oo]ng.
Origin and geographic distribution *T. villosus* occurs in Indo-China, southern China, Thailand and Java.
Uses Leafy twigs of *T. villosus* are used to treat sprue in Java. In Vietnam an extract of whole plants is administered to treat rheumatism, oedema, jaundice and as a diuretic. All parts of *T. wightianus* Hook. & Arnott are used externally in China to treat traumatic injury and boils.
Botany A liana up to 10 m long, rusty villous especially on young parts; white latex present. Leaves opposite, simple and entire, orbicular to elliptical-oblong, (2.5–)4.5–12 cm × (1.5–)2–7 cm, acute or apiculate at apex, usually thinly leathery, densely rusty villous below, venation pinnate with 6–8 pairs of lateral veins; petiole 0.5–1.5 cm long; stipules absent. Inflorescence an axillary umbel-like cyme, irregularly dichotomous, rusty villous; peduncle up to 10 cm long. Flowers bisexual, regular, 5-merous, fragrant; pedicel c. 2 mm long; sepals oblong-lanceolate, c. 3 mm long; corolla subrotate, with short tube and oblong-lanceolate lobes c. 1 cm long and overlapping to the left in bud, villous at base, yellowish; corona lobes inserted at back of gynostegium, with subulate tips overtopping anthers; stamens inserted at base of corolla, connate at base, anthers small, retuse, appressed to the stigma head, without apical membrane, pollinia 4 on each pollinarium; ovaries 2, free, superior, 1-celled, stigma head beaked, longer than anthers. Fruit consisting of 1–2 divaricate, subcylindrical follicles up to 18 cm long, villous, many-seeded. Seeds flat, c. 10 mm × 2 mm, comose.
Toxocarpus comprises about 40 species and occurs in Africa, tropical Asia, northern Australia and on islands in the Pacific Ocean. Tropical Asia is by far the richest in species. *Toxocarpus* is closely related to *Secamone* and sometimes combined with that genus.
Ecology *T. villosus* occurs in open mixed forest, brushwood, hedges and bamboo forest in the lowland, in China also in montane forest up to 1500 m altitude.
Genetic resources *T. villosus* does not seem to be in danger of genetic erosion; it is fairly widespread and also occurs in anthropogenic habitats.
Prospects At present the value of *T. villosus* as a medicinal plant in the Malesian region is very limited. However, based on medicinal applications in Vietnam, it may have prospects, but research on phytochemistry and pharmacological activities is a prerequisite. The taxonomy of *Toxocarpus* and related genera is still in need of review.
Literature 62, 334, 971.

Other selected sources 1013.

Tran Dinh Ly & Tran The Bach

Trapa natans L.

Sp. pl. 1: 120 (1753).

TRAPACEAE

$2n = 48, 96$

Synonyms *Trapa bicornis* Osbeck (1757), *Trapa cochinchinensis* Lour. (1790), *Trapa bispinosa* Roxb. (1815).

Vernacular names Water chestnut, water caltrop, Singhara nut (En). Indonesia: lengkat, lengkong, salaikat (Jakarta, Java). Cambodia: krachap. Thailand: kra chap (central), khao khwaai (northern), ma ngaeng (Chiang Rai). Vietnam: c[ur] [aas]u, [aas]u n[uw][ows]c.

Origin and geographic distribution *T. natans* occurs in southern Europe, Africa and temperate, subtropical and tropical Asia. It is rare in the Malesian region, known only from southern Sumatra and western Java, where it was possibly introduced by Chinese people. It is cultivated in India, Indo-China and southern China, mainly for its edible fruits.

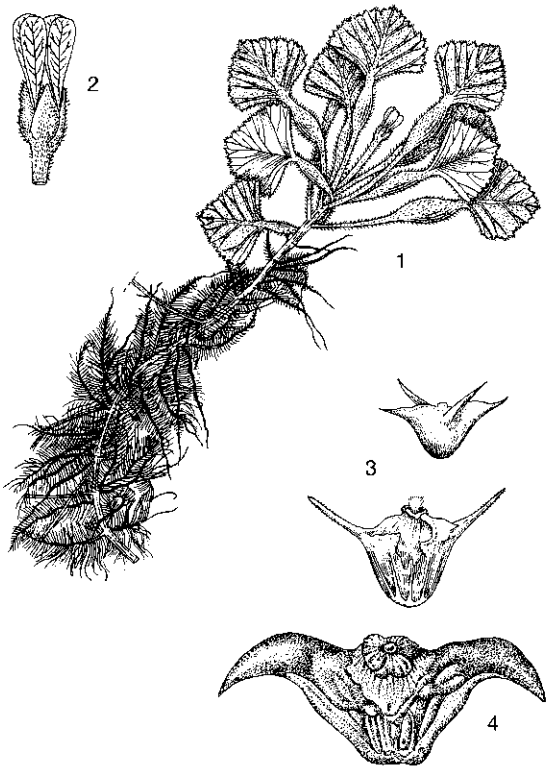
Uses In Vietnam and Cambodia a decoction or infusion of the fruits is used in traditional medicine to treat fever and headache, and as a tonic. In China the fruits are additionally used as a thirst quencher and to treat sunstroke. They are considered to be tonic and to heal stomach cancer in Japan.

The fruits are faintly sweet and eaten as a delicacy after being cooked. They should not be confused with the tubers of Chinese water chestnut (*Eleocharis dulcis* (Burm.f.) Trinius ex Henschel), which are commonly used in stir-fried Chinese dishes. In Indo-China flour is prepared from the seeds, which is sweetened with sugar and honey and made into pastry. *T. natans* is also used as an ornamental aquatic plant. It is reputed for its ability to absorb large amounts of toxic metals from polluted water.

Properties Extracts of *T. natans* fruits showed distinct antimicrobial activity against gram-positive and gram-negative bacteria, and also significant cytotoxic activity, e.g. against HeLa cells in vitro. Gallic acid was isolated as a cytotoxic constituent. In tests, an extract also inhibited glycosyl transferase, thus preventing the formation of dental plaque, and it showed distinct activity against several plant viruses. A screening showed that *T. natans* may be a potential source of antioxidants. Several tannins have been isolated from *T. natans* leaves.

Per 100 g dry weight, fruits contain up to 70 g starch, about 10 g protein, 7 g sugar, 0.5 g fat and 0.7 g fibre. The starch is suitable for uses as tablet disintegrant in pharmaceuticals. The fruits can be eaten raw, but this is not recommended as they may contain parasites, particularly flukes, from contaminated water.

Botany An annual, aquatic, floating herb with slender main axis up to 4 m long, branched or not; adventitious roots developing from leaf scars of submerged leaves, with many filiform segments. Leaves dimorphic; submerged ones opposite, linear, entire, sessile, caducous; floating ones alternate, in rosettes, rhombic to deltoid, (1–)3–7 cm × (1–)4–9 cm, the upper margins dentate, glabrous to hairy beneath, petiole 6–21 cm long, spongy and more or less inflated about the middle; stipules small, scarious, divided to the base. Flowers solitary in axils of upper leaves, bisexual, regular, 4-merous, pedicelled; sepals lanceolate to narrowly triangular, 4–7 mm long; petals free, oblanceolate



Trapa natans L. – 1, habit of flowering plant; 2, flower; 3, different types of fruits; 4, fruit as found on the market.

to obovate, 8–16 mm long, white; stamens inserted at the base of the ovary; disk surrounding the ovary, crenulate; ovary half-inferior, 2-celled, style with capitate stigma. Fruit a top-shaped drupe up to 3 cm wide and long, pericarp blackish, soon disappearing, endocarp hard, very variably 2–4-horned, 1-seeded. Seed with woody testa; cotyledons very unequal, 1 almost vestigial.

A single seed may give rise to 10–15 rosettes of floating leaves, and each rosette may produce up to 20 fruits. The fruits fall to the bottom of the water, and the seeds may remain viable for up to 12 years. This all contributes to the large growing-power of *T. natans* under suitable conditions.

Trapa is the only genus of the *Trapaceae*, but has often been included in the *Onagraceae*. The number of species in the genus is still under debate; some botanists maintain up to 30 species, but most recognize only a few or even only one polymorphic species (then usually a number of varieties is distinguished). This latter view is followed here. The fruit is most variable, especially the number and shape of its horns. Many fossil species have been described.

Ecology *T. natans* occurs in ponds and swamps with slowly flowing or stagnant, eutrophic water in lowland areas, where it roots in soft mud. It cannot stand brackish or acid water. *T. natans* is best grown in shallow ponds, which hold water throughout the year; it requires full sun.

Management *T. natans* is commercially cultivated in China and India, where maximum yields of 4–5 t of fruits per ha have been obtained. It is propagated by seeds, but in China stem segments and axillary buds have been cultured successfully on a half-strength Murashige and Skoog medium supplemented with growth hormones. Blight caused by *Sclerotium rolfsii* is the major disease in China, and the beetle *Galerucella birmanica* is the most serious pest in Asia.

T. natans is considered a serious weed in some regions, e.g. in the eastern United States, where it clogs waterways locally and where special control programmes exist.

Genetic resources *T. natans* is found only very locally in the Malesian region, mainly in Java, and it is not clear whether it only descends from cultivation or also occurs naturally in this region. In view of its enormous variability worldwide, there is ample scope for evaluating the genetic resources and possible breeding activities.

Prospects Both the nutritious fruits and their medicinal properties seem to justify more research on more intensive utilization of *T. natans* in the Malesian region. Efforts to cultivate this plant resource should take into account the potential danger of it becoming a serious weed.

Literature 247, 334, 504, 671, 764.

Other selected sources 121, 250, 966.

Rosna Mat Taha

Trevesia burckii Boerl.

Ann. Jard. Bot. Buitenzorg 6: 110 (1887).

ARALIACEAE

$2n$ = unknown

Synonyms *Trevesia cheirantha* (C.B. Clarke) O. Kuntze (1891).

Vernacular names Ghost's foot (En). Malaysia: tapak harimau, daun tapak badak, tapak itek (Peninsular).

Origin and geographic distribution *T. burckii* occurs in peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo (West Kalimantan, Sarawak).

Uses In Peninsular Malaysia the leaves are used for poulticing small sores, skin complaints in general, fractured bones, and, combined with rubbing, to treat rheumatism, ague and fever. Mention is further made of a decoction of root bark and leaves drunk as a tonic with aphrodisiac properties.

In Java the leaves of *T. sundaica* Miq. are an ingredient of traditional 'jamus'. *T. palmata* (Roxb. ex Lindley) Vis., a species of the seasonally more or less dry climatic core of continental South-East Asia, is used in Indian folk medicine as a general tonic. In Thailand the young flowers of *T. palmata* are used as an appetizer. The young inflorescences of *Trevesia* are eaten as a cooked vegetable.

Properties There is no information on the phytochemistry or pharmacological activities of *T. burckii*, but some information is available on *T. palmata*. A crude saponin fraction of *T. palmata* leaves as well as several purified saponins and prosapogenins showed antiproliferative activity in 3 cultured cell lines (J774 murine monocyte-macrophage, HEK-293 human epithelial kidney, WEHI-164 murine fibrosarcoma). Similar bisdesmosidic saponins have been isolated from the leaves and flowers of *T. sundaica*.

Botany A shrub or small tree up to 10 m tall; branches upright to somewhat reclining, with scattered stout spines. Leaves alternate, crowded at the end of branches, palmately lobed, but seemingly digitately compound, more or less circular in outline, up to 60 cm across; lobes 7–9, lanceolate-

oblong to obovate, up to 36 cm × 15 cm, base cuneate to rounded, apex acuminate, margin serrate in the upper part; petiole 20–50 cm long; stipules ligulate. Inflorescence a terminal or lateral panicle up to 60 cm long, consisting of 6–12 secondary branches ending in 30–50-flowered umbellules, and with a terminal umbel of branches; bracts triangular, persistent. Flowers bisexual, regular, 7–10-merous; pedicel slender; calyx an irregular rim; corolla consisting of fused petals falling as a calyptra; stamens with short filaments; disk flattened-conical; ovary inferior, broadly obconical, 7–10-celled, styles united, stigmas slightly swollen. Fruit drupe-like, globose, apically conical, up to 2 cm in diameter; pyrenes compressed.

The fruits are probably eaten by birds and bats, which may serve as seed dispersers. *Trevesia* consists of 7 species and is found from India to Indo-China, southern China, Thailand and western Malesia, east to Java, the Lesser Sunda Islands (Bali, Lombok) and Borneo (West Kalimantan, Sarawak). *T. burckii* has often been confused with *T. palmata*, but the two species are geographically well isolated.

Ecology *T. burckii* is an understorey tree of evergreen rain forest, from sea-level up to 900 m altitude.

Genetic resources *T. burckii* is relatively widespread and locally common in humid, shady localities. It does not appear to be threatened by genetic erosion.

Prospects Little is known about the pharmacology of *Trevesia*. Further research is needed to evaluate the potential of the traditional medicinal uses of *T. burckii*.

Literature 121, 201, 202, 334, 424.

Other selected sources 173, 178, 247, 731.

J.L.C.H. van Valkenburg

Trichodesma R.Br.

Prodr.: 496 (1810).

BORAGINACEAE

x = 7, 11, 12; *T. indicum*: $2n$ = 22, 44, *T. zeylanicum*: $2n$ = 24

Origin and geographic distribution *Trichodesma* consists of some 40 species and is found in subtropical and tropical regions of Africa, Asia and Australia; in Malesia 2 species occur.

Uses In South-East Asia *Trichodesma* species are used indiscriminately as a sudorific and pectoral, as a substitute for *Borago officinalis* L. In India and Africa the leaves are credited with emollient, demulcent and diuretic properties, and the roots are used as an antidote.

T. africanum (L.) Lehm. is employed in traditional medicine in Africa; the leaves are used as a diuretic, to treat diarrhoea, and as an antifebrile and anti-inflammatory, the roots to treat hepatitis.

Properties Pyrrolizidine alkaloids were isolated from *T. zeylanicum* seeds, mainly supinine. These compounds also occur in other *Boraginaceae*, e.g. *Borago officinalis*, *Cynoglossum* and *Symphytum* species, and this may explain similar properties and uses. Ricinoleic acid and cyclopropene acid were found in *T. zeylanicum* seed oil. Chohexacosa-21,24-dienoic acid ethyl ester, n-hexacosanoic acid ethyl ester and hexacosanoic acid ethyl ester were isolated from *T. indicum* leaves. The alkaloid trichodesmine and 2 saponins have been isolated from *T. africanum*.

Botany Annual or perennial herbs, sometimes suffrutescent. Leaves alternate or opposite, simple and entire, sessile or petiolate; stipules absent. Inflorescence a terminal loose cyme, often many-flowered, often with leafy bracts. Flowers bisexual, regular, 5-merous, pedicelled; calyx with lobes free to the base or partly united, strongly accrescent; corolla rotate to funnel-shaped, with a short tube and long-acuminate lobes, without scales in the throat; stamens inserted in the corolla tube, anthers subsessile, with long sterile awns that are twisted round each other; ovary superior, not divided in flower, style filiform, stigma small, globose. Fruit consisting of 4 pyrenes, ovoid, triquetrous or nearly globose, smooth or rugose.

The flowers of *T. indicum* are protandrous and functional for 3 days; pollination is effected by insects.

Trichodesma belongs to the tribe *Cynoglosseae*, together with e.g. *Cynoglossum*.

Ecology *Trichodesma* prefers dry open habitats at low elevations.

Genetic resources The Malesian *Trichodesma* species occur in disturbed habitats and are widely distributed, and therefore not in danger of genetic erosion.

Prospects Further research is needed to evaluate the potential of the traditional medicinal uses of *Trichodesma*. Since pyrrolizidine alkaloids are not without long-term toxic effects, an evaluation of these effects should also be included.

Literature 120, 181, 247, 731, 760.

Selection of species

Trichodesma indicum (L.) J.E. Smith

Rees, Cyclop. 36, 1: No 1 (1817).

Synonyms *Borago indica* L. (1753).

Vernacular names Thailand: phak phaeo (Lamphun), phak phaeo khaao (Kanchanaburi).

Distribution The Mascarene Islands, Afghanistan, Pakistan, India, Burma (Myanmar), Thailand and the Philippines (Luzon); introduced in eastern Africa.

Uses In the Philippines the flowers are used as a sudorific and pectoral, as a substitute for *Borago officinalis*. In Thailand roots are used to treat cough and indigestion. In India the leaves and roots are esteemed as a remedy for snakebites, leucorrhoea and cough, and are also considered diuretic. *T. indicum* is prescribed in Ayurvedic medicine for the expulsion of a dead foetus. An infusion of the leaves is considered depurative. The leaves are used as an emollient poultice, and a paste made from the root is applied to swellings. The root is used to treat dysentery and fever.

Observations An annual herb up to 40 cm tall, much-branched; leaves oblong-lanceolate, lower leaves 5–8 cm × 0.8–2.2 cm, base narrow, upper leaves 2–4.5 cm × 0.3–1.2 cm, base broadly rounded to semi-amplexicaul; flowers with calyx c. 1 cm long, accrescent to 1.3 cm in fruit, cleft to the base into narrowly triangular lobes, sagittate at base, corolla funnel-shaped, lilac, tube c. 5 mm long, limb 1.3–1.5 cm in diameter; pyrenes oblong-ovoid, 5 mm × 2–3 mm, smooth, whitish. In the Philippines *T. indicum* occurs as a weed in fields, especially of groundnut at low elevations.

Selected sources 181, 247, 322, 731, 760.

Trichodesma zeylanicum (Burm.f.) R.Br.

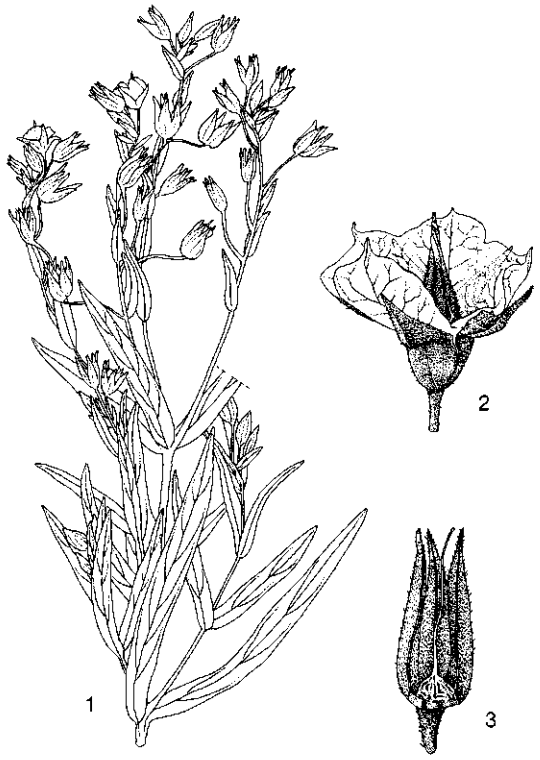
Prodr.: 496 (1810).

Synonyms *Borago zeylanica* Burm.f. (1768), *Trichodesma sericeum* Lindley (1848).

Vernacular names Philippines: dilang-usa, mabulo, sigang-dagat (Tagalog). Vietnam: mao ty t[is]ch lan.

Distribution Eastern and north-eastern Africa, islands of the Indian Ocean, India, Sri Lanka, Vietnam, Java, the Lesser Sunda Islands, the Philippines (Luzon), New Guinea and Australia.

Uses In the Philippines the flowers are used as a sudorific and pectoral, as a substitute for *Borago officinalis*. In India the leaves are credited with emollient, demulcent and diuretic properties, and are used as a poultice. In eastern Africa, roots are used to treat snakebites, and a root decoction is taken to treat tuberculosis.



Trichodesma zeylanicum (Burm.f.) R.Br. – 1, part of flowering plant; 2, flower; 3, fruit in calyx.

Observations An annual or short-lived perennial herb up to 175 cm tall, much-branched; leaves oblong-lanceolate to narrowly linear-lanceolate, lower leaves 6–12(–16) cm × (0.2–)1–3(–5.5) cm, shortly petioled or tapering towards the base, upper leaves 3–6 cm × 0.2–1.5 cm, base narrow; flowers with calyx (1.2–)1.5–1.8 cm long, accrescent to 2 cm in fruit, cleft to the base into long acute lobes, truncate at base, corolla funnel-shaped, bluish with 5 red dots, or violet, pink, or white, tube c. 8 mm long, limb 1.5–2(–2.5) cm in diameter; pyrenes ovoid, c. 5 mm × 2 mm, smooth, shining, brown. *T. zeylanicum* is found as a weed in fields, thickets, waste land, and roadsides at low elevations. Two varieties are distinguished; var. *sericeum* (Lindl.) Benth., with narrow sericeous leaves, is confined in Malesia to the Lesser Sunda Islands.

Selected sources 62, 181, 247, 331, 367, 499, 731, 760.

N.O. Aguilar

Trigonostemon Blume

Bijdr. fl. Ned. Ind.: 600 (1826; 'Trigostemon').
EUPHORBIACEAE
x = unknown

Origin and geographic distribution *Trigonostemon* comprises about 40 species and occurs in eastern India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, Thailand, throughout the Malesian region, and New Caledonia. Borneo and the Philippines are richest in species (about 16 each), followed by Thailand and Peninsular Malaysia (about 13 each), and Sumatra (about 10). Java (3) and central Malesia and New Guinea (2 each) are poor in species. One species occurs in New Caledonia.

Uses There is a record from Peninsular Malaysia of the roots of *T. longifolius* being used to treat stings. Extracts of the roots of *T. reidioides* are used traditionally in Thailand as an expectorant and a laxative, and in the treatment of skin diseases. The wood of some *Trigonostemon* species is used in house and boat building, but the size of the bole is insufficient to be really useful.

Properties An aromatic ketone, the phenanthrenone trigonostemone, was isolated from *T. reidioides* roots. Rediocide A, a highly modified daphnane with potent insecticidal activity, was also isolated from the roots. The presence of phorbol esters was detected in a crude organic extract of *T. viridissimus* (Kurz) Airy Shaw (synonym: *T. sumatranus* Pax & Hoffm.) using a phorbol dibutyrate receptor binding assay. In general, phorbol esters are well known for their strong skin-irritant and tumour-promoting activities, although some compounds exhibit anti-tumour and in-vitro anti-human immunodeficiency virus (HIV) effects.

Botany Monoecious shrubs or small trees. Leaves alternate or subopposite, simple, entire or denticulate, pinnately veined, often 3-veined from the base, shortly to distinctly petiolate; stipules mostly minute and subulate or obsolete. Inflorescence axillary or terminal, occasionally cauliflorous, variously cymose, thyrsiform or apparently racemose, often with conspicuous bracts. Flowers unisexual, 5-merous; sepals very shortly connate, imbricate; petals free, mostly exceeding the sepals, often brightly coloured (often blackish-crimson); disk glands free or variously united; male flowers with 3 or 5 stamens, filaments connate or free; female flowers with a superior, 3-celled ovary, styles simple or 1–2-bifid, spreading. Fruit a tricoccous capsule, smooth or verruculose, few-seeded. Seeds trigonous-ovoid.

Ecology Most *Trigonostemon* species occur in lowland evergreen forest, e.g. *T. longifolius*. *T. reidioides* is found in open, dry deciduous forest.

Genetic resources The two *Trigonostemon* species treated here are fairly widespread and common, and there is no reason to consider them as threatened. Several other *Trigonostemon* species appear to be restricted to small regions and habitats under much pressure, such as lowland primary rain forest, and are consequently liable to genetic erosion.

Prospects The common use of *T. reidioides* in traditional medicine in Thailand deserves more attention in research. The presence of phorbol esters in *Trigonostemon* may be of future importance in medicinal research.

Literature 85, 121, 173.

Selection of species

Trigonostemon longifolius Baillon

Étude Euphorb.: 341 (1858).

Vernacular names Malaysia: mentua pelandok besar, gadu gajah, cha antan besar (Peninsular). Thailand: thao yaai mom paa, aai baao (Pattani).

Distribution Burma (Myanmar), the Andaman Islands, peninsular Thailand, Peninsular Malaysia, Singapore and Sumatra.

Uses In Peninsular Malaysia the root juice is rubbed on bee and jellyfish stings. In the Andaman Islands the leaves have been rubbed on the body to treat fever.

Observations A shrub or small tree up to 5 m tall; leaves alternate, obovate to spatulate-oblanceolate, 10–55 cm long, base long-attenuate into a short stout petiole, obscurely or manifestly crenate or dentate, glabrous; petals blackish-crimson; fruit 10–12 mm in diameter, golden scurfy. *T. longifolius* is locally common in evergreen forest up to 600 m altitude.

Selected sources 19, 22, 121, 990.

Trigonostemon reidioides (Kurz) Craib

Bull. Misc. Inf. Kew: 464 (1911).

Vernacular names Thailand: naat kham (northern), lot thanong (Ratchaburi, Prachin Buri, Trat), khaao yen noen (Ratchaburi, Prachuap Khiri Khan). Vietnam: tin tranh.

Distribution Burma (Myanmar), Indo-China and Thailand.

Uses In Thailand the roots are used in traditional medicine for many complaints. They are

used internally as a laxative, as an emetic to treat food poisoning and to treat dysentery, and externally to treat abscesses, sprains, swellings, bruises and snakebites. They are also used for birth control.

Observations A small shrub up to 1.5 m tall; leaves alternate, narrowly to broadly oblong or oblanceolate, 4–12 cm long, entire, densely tomentellous below, densely reticulately veined; petals very variable in colour, from white to pink, purple or almost black; fruit c. 12 mm in diameter, tomentose. *T. reidioides* is common on sandy locations in open, dry deciduous forest, often teak forest, up to 450 m altitude.

Selected sources 19, 173, 416, 498.

Umi Kalsom Yusuf

Tropidia curculigoides Lindley

Gen. sp. orchid. pl.: 497 (1840).
ORCHIDACEAE
$2n = 60$

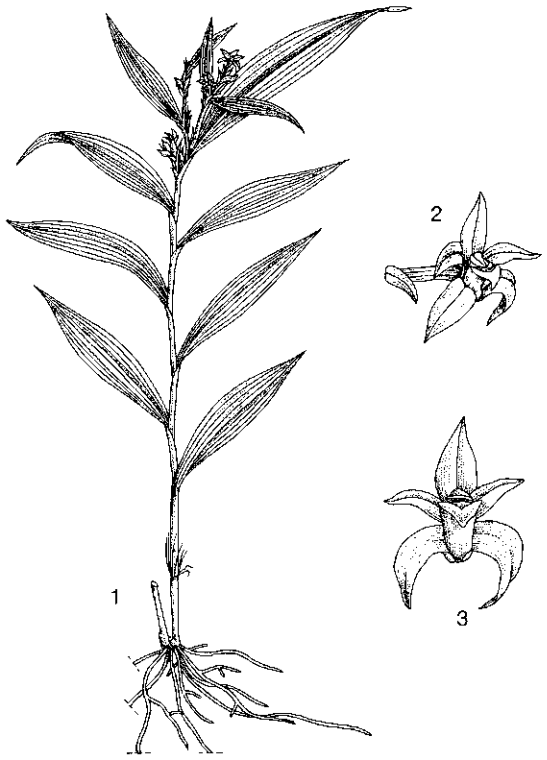
Vernacular names Malaysia: serugat, ranchang hantu (Peninsular). Vietnam: tr[us]c kinh.

Origin and geographic distribution *T. curculigoides* occurs in India, Indo-China, southern China, Taiwan, the Malesian region (Peninsular Malaysia, Java, Borneo) and northern Australia.

Uses In Peninsular Malaysia a root decoction is drunk to treat diarrhoea, and a decoction of the whole plant, in combination with *Ardisia*, to treat malaria.

Botany An erect, glabrous herb up to 125 cm tall, with branched rhizome and tufted, branched stems. Leaves arranged spirally, simple and entire, lanceolate or ovate-lanceolate, 6.5–23 cm × 1–4 cm, longitudinally plaited. Inflorescence a terminal or lateral spike, short, up to 1.5 cm long, erect or nodding, bracteate, rather few-flowered. Flowers bisexual, 0.5–1 cm long, 3-merous, greenish-white or yellowish-white; sepals lanceolate, lateral ones shortly connate and embracing the base of the lip, petals narrower, lip ventricose, entire, top recurved, without spur, applied against the column; column 5–8 mm long, anther with two 2-partite pollinia, rostellum 2-dentate. Fruit a cylindrical capsule, many-seeded. Seeds very small.

The flowers of *T. curculigoides* open in the evening. *Tropidia* comprises about 15 species, and occurs from India to China and Japan, and through South-East Asia to northern Australia and Pacific islands. It is related to *Corymborkis*.



Tropidia curculigoides Lindley – 1, plant habit; 2, flower in side view; 3, flower in front view.

Ecology *T. curculigoides* occurs in lowland and lower montane, primary or old secondary forest up to 1600 m altitude.

Genetic resources *T. curculigoides* is widespread and locally common. Its flowers are rather unattracive, and plants are rarely collected for ornamental purposes. Therefore, it does not seem to be liable to genetic erosion.

Prospects Phytochemical and pharmacological research is needed to judge the value of *T. curculigoides* as a medicinal plant.

Literature 62, 121.

Other selected sources 544, 789.

R.H.M.J. Lemmens

Typhonium Schott

Wiener Zeitschr. Kunst 1829(3): 732 (1829).
ARACEAE
$x = 8, 9, 10, 13$

Origin and geographic distribution *Typhonium* comprises about 40 species, and occurs in tropical, subtropical and warm-temperate regions

from Pakistan, Nepal, Bhutan, India and Sri Lanka, through Burma (Myanmar), Indo-China, southern and eastern China, southern Japan, Thailand and the whole of the Malesian region, to the Caroline and Mariana Islands, and northern and eastern Australia. It is naturalized in tropical America, Africa and Madagascar. Mainland South-East Asia and Australia are richest in species, whereas the genus is more poorly represented in Malesia, with probably only 3 endemic species (2 in Peninsular Malaysia, and 1 in Sumatra and Java).

Uses In South-East Asia, usually the tuber of *Typhonium* is used to treat wounds, abscesses, eczema, snakebites, gastric ulcers, cough, asthma and nausea. *T. flagelliforme* is applied to treat different types of malignancy in Peninsular Malaysia and Singapore.

In the Philippines the tubers of *Typhonium* (possibly *T. blumei* Nicolson & Sivadasan) have been used as rubefacient. *T. blumei*, native in China and Japan, but introduced in the Philippines, is used in traditional medicine in China in a tincture to treat internal injuries (leaves), as a resolvent and styptic (flowers), as an expectorant and rubefacient (tuber), and as an antidote and energetic (whole plant). The tubers of *T. giganteum* Engl. are used medicinally in China, e.g. to treat flatulence, rheumatism and as an expectorant.

Properties A crude extract of *Typhonium* produced a concentration-dependent decrease in proliferation of human leukaemia cell lines in tests in Malaysia. Crude extracts of *T. flagelliforme* caused significant reduction of [3H]-thymidine incorporation by a murine lymphoid cell line. In another test in Malaysia, a hexane extract showed weak cytotoxic activity against P388 murine leukaemia cells. Methyl esters of hexadecanoic acid, octadecanoic acid, 9-octadecanoic acid and 9,12-octadecadienoic acid, and several common aliphatics were isolated, none of these known to have cytotoxic activity. The fatty acid benzenetridecanoic acid and its methyl ester have also been isolated from *T. flagelliforme*.

Tests in India indicated that powder from *Typhonium* tubers showed distinct nematicidal activity against *Meloidogyne incognita* in tomatoes.

In the essential oil from *T. giganteum* tubers, N-phenyl benzenamine is the most abundant component, accounting for 47% of the total. Tests on expectorant properties showed negative results, but a water extract of *T. giganteum* rhizomes exhibited a tranquillizing effect.

Botany Small to medium-sized herbs, with subglobose or irregular tuber, sometimes rhizomatous or stoloniferous. Leaves alternate, few to several together, usually sagittate to hastate, sometimes narrowly lanceolate to elliptical or cordate; petiole with rather short sheath at base; stipules absent. Inflorescence a spadix, shorter to much longer than the enclosing spathe, female zone at base separated from the male zone higher up by a rather long sterile zone, apex with conoid to filiform-subulate appendix usually long exserted from the spathe; spathe constricted between tube and blade, blade eventually bending backwards, usually purple, tube persistent. Flowers unisexual, without perianth; male flowers with 1(-3) stamens; female flowers with superior 1-celled ovary, stigma sessile. Fruit an ovoid berry, usually orange-red, sometimes green or white, 1(-2)-seeded, densely packed and usually enclosed by the persistent spathe base. Seed globose to obnapiform, testa usually minutely rugulose, strophiolate, albuminous.

Typhonium belongs to the tribe *Areae*, together with e.g. *Arum* and *Biarum*, both from temperate regions. The 3 species treated here are frequently confused, and it is often not clear to which species uses mentioned in the literature should be referred. They are variable, especially in leaf characters, and differ mainly in floral characters which are often obscure in herbarium specimens.

Ecology *Typhonium* usually occurs below 1000 m altitude in more or less open localities varying from grassland to open forest, often in humid localities, sometimes also as a weed along roadsides, in gardens and fields.

Management A high frequency of shoot-bud regeneration was obtained from leaf and petiole explant-derived callus of *Typhonium* on modified Murashige and Skoog medium.

In Vietnam the tubers are washed after harvesting from the wild, and then dried in the sun or in an oven. Before use, they are soaked in a solution of alum and a maceration of ginger, sliced, and subsequently impregnated with a decoction of liquorice and lightly roasted on a fire.

Genetic resources *T. flagelliforme*, *T. roxburghii*, as well as *T. trilobatum* are widespread and locally common, although they often occur scattered. They are not in danger of genetic erosion.

Prospects *Typhonium* is commonly used in local medicine throughout tropical and subtropical Asia, often for similar complaints. Some interesting properties have been recorded including anticancer activity. More research on phytochemistry

and pharmacological activity is desirable to confirm the claimed efficacy of these plants, which are also easy to cultivate.

Literature 41, 146, 680.

Selection of species

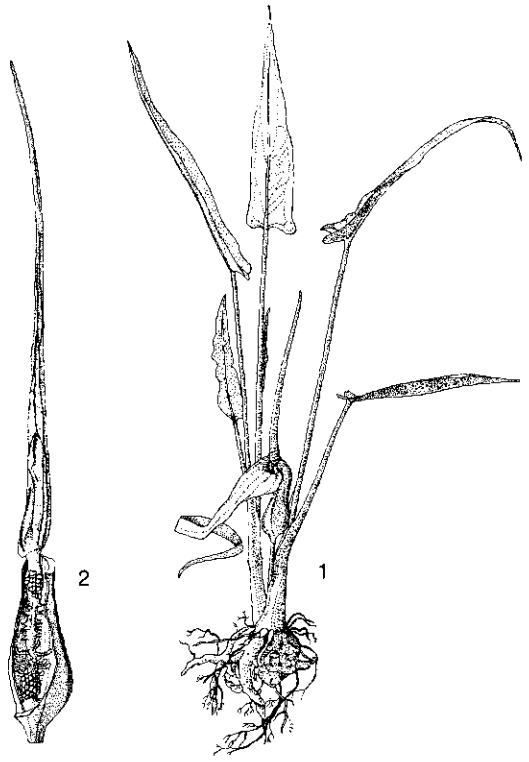
Typhonium flagelliforme (Lodd.) Blume

Rumphia 1: 134 (1837).

Synonyms *Typhonium cuspidatum* (Blume) Blume (1834), *Typhonium divaricatum* auct. non Blume.

Vernacular names Thailand: sa oy (Surin), ta phit kap yao (Loei), wan dakdae (Yasothon). Vietnam: b[as]n h[aj] roi, c[ur] ch[os]c mo d[af]i.

Distribution India, Sri Lanka, Bangladesh, Burma (Myanmar), the Andaman and Nicobar Islands, Indo-China (Cambodia, Vietnam), southern China, Thailand, Peninsular Malaysia, Singapore, Java, the Lesser Sunda Islands, the Philippines (Luzon), southern New Guinea and Australia (northern Queensland).



Typhonium flagelliforme (Lodd.) Blume – 1, habit of flowering plant; 2, spadix with part of spathe.

Uses *T. flagelliforme* is used in traditional medicine in Peninsular Malaysia and Singapore for treating different types of malignancy. In Thailand the whole plant is applied as a poultice to abscesses. In Vietnam the tubers are probably used to treat cough, asthma and nausea.

Observations A small herb up to 40 cm tall, with depressed-globose tuber up to 2 cm in diameter and subterranean stolons; leaves extremely variable, elliptical to ovate, with base acute to auriculate, cordate or hastate, but usually narrowly hastate, up to 25 cm long, petiole up to 30 cm long; spathe very narrow and elongate, up to 28 cm long, pale greenish; lower sterile flowers spatulate, black or purple-tipped. *T. flagelliforme* occurs in a variety of habitats in the lowland, from swamp forest to savanna and eucalypt lowland.

Selected sources 154, 166, 324, 680.

Typhonium roxburghii Schott

Aroid. 2: t. 17 (1855).

Synonyms *Typhonium divaricatum* Blume (1834; nom. illegit.), *Typhonium trilobatum* auct. non (L.) Schott.

Vernacular names Indonesia: trenggiling mentik (Javanese), ileus (Sundanese), bira kecil (Moluccas). Malaysia: birah kechil, keladi puyoh (Peninsular). Vietnam: c[ur] ch[os]c [aas]n d[ooj].

Distribution India, Sri Lanka, the Andaman and Nicobar Islands, Peninsular Malaysia, Singapore, Sumatra, Java, Borneo, the Lesser Sunda Islands and the Moluccas; introduced in the Philippines (Luzon), Papua New Guinea (Lae), Vietnam, Taiwan, eastern Africa (Zanzibar) and Brazil.

Uses In Java the tubers are applied to the skin to treat eczema.

Observations A small herb up to 45 cm tall, with subglobose tuber up to 3.5 cm in diameter; leaves usually shallowly 3-lobed, up to 18 cm long, usually broader than long, petiole up to 30 cm long; spathe 3–4 times longer as broad, up to 30 cm long, dark red to purple; all sterile flowers subulate, spreading and strongly decurved. *T. roxburghii* occurs in grassland, roadsides, gardens and open forest, often in humid localities, up to 1000 m altitude, usually scattered.

Selected sources 121, 245, 324, 334, 680.

Typhonium trilobatum (L.) Schott

Wiener Zeitschr. Kunst 1829(3): 732 (1829).

Vernacular names Malaysia: keladi puyuh (Peninsular). Laos: bo:n biew. Thailand: ma-ho-ra (Chong, Chanthaburi), utta phit (central), bon

baeo (Ubon Ratchatani). Vietnam: c[ur] ch[os]c, b[as]n h[aj] nam.

Distribution Nepal, eastern India, Sri Lanka, Bangladesh, Burma (Myanmar), Indo-China, Thailand and northern Peninsular Malaysia; introduced in Singapore, western Borneo, the Philippines, and locally in western Africa and Central America.

Uses In Thailand the tubers are applied to the abdomen in case of rigidity and to wounds. In Vietnam a decoction of the tubers is used to treat cough, asthma and nausea, and also to stop vomiting and against headache, gastric ulcers, abscesses and snakebites. The dried sliced tubers are eaten locally in Indo-China.

Observations A small herb up to 45 cm tall, with subglobose tuber up to 4 cm in diameter; leaves usually deeply 3-lobed, anterior lobe up to 20 cm × 10 cm, lateral lobes slightly smaller, petiole up to 40 cm long; spathe up to 20 cm long, comparatively broad, dark red to purplish outside; sterile flowers all filiform, curly, whitish. *T. trilobatum* occurs in open sites and open forest in the lowland, often on wet soils, also on limestone. In Peninsular Malaysia it is a weed around towns.

Selected sources 121, 173, 245, 671, 680.

Wongsatit Chuakul, Noppamas Soonthornchareonnon & Orawan Ruangsomboon

Uvaria L.

Sp. pl. 1: 536 (1753); Gen. pl. ed. 5: 240 (1754).
ANNONACEAE
x = unknown; *U. cordata*: $2n = 22$

Origin and geographic distribution *Uvaria* comprises about 100 species and occurs in the tropics of Africa, Asia and Australia, and in New Caledonia. A few dozens of species are found in tropical Asia.

Uses *Uvaria* is commonly used in medicine in many parts of its distribution area, including tropical Asia, where usually a decoction of the roots and leaves is applied, especially to treat stomach and intestinal complaints, fever, wounds and skin diseases, and after childbirth. Several *Uvaria* species are used in traditional medicine in Africa, the most important being *U. chamae* P. Beauv. and *U. afzelii* Scott-Elliot, which are used to treat various complaints, often as a febrifuge and to treat wounds and swellings.

The fruits of many species are edible, and the stems are used as a substitute for rattan.

Properties Alkaloids are present in the bark and, to a lesser extent, in the leaves of *U. rufa*. Extracts of *U. cordata* stem bark and leaves showed distinct antibacterial activity but no antifungal properties.

Several cyclohexene oxides have been isolated from *U. purpurea* stems and leaves. One of these, zeylenone, was found to be a highly active nucleoside transport inhibitor. Uvarigranols, which are polyoxygenated cyclohexenes, have also been isolated from *U. purpurea*. The acetogenin uvarigrin isolated from its roots showed cytotoxicity against human tumour cell lines. Other acetogenins with in-vitro activity against human leukaemia and colon adenocarcinoma cell lines have been isolated from the Vietnamese *U. tonkinensis* Finet & Gagnep. A stem extract of the African *U. lucida* Benth. showed strong mitogenic activity in isolated human and mouse T cells, whereas benzylisoquinoline alkaloids isolated from leaves of the African *U. chamae* exhibited cytotoxic activity against L929 transformed cells. Extracts of *U. chamae* and *U. klaineana* Engl. & Diels, another African species, showed significant antiplasmodial activity.

Hexane and ethyl acetate extracts of root bark of *U. narum* (Dunal) Wallich and *U. hookeri* King from India showed substantial antibacterial, antifungal and anthelmintic activities, mainly attributable to acetogenins.

Botany Lianas, straggling or erect shrubs to small trees; branches often converted into leafy tendrils, usually stellately pubescent. Leaves distichously alternate, simple and entire, often stellately pubescent, pinnately veined, shortly petiolate; stipules absent. Inflorescence a terminal, extra-axillary or leaf-opposed, few-flowered cyme or flowers solitary. Flowers bisexual, 3-merous; pedicel with 2 bracteoles; calyx lobed, irregularly splitting or entire; petals 6(–8), free or shortly connate at base, spreading or recurved; stamens numerous, outer ones sometimes sterile, with connective concealing the anther cells; carpels numerous, free, style absent, stigma horseshoe-shaped. Fruit consisting of several to many stalked monocarps, fleshy, 1–many-seeded. Seeds sometimes with a small aril.

Uvaria belongs to the tribe *Uvarieae*, as does e.g. *Cyathostemma*, which differs in its small flowers having petals that do not expand. *Uvaria* is badly in need of revision.

Ecology *Uvaria* most commonly occurs in lowland forest, usually below 1000 m altitude, often in more open localities or edges, also in brushwood or even hedges.

Genetic resources The *Uvaria* species treated here are all widespread and do not seem to be in

immediate danger of genetic erosion, although they may be rare or even absent in many regions or islands within their areas of distribution.

Prospects *Uvaria* species are interesting medicinal plants that deserve more attention in South-East Asia. Important pharmacological properties have been demonstrated, e.g. antimicrobial, anticancer and febrifuge activities, which warrant more research.

Literature 120, 155, 715.

Selection of species

Uvaria cordata (Dunal) Alston

Trimen, Handb. Fl. Ceylon 6: 4 (1931).

Synonyms *Uvaria macrophylla* Roxb. ex Wallich (1830).

Vernacular names Malaysia: akar pisang-pisang jantan, bunga jari hutan (Peninsular). Thailand: kluai muu sang (Trang), nom chaang (northern), laa-koh (Malay, Narathiwat).

Distribution Eastern India, Sri Lanka, southern Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, New Guinea; probably also elsewhere in Malesia.

Uses In Vietnam the roots and leaves are used to treat indigestion, diarrhoea and wounds. The fruits are edible.

Observations A straggling shrub or large liana; leaves obovate to elliptical or broadly oblong, 10–30 cm × 6–15 cm; flowers with calyx almost entire or splitting less than halfway into segments and corolla c. 2.5 cm in diameter, dark red; fruit consisting of several monocarps 2–3 cm long, on stalks 0.2–1.5 cm long, orange, fleshy, smooth and glabrous, several-seeded. *U. cordata* occurs in lowland forest, often in more open localities.

Selected sources 121, 467, 782, 967.

Uvaria purpurea Blume

Bijdr. fl. Ned. Ind. 1: 11 (1825).

Synonyms *Uvaria grandiflora* Roxb. ex Wallich (1830).

Vernacular names Indonesia: kalak (Java), larap putih (Lampung), tali pisang (Moluccas). Malaysia: akar larak, larak tahi kuching, akar pisang-pisang tandok (Peninsular). Philippines: banauak, susong-kalabau (Tagalog, Bisaya), hinlalaki-saging (Tagalog). Thailand: kluai muu sang (peninsular), yaan nom khwaai (Trang), kluai phangphon (Trat). Vietnam: chu[oos]i con ch[oof]ng.

Distribution Southern Burma (Myanmar), southern China, Indo-China, southern Thailand, Peninsular Malaysia, Sumatra, Java and the Philippines.

Uses The roots, crushed with water, and a decoction of the leaves are used to treat colic, stomach-ache, skin diseases and after childbirth. The aromatic fruits are eaten raw or preserved. The stems are said to be a good substitute for rattan.

Observations A straggling shrub or liana up to 10 m long; leaves elliptical-oblong-obovate, 11–30 cm × 4.5–10 cm; flowers with calyx entirely closed before anthesis, afterwards irregularly 2–4-fid, and corolla 6–9 cm in diameter, vermilion-red to purplish; fruit consisting of numerous monocarps 2.5–8.5 cm long, on stalks 4–6 cm long, orange, fleshy, densely brown hairy, 5–21-seeded. *U. purpurea* occurs in forest edges and brushwood, up to 1000 m altitude.

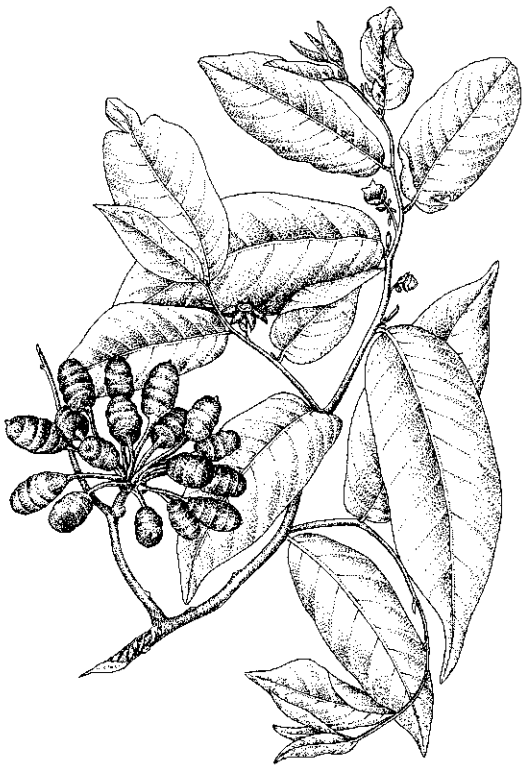
Selected sources 62, 121, 334, 548, 782, 967.

Uvaria rufa Blume

Fl. Javae 21, t. 4, 13c (1830).

Synonyms *Uvaria ridleyi* King (1893).

Vernacular names Indonesia: kalak (Java), turalak (Sundanese), larap nyapa (Lampung). Ma-



Uvaria rufa Blume – flowering and fruiting branch.

laysia: larak, pisang-pisang (Peninsular). Philippines: hilagak (Tagalog), allagat (Iloko), batag-kabalang (Bikol). Thailand: nom khwaai (general), nom maeo (central), bu ngaa yai (northern). Vietnam: b[uf] d[er] hoa d[or].

Distribution The Andaman Islands, southern Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java and the Philippines.

Uses In the Philippines an alcoholic tincture of the roots is employed as an ecbolic. In Thailand a decoction of the root and wood is used to treat intermittent fever and after childbirth. The fruits, ground with water, are applied externally against itch. The fruits are slightly sweet and are eaten.

Observations A straggling shrub or liana up to 10 m long; leaves elliptical-oblong or ovate-oblong, 4.5–16 cm × 2.5–6 cm; flowers with sepals connate at base only and corolla 1.5–2.5 cm in diameter, at first bright red, afterwards dark red; fruit consisting of 4–20 monocarps 2–3 cm long, on stalks 1–4 cm long, bright red, fleshy, rather densely brown hairy, 10–20-seeded. *U. rufa* occurs in open forest, brushwood and hedges, at low and medium altitudes.

Selected sources 62, 121, 173, 334, 760.

Max Joseph Herman

Ventilago Gaertner

Fruct. sem. pl. 1(1): 223, t. 49 (1788).

RHAMNACEAE

x = unknown

Origin and geographic distribution *Ventilago* consists of some 40 species, and occurs from Africa and Madagascar throughout tropical Asia to tropical Australia.

Uses *Ventilago* is only little used in traditional South-East Asian folk medicine. In Peninsular Malaysia leaves of a *Ventilago* species were used to make a poultice all over the body to treat cholera. Root bark of *Ventilago* mixed with oil is applied externally to treat certain skin affections. In India root bark of *V. madraspatana* is credited with stomachic, tonic and stimulant activities, and it is used to dye clothes reddish. In Taiwan stems of *V. leiocarpa* Bunge have been employed in the treatment of numerous affections, e.g. cough, hepatitis, rheumatism and contusions.

Properties The root bark of *V. madraspatana* contains as major pigment ventigalin, a reddish-brown resinous product, and as principal drug compound the anthraquinone emodin. In addition numerous naphthalene derivatives, naphthoquinones and anthraquinones have been isolated.

The anthraquinone derivative emodin is a well-known laxative. Emodin isolated from *V. leiocarpa* stems exhibited hepatoprotective effects on CCl_4 as well as D-galactosamine-induced liver damage in rats. Histopathological examination showed that emodin reduced lymphocyte cells, Kupffer cells, ballooning degeneration, cell necrosis and hyaline degeneration. Emodin also exhibited anti-inflammatory effect on carrageenan-induced oedema in rats. Two xanthone derivatives with cytotoxic activity against K 562 cells have also been isolated from *V. leiocarpa*. Quinones isolated from *V. madraspatana* roots showed significant antifeedant activity against adult beetles of *Henosepilachna vigintioctopunctata* and 4th instar larvae of the moth *Spodoptera litura*.

Botany Lianas or scandent shrubs. Leaves alternate, simple, petiolate; stipules minute. Inflorescence an axillary or terminal panicle or umbellate cyme. Flowers bisexual, 5-merous; calyx tube obconical or flat and saucer-like, lobes acute, puberulous outside; petals free, small, clawed at base; stamens opposite the petals; disk filling the calyx tube; ovary hemi-inferior, sunk in the disk, 2-celled, style very short. Fruit a samaroid, 1(–2)-seeded globose nut, prolonged above by a linear or linear-oblong, coriaceous wing, at the base encircled by the calyx tube or not. Seed globose to subglobose, without albumen; cotyledons thick, fleshy.

Ecology *Ventilago* can be found in lowland rain forest and thickets, but also in mountain regions with a more or less dry climate.

Genetic resources *Ventilago* species such as *V. madraspatana* are relatively widespread, usually common, and cannot be considered threatened. However, some species are restricted in their distribution, and may be threatened with continued habitat degradation.

Prospects Anthraquinone derivatives such as emodin, also present in many other plant resources (e.g. *Aloe*, *Rheum* and *Senna*), have shown interesting pharmacological activities. However, they may lead to serious problems in daily and prolonged internal use, and *Ventilago* root bark is therefore recommended for external use only, e.g. for its anti-inflammatory activity and in the treatment of skin diseases such as psoriasis.

Literature 139, 316, 509, 552, 769, 782.

Selection of species

Ventilago dichotoma (Blanco) Merr.

Philipp. Gov. Lab. Bur. Bull. 27: 32 (1905).

Synonyms *Ventilago monoica* Blanco (1845).

Vernacular names Philippines: salapau, salipau, pakpak-tutubi (Tagalog).

Distribution The Philippines (Luzon, Palawan).

Uses In the Philippines the bark, pulverized and mixed with oil, is used as a remedy for skin diseases.

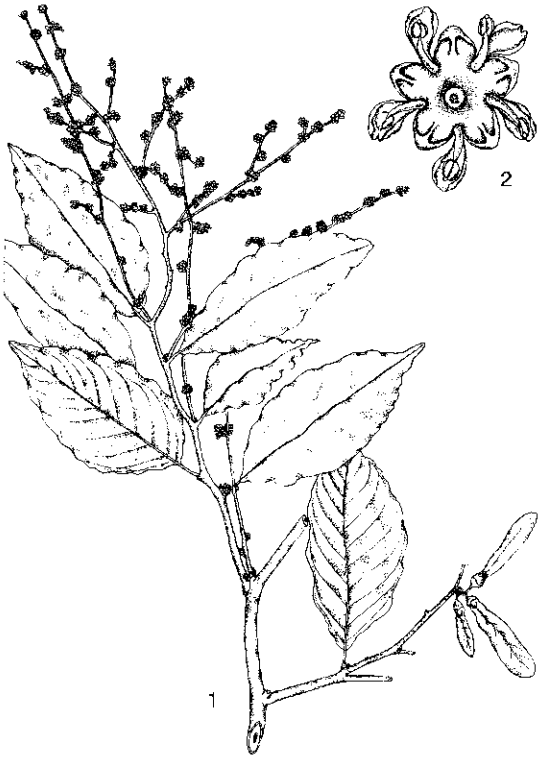
Observations A scandent shrub; leaves oblong, c. 10 cm × 3–3.5 cm, base rounded, apex acuminate, glabrous; inflorescence terminal; flowers yellowish-green; fruit rounded at base, enclosed by the cup-shaped calyx tube, 5–7 mm in diameter, apical wing 4–5 cm long. *V. dichotoma* is found in forests and thickets at low and medium altitudes.

Selected sources 731, 760.

Ventilago madraspatana Gaertner

Fruct. sem. pl. 1(1): 223, t. 49, f. 2 (1788).

Vernacular names Indonesia: lian, talibubu (Ambon).



Ventilago madraspatana Gaertner – 1, flowering and fruiting branch; 2, flower.

Distribution Southern India, Sri Lanka, the Andaman Islands, southern Burma (Myanmar) and Indonesia (Java, the Moluccas).

Uses In India the root bark is credited with stomachic, tonic and stimulant properties. It is prescribed in atonic dyspepsia, debility and fevers. Mixed with oil it is used as an external application for the treatment of itch and other skin troubles. The root bark is used for dyeing mordanted cotton, wool and silk. Reddish shades are obtained. The bark fibre can be used for cordage.

Observations A liana; leaves elliptical-ovate or ovate-lanceolate, 1.5–8.5(–12.5) cm × 1.5–3(–6) cm, base rounded, sometimes slightly oblique, apex acute or sub-acuminate, glabrous; inflorescence a terminal or axillary panicle; flowers yellowish-green; fruit surrounded near the base by the saucer-shaped calyx tube, 5–7(–13) mm in diameter, apical wing 2–4(–7) cm long. *L. madraspatana* occurs very locally in lowland forest in Java; in Sri Lanka it is found in hilly forest up to 700 m altitude.

Selected sources 62, 181, 542, 782.

A.M. Aguinaldo

Viscum L.

Sp. pl. 2: 1023 (1753); Gen. pl. ed. 5: 448 (1754).

VISCACEAE

x = 10–15; *V. articulatum*: 2*n* = 24, *V. ovalifolium*: 2*n* = 22, 44

Origin and geographic distribution *Viscum* comprises some 100 species and is distributed in Europe, Africa, Asia including the whole of Malesia, and Australia. The main centres of diversity are Madagascar, Africa and southern Asia. In Malesia 9 species have been found, 5 of which are probably endemic, without a distinct centre of species richness.

Uses *Viscum* is only little used in South-East Asian folk medicine. In general it is applied as a poultice for the treatment of neuralgia, cuts and itch, and in a poultice or bath as a febrifuge.

V. orientale Willd., an Indian species not present in South-East Asia, is used as an abortifacient. *V. album* L., well known in temperate Europe and Asia, features prominently in folk medicine, along with many magical uses.

Properties The qualities of various *V. album* extracts in complimentary and alternative medicine are somewhat controversial. Present-day use as an adjuvant therapy in cancer patients is based on activation of the immune system, which could

potentially translate into valuable clinical effects. Lectins have been identified as the active principle with cytotoxic and immunomodulatory potencies. In-vitro and in-vivo results are very promising. However, translating these findings into controlled clinical trials following standard procedures is very difficult because the population of patients involved is too heterogenous.

It is possible that chemical compounds isolated from a particular parasite are in fact derived from its host plant. Comparative analyses of host plants and their parasites are essential for definitively establishing the site of synthesis, especially of easily transportable hydrophylic constituents. *V. album* may serve as an example: whilst pinitol, quebrachitol and chiro-inositol are characteristic of *V. album*, sorbitol and scyllo-inositol are only present when they occur in the host.

Botany Stem-parasitic shrubs, attached to the host by a single primary haustorium, with much-branched stems. Leaves opposite, simple and entire, normally developed or rudimentary; stipules absent. Inflorescence basically a 3-flowered cymule, terminal or axillary; bracts small, triangular, forming a boat-shaped cupule subtending each cymule. Flowers unisexual, small (less than 2 mm long), 4-merous, tepals triangular, valvate; male flowers flattened, stamens with sessile anthers, fused to the tepals; female flowers cylindrical, ovary inferior, stigma small, nipple-shaped. Fruit berrylike, narrowly ellipsoid to globose, 1-seeded. Seed covered by a sticky layer, smooth or tuberculate.

After germination of the seed, it takes 1.5–3 years before plants start flowering and fruiting. Pollination in *Viscum* is consistently by insects and effective seed dispersal is by fruit-eating birds. The seed is removed from the fruit and swallowed whole, and is defecated within 10–20 minutes. The viscous layer cements the seed in place, and it germinates spontaneously. Instead of normal roots, the embryo radicle produces a haustorium which penetrates to the cambial layer of the host to take up water and nutrients from the xylem.

Ecology *Viscum* occurs in a range of habitats from closed humid forest to open woodland and disturbed habitats; in Malesia usually in the lowlands to 1500 m, but in Java up to 2300 m altitude. Host specificity of most *Viscum* species is low. *V. ovalifolium* is commonly recorded on *Ficus*. *V. articulatum* appears to have a preference for *Loranthaceae* and other *Viscaceae*, being an example of secondary parasitism.

Management Seeds of *V. ovalifolium* have no dormant period and can germinate within the fruit, although this affects vigour. Germination takes 2–8 days at 18–32°C with over 90% success rate. Germination can occur on any natural substrate, and artificial propagation is possible. However, best results are obtained with seeds from fresh fruits sown on small branches of hosts.

Genetic resources The *Viscum* species treated here are widely distributed and occur in both primary and disturbed habitats. Therefore they do not appear to be threatened by genetic erosion.

Prospects Apart from the considerable attention given to *V. album*, little is known about the phytochemistry and pharmacological properties of *Viscum*. Research is needed to evaluate the potential of South-East Asian *Viscum*.

Literature 72, 118, 119, 232, 247, 1018, 1049.

Selection of species

Viscum articulatum Burm.f.

Fl. ind.: 211 (1768).

Vernacular names Philippines: logolai (Bagobo), taka (Igorot). Thailand: kaafaak ton pao (northern), kafaak thao haa phao chok, naang hak (peninsular). Vietnam: ghi ph[aa]n d[oos]t, t[aaf]m g[uwr]i d[ej]t.

Distribution From eastern India to southern China and northern and eastern Australia; widespread throughout South-East Asia.

Uses In Cambodia a decoction of *V. articulatum* is prescribed for the treatment of bronchitis. It is credited with tonic and sedative properties. In India it is used as an aphrodisiac and febrifuge, and to treat skin tumours. A poultice of crushed stems is applied to cuts. In Taiwan the whole plant is used as a remedy for neuralgia. In China whole plants are used to treat arthritis.

Observations A hemiparasitic shrub, with slender, pendulous stems up to 1 m long; leaves rudimentary, spreading, c. 0.5 mm long; inflorescence consisting of a single flower, usually with many subsidiary cymules developing around the first one, with the first-formed flower female and the lateral flowers female or male, sessile; fruit globose, smooth, white. *V. articulatum* is found in open and closed forests from sea-level up to 1500 m altitude.

Selected sources 72, 181, 247, 731, 732.

Viscum ovalifolium DC.

Prodr. 4: 278 (1830).

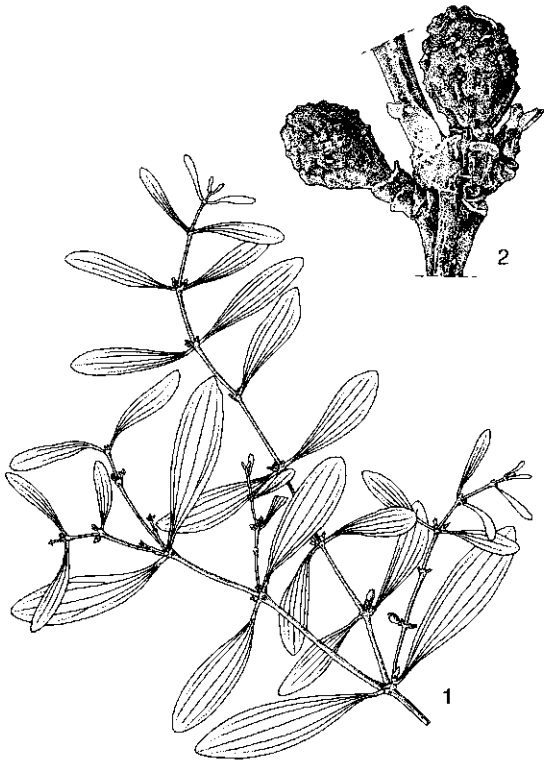
Synonyms *Viscum pedunculatum* Barlow (1962), *Viscum orientale* auct. non Willd.

Vernacular names Malaysia: api-api, dedalu umping, seri sabulan (Peninsular). Philippines: bogto (Tagalog). Thailand: kaafaak mai cheko hin, kaafaak mai taatum (peninsular), kaafaak mai mahuat (south-western). Vietnam: ghi l[as] h[if]nh xoan.

Distribution From Burma (Myanmar) to southern China and northern Queensland (Australia); widespread throughout South-East Asia.

Uses In Peninsular Malaysia a poultice of the leaves of *V. ovalifolium* is applied to the temples to treat neuralgia. The ashes of the burned plant are mixed with sulphur and coconut oil, and rubbed on the body to treat pustular itches. In Cambodia the plant is employed in a herbal bath to treat fever in children.

Observations A hemiparasitic, erect, divaricate, spreading shrub up to 1.5 m tall; leaves elliptical to obovate, 2.5–12 cm × 1–3.5 cm, base attenuate, apex rounded or obtuse, petiole 2–5 mm long; inflorescence consisting of 3 flowers, usually with many subsidiary cymules developing around the first one, with the middle flower female and the lateral flowers male, peduncle 0–5 mm long; fruit globose or slightly ellipsoid, distinctly tuberculate before maturity, yellow, orange or red. *V. ovalifolium* is found in habitats ranging from mangrove forest to open and closed primary and secondary forest from sea-level up to 500(–1400) m altitude.



Viscum ovalifolium DC. – 1, flowering and fruiting branch; 2, node with flowers and fruits.

Selected sources 72, 121, 247, 731, 732, 760.

J.L.C.H. van Valkenburg

Wahlenbergia marginata (Thunberg) A.DC.

Monogr. Campan.: 143 (1830).

CAMPANULACEAE

$2n = 18, 36, 54, 64, 72$

Vernacular names Indonesia: angkeb, patikan (Javanese), jukut riut (Sundanese). Philippines: ligam (Igorot). Vietnam: s[aa]m ru[ooj]ng.

Origin and geographic distribution *W. marginata* occurs in India, Sri Lanka, Burma (Myanmar), Indo-China, China, Taiwan, Japan, northern Thailand, the Malesian region except Peninsular Malaysia, Sumatra and Borneo, Australia and New Zealand. It is locally naturalized elsewhere, e.g. in the United States.

Uses In Java *W. marginata* is used to treat skin diseases. In China and Indo-China, the roots are esteemed for the treatment of pulmonary afflictions such as cough and haemoptysis, and for the treatment of gastralgia.

Properties A number of ionone-related and phenylpropanoid-derived glycosides have been isolated from an aqueous ethanol extract of the whole plant. In in-vitro testing, no activity was found against the human pathogenic fungi *Aspergillus flavus*, *Candida albicans* or *Trichoderma viride*.

Botany A perennial herb 3–60 cm tall, glabrous or hairy, woody at base. Leaves arranged spirally, simple, linear to elliptical, 1.5–5.5 cm × 0.1–0.5 cm, decreasing in size upwards, serrate to almost entire, mostly sessile; stipules absent. Inflorescence a 1-few-flowered, terminal or axillary raceme, with small bracts. Flowers bisexual, regular, 3–5-merous, distinctly protandrous; pedicel 1–15 cm long; calyx lobes 0.8–4 mm long; corolla tube 1–5 mm long, lobes ovate or elliptical, 1–7 mm long, acute or acuminate, violet-blue or white; stamens alternating with corolla lobes, free; ovary

inferior, obconical to bell-shaped, 1–5 mm long, 2–3-celled, style 1.5–5 mm long, stigma 2–3-lobed. Fruit an obconical to bell-shaped capsule 1.5–10 mm × 1–5 mm, 2–3-valved, many-seeded. Seeds ellipsoid to triangular, up to 1 mm long, shining.
W. marginata can be found flowering and fruiting throughout the year. *Wahlenbergia* comprises over 150 species and has an almost cosmopolitan distribution, the majority of species being found in the Southern hemisphere. In the Malesian region some 5 species occur, primarily at higher elevations. *W. marginata* is extremely variable with respect to its overall habit, and absolute and relative dimensions of nearly all floral parts.

Ecology *W. marginata* appears to prefer a distinct seasonality, and is found in Malesia mainly in the mountains at 1000–3500 m altitude. It occurs in open *Casuarina* and *Eucalyptus* forest, but also on grassland, roadsides, and exposed rocks and old lava streams.

Management Hairy root cultures of *W. marginata*, infected with *Agrobacterium rhizogenes*, grew well in various hormone-free media and produced a high content of polyacetylenes, particularly the monoglucoside constituent lobetyolin.

Genetic resources *W. marginata* is widespread and occurs in a wide range of often disturbed habitats, and is as such not threatened by genetic erosion. However, the genetic variability is remarkable and deserves more attention.

Prospects Little is known about the pharmacological properties of *W. marginata*. Further research is needed to support its traditional medicinal uses. More research on the biosystematics of *W. marginata* is needed, as it is extremely widespread and variable, morphologically but also concerning chromosome number. The latter has been found a valuable tool for classification in New Zealand, resulting in a much narrower species concept than adopted here.

Literature 38, 181, 247, 334, 913.
Other selected sources 62, 621, 733, 734, 782.

R.P. Escobin

Woodfordia fruticosa (L.) Kurz

Journ. As. Soc. Beng. 40(2): 56 (1871).
LYTHRACEAE
$2n = 16$

Synonyms *Lythrum fruticosum* L. (1759), *Grislea tomentosa* Roxb. (1795), *Woodfordia floribunda* Salisb. (1806).

Vernacular names Indonesia: sidawayah (Javanese), dhubaja (Madurese), silu (Timor). Malaysia: seduwayah (Peninsular). Vietnam: l[aa]m ph[as]t.

Origin and geographic distribution *W. fruticosa* is widely distributed in eastern Africa (Mafia Island), Comoros, Madagascar, Pakistan, India, Sri Lanka, Burma (Myanmar), Indo-China, southern China, northern Thailand and Malesia (Java, Madura, Sumbawa and Timor).

Uses *W. fruticosa* is a popular and important medicinal plant employed throughout its range for many complaints by many different ethnic groups. In Malaysia the dried flowers or young fruits (imported from Java) are an ingredient of various prescriptions, used externally or as a drink by women shortly after childbirth. In Java they are roasted and ground, and externally applied to wounds and to the cut umbilical cord of a newborn baby to cause it to dry. A decoction of the seeds is recommended as a diuretic for patients with fever, or to treat rheumatism. Flowers, fruiting twigs and seeds are ingredients of complex prescriptions for dysentery and sprue, apparently because of their astringent properties. In Burma (Myanmar) the flowers are used to treat bowel complaints. In India a paste or dry powder of the flowers is applied to ulcers, dermal lesions and wounds. In Sri Lanka the dried flowers are used as an astringent tonic to treat disorders of the mucous membranes, haemorrhoids and liver problems; they are further considered a safe stimulant for pregnant women. In India and Nepal the leaves are applied as a sedative and antipyretic, and credited with antibiotic properties. In Madagascar dried flowers are used to treat gout, urethritis and cystitis, and as an aphrodisiac.
Dried flowers are a source of a hair dye, whereas leaves and twigs yield a yellow dye used in printing.

Properties Leaves, fruits and especially flowers of *W. fruticosa* are rich in tannin. The whole plant contains considerable amounts of flavonoid glycosides, anthraquinone glycosides and phenylpropanoids.
In small doses, plant extracts stimulate the central nervous system in mice, but in large doses they act as a depressant. They antagonize amphetamines and enhance the analgesic action of barbiturates. In tests with rats, anti-inflammatory and immunomodulatory activities are recorded. The active principles are the oligomeric hydrolyzable tannins with macrocyclic structures. The two major constituents, woodfordin C (woodfruticosin) and oenothin, exhibited significant host-mediated

antitumour and anti-HIV activities in mice. Woodfordin C shows an inhibitory effect against DNA topoisomerase II.

In screening experiments for antiviral properties, methanol and water extracts of *W. fruticosa* flowers and leaves showed potent inhibition of avian myeloblastosis virus reverse transcriptase, and strong inhibitory activity of human immunodeficiency virus type-1 (HIV-1)-protease.

Botany An evergreen shrub up to 5 m tall, with diffuse, irregular branching. Leaves opposite, distichous, ovate-lanceolate to narrowly lanceolate, 2–10(–14) cm × 1–3(–4) cm, base rounded to subcordate, apex attenuate to acuminate, entire, sparsely patently pubescent above, densely greyish tomentose and black punctate below; petiole 0–3 mm long; stipules absent. Inflorescence a 1–17-flowered cluster on a much condensed, axillary shoot. Flowers bisexual, slightly zygomorphic, 6-merous, pedicellate, with 2 bracteoles, protandrous; calyx with 1–1.5 cm long tube, greenish at base, pale to dark red distally, lobes 2–3 mm × 1.5–2 mm; petals inserted near the mouth of the calyx tube, narrowly lanceolate, 1–5 mm long, red, pale pink or white; stamens 12, inserted at one-third of the calyx tube and far exserted; ovary superior, incompletely 2-celled, style slender. Fruit a thin-walled, ellipsoid capsule 8–10 mm long, enclosed by the calyx tube, many-seeded. Seeds minute, narrowly obpyramidal, slightly compressed, smooth.

Woodfordia fruticosa (L.) Kurz – 1, flowering and fruiting branch; 2, flower; 3, fruit in calyx tube; 4, fruit; 5, seed.

W. fruticosa can be found flowering throughout the year, but a distinct peak in abundance can be observed. The nectar-rich flowers are regularly visited by insects. Mature fruits are present within one month of flowering, and may persist on older leafless stems after new flowering branches are produced.

Woodfordia consists of 2 closely related species that can be artificially hybridized.

Ecology *W. fruticosa* is a pioneer preferring rocky localities and exposed slopes, but it can be found in a wide range of habitats, including river banks, rain forest, semi-deciduous forest, montane grassland and open anthropogenic habitats, in Java at 30–1000 m altitude.

Management *W. fruticosa* can be propagated by seed and cuttings. Germination starts 7–12 days after sowing and is completed within one month. Seeds stored in a closed plastic bottle at room temperature gradually lose their viability in the period up to 6 months of storage (when the germination rate is about 78%), but rapidly lose it after this period, with only about 1% of seeds germinating after 12 months.

Genetic resources In view of its large natural distribution and its preference for disturbed habitats, *W. fruticosa* does not appear to be threatened by genetic erosion. However, overcollecting may locally reduce natural populations substantially.

Prospects Apart from the attention given to antiviral and antitumour properties of *W. fruticosa*, phytochemical and pharmacological investigations are few. Further research is needed to evaluate its traditional medicinal uses, and to determine its potential as a modern herbal medicine.

Literature 290, 442, 491, 518, 519, 1036.

Other selected sources 62, 86, 121, 334, 520, 731, 732, 953.

D. Mutiatikum

Xyris L.

Sp. pl. 1: 42(1753); Gen. pl. ed. 5: 25 (1754).
XYRIDACEAE
$x = 9, 17$

Origin and geographic distribution *Xyris* comprises nearly 300 species, and occurs in tropical to temperate regions of America, Africa, Asia and Australia. South America is richest in species. In Malesia 8 species occur, in Indo-China and Thailand each 11.

Uses *Xyris* is used externally in traditional medicine in India and Peninsular Malaysia to treat skin diseases. In Thailand dried inflorescences are used to treat leprosy and ringworm. Similar applications are recorded for tropical America. It is sometimes cultivated as an ornamental for pools. In Java the scapes of *X. capensis* Thunberg are sometimes used as an inferior substitute for *Fimbristylis* in the construction of mats.

Properties Anthraquinones and 2 isocoumarins (xyridins A and B) have been isolated from inflorescences of *X. indica* collected in Thailand.

Botany Small to medium-sized perennial, grasslike herbs, with fibrous roots. Leaves distichously alternate, often more or less radical, simple, ensiform to linear or filiform, rough or smooth, sheathing. Inflorescence a dense spike on an elongated scape; bracts imbricate, persistent, usually with a greenish or brownish blot below apex. Flowers bisexual, 3-merous, transient; sepals free, lateral sepals keeled, persistent, median sepal hoodlike, membranous, covering the flower in bud, falling off at anthesis; petals obovate to obtriangular, claws more or less adhering with staminodial filaments, distally erosate to lacerate, yellow; stamens inserted on petals, alternating with filiform, 2-armed staminodes, each arm brush-like by numerous hairs; ovary superior, 1-celled with 3 parietal placentas (in Australia sometimes 3-celled with axile placentation), style trifid, stigma horseshoe-shaped. Fruit an obovoid capsule, dehiscing loculicidally, many-seeded. Seeds ovoid to ellipsoid, longitudinally and transversely ridged.
The flowers are usually open for a few hours; those of *X. indica* usually open during the late morning and persist until mid-afternoon. However, those of *X. complanata* remain open for a longer period, from mid-morning until late afternoon.

Ecology *Xyris* species are mostly found in open, moist localities on sandy, acid soils, sometimes also on loamy or clayey soils.

Genetic resources Both *X. complanata* and *X. indica* are widespread and occur locally gregariously, also in anthropogenic habitats, and they are not in danger of genetic erosion.

Prospects The use of *Xyris* to treat skin diseases in different parts of the world is remarkable, and warrants more research, which has only been done sporadically up to now.

Literature 247, 483, 799, 945.

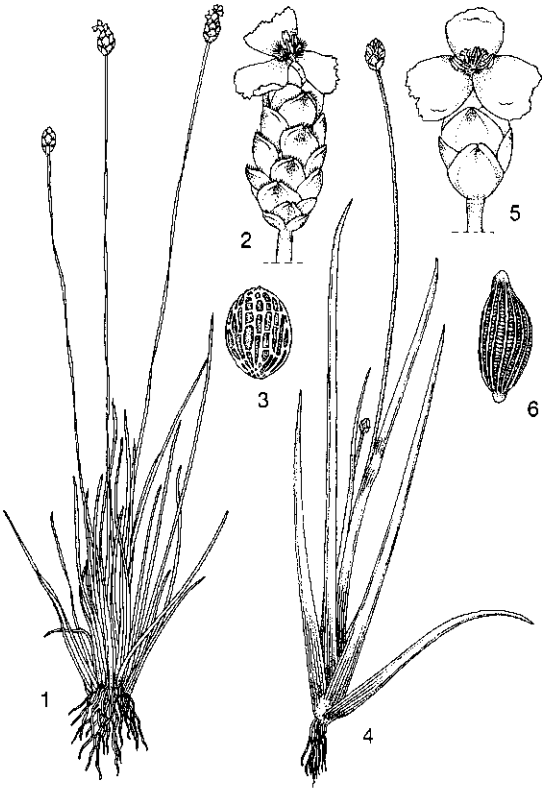
Selection of species

Xyris complanata R.Br.

Prodr. 1: 256 (1810).

Synonyms *Xyris anceps* auct. non Lamk.

Vernacular names Indonesia: jangot tutu (Belitung), purum bili bili (Kalimantan). Malaysia: chelagi, berudang (Peninsular). Philippines: gumi-gumi (Tagalog). Thailand: tan (peninsular), ya krathiam, ya krathin (south-eastern). Vietnam: c[or] v[af]ng.



Xyris complanata R.Br. – 1, plant habit; 2, inflorescence; 3, seed. Xyris indica L. – 4, plant habit; 5, inflorescence; 6, seed.

Distribution India, Sri Lanka, Indo-China, southern China (Hainan), Thailand, the Malesian region (throughout, but not yet collected in Java, the Lesser Sunda Islands and the Moluccas) and northern and western Australia.

Uses In Peninsular Malaysia *X. complanata* is used to treat skin complaints. In India the leaves, boiled in oil, are applied in cases of leprosy, other skin diseases and itch.

Observations A perennial herb; leaves flat, up to 60 cm × 0.4 cm, rough on the edges, without transverse veins, sheath up to 11 cm long; inflorescence several per plant, ovoid to cylindrical, up to 4 cm long, up to 50-flowered, on an up to 80 cm long, complanate to subterete scape usually with 2 ridges, median bracts with upper margin lacerate. *X. complanata* occurs in open, wet localities among grasses or mosses up to 1600 m altitude.

Selected sources 121, 219, 247, 249, 250, 483.

Xyris indica L.

Sp. pl. 1: 42 (1753).

Vernacular names Indonesia: jajaruman, jukut pentolan (Sundanese), acuk-acuk (Javanese). Malaysia: bunga dari kandang, rumput bagau, jerangau padang (Peninsular). Cambodia: thnâk' tuk (Pursat). Laos: :khi:z ka:k (Vientiane). Thailand: krathin thung, ya krathiam (south-eastern), ya khi klak (central). Vietnam: ho[af]ng d[aaf]u.

Distribution India, Sri Lanka, Burma (Myanmar), Indo-China, southern China (Hainan), Thailand, the Malesian region (Peninsular Malaysia, Sumatra and Java) and northern Australia.

Uses In India *X. indica* is used to treat ringworm, leprosy and itch.

Observations A perennial herb; leaves flat, slightly spongy, up to 50(–70) cm × 1.3 cm, smooth on the edges, with prominent transverse veins, sheath up to 30 cm long; inflorescence several per plant, spherical to cylindrical, up to 1.5(–3.5) cm long, up to 20-flowered, on an up to 80(–110) cm long, terete scape with 6–15 ridges, median bracts with upper margin entire. *X. indica* occurs in open, swampy localities, often along rice fields up to 250 m altitude, rarely up to 1200 m.

Selected sources 121, 219, 247, 249, 250, 483, 799.

R.P. Escobin

Zehneria indica (Lour.) Keraudren

Fl. Camb., Laos & Vietn. 15: 52 (1975).

CUCURBITACEAE

$2n$ = unknown

Synonyms *Melothria indica* Lour. (1790), *Melothria leucocarpa* (Blume) Cogn. (1881).

Vernacular names Indonesia: bobontengan lalaki (Sundanese), antimon tikus (Moluccas). Philippines: melon-daga (Tagalog), timun-ambau (Sulu). Vietnam: d[uwj]a chu[ooj]t d[aj]i, ch[uf]m th[awr]ng, hoa b[as]t, d[aa]y p[oj]p.

Origin and geographic distribution *Z. indica* occurs in eastern India, Burma (Myanmar), Indo-China, southern China, Thailand and the Malesian region eastwards to the Moluccas.

Uses In the Moluccas juice of the leaves of a plant tentatively identified as *Z. indica* is a traditional remedy for thrush in children. It is further used as part of a treatment to clear opacity of the cornea. In Vietnam *Z. indica* is used to suppress inflammation and swellings and as a diuretic, and the root is considered a vermifuge and depurative. It is especially applied for respiratory and urogenital inflammations. The plant is applied externally to treat a range of afflictions from burns to eczema and furuncles. In China a decoction of the whole plant is taken as a cooling drink and to relieve inflammation. It is used to treat dysentery, rheumatism, urinary gravel and skin diseases.

Botany A monoecious, perennial, herbaceous climber up to 2 m long; stem finely angular, glabrescent, climbing by simple tendrils. Leaves alternate, simple, entire or 3-lobed, ovate or triangular in outline, 3–10 cm × 4–7 cm, base deeply incised to cordate, apex acuminate, subentire to dentate, finely scabridly warted above, pubescent on the veins below; petiole 1–2 cm long; stipules absent. Inflorescence axillary; male flowers fascicled or in sessile short racemes, female flowers solitary or 2–4 together, sometimes at the base of a male inflorescence. Flowers unisexual, regular, 5-merous, pedicellate; calyx campanulate; corolla gamopetalous, lobes entire; male flower with corolla lobes c. 4 mm long, 3 stamens and a pistillode; female flowers with inferior, fusiform ovary, finely papillose, glabrescent. Fruit a globose to ellipsoid berry 10–12(–16) mm × 7–10 mm, glabrous, white or yellow to reddish, many-seeded. Seeds obovate, 5 mm × 2.5 mm, very flat.

Zehneria comprises some 30 species and is found in the Old World tropics and subtropics. *Z. indica* is sometimes considered a synonym of *Z. japonica* (Thunberg) H.-Y. Liu, thereby extending the

range of the taxon to more temperate East Asia.

Ecology *Z. indica* is found in thickets, open forest and forest fringes from sea-level up to 1500 m altitude.

Management In Vietnam roots, stems and leaves of *Z. indica* are harvested at the end of the growing season, and dried for later use as a drug.

Genetic resources *Z. indica* is widespread, often occurring in disturbed habitats, and does not seem to be threatened by genetic erosion.

Prospects Pharmacological research is needed to support the traditional uses of *Z. indica* as an anti-inflammatory and antiseptic agent.

Literature 250, 334, 532, 731, 740, 760.

Other selected sources 62, 121, 380.

Nguyen Huu Hien

Ziziphus Miller

Gard. dict., abr. ed. 4 (1754).

RHAMNACEAE

$x = 12$

Origin and geographic distribution *Ziziphus* comprises about 100 species and has a pantropical distribution, the two main centres being tropical America and South-East Asia. It extends into temperate and even arid regions. About 25 species occur within Malesia.

Uses *Ziziphus* is only little used in South-East Asian folk medicine, e.g. the root bark in preparations for contraconception and to treat fever. In Peninsular Malaysia a decoction of the leaves or roots of possibly *Z. kunstleri* King was used as a post-partum medicine. The bark of *Z. oenoplia* (L.) Miller, occasionally used for tanning in India, has several medicinal uses, common for plants containing tannin; it is used for healing wounds and to treat stomach-ache. The roots serve as a remedy against hyperacidity and *Ascaris* infection. The roots, bark, leaves, seeds and fruits of *Z. mauritiana* Lamk are all applied medicinally, in particular to aid digestion and to poultice wounds. *Z. mauritiana* is a well-known firewood in semi-arid regions.

Some *Ziziphus* species are more widely used medicinally in temperate East Asia. *Z. jujuba* Miller (synonym: *Z. vulgaris* Lamk) is well known in Chinese medicine, all parts being used for a wide range of afflictions; the fruits are also well known as an adjuvant. Several species, notably *Z. jujuba* and *Z. mauritiana*, are widely cultivated for their edible fruits. In Indonesia young leaves of *Z. mauritiana* are cooked as a vegetable and also serve as fodder.

Properties The bark of several *Ziziphus* species is rich in cyclopeptide alkaloids. Ethanolic extracts of the aerial parts of *Z. oenoplia* exhibit hypotensive effect and also low diuretic activity. Betulinic acid appears to be responsible for some of the medicinal properties of its root bark.

In order to support its use in traditional medicine for the treatment of nephritis, *Z. jujuba* was subjected to both in-vitro and in-vivo testing. Intraperitoneal injection in rats and in-vitro tests with endothelial cells and kidney homogenates revealed stimulatory effects on nitric oxide release. This may well contribute to the hypotensive effect and antinephretic action, possibly by increasing renal bloodflow. In a behavioural evaluation test with mice, an orally administered ethanol extract of *Z. jujuba* seeds revealed an anxiolytic effect at lower dose and a sedative effect at higher dose. A decoction of dried *Z. jujuba* leaves showed antihyperglycaemic activity in rats.

Botany Deciduous or evergreen lianas, shrubs or small to medium-sized trees. Leaves alternate, simple, entire or serrate to crenate, generally 3-veined from the base; stipules caducous or transformed into spines. Inflorescence a small axillary fascicle or umbel-like cyme, rarely an axillary or terminal thyrse. Flowers bisexual, 5-merous; calyx shortly funnel-shaped, often deeply cleft; petals free, small, rarely absent, hooded, shortly clawed, yellowish to greenish; disk fleshy, 5–10-lobed; stamens before the petals; ovary semi-inferior, 2–3(–4)-celled, styles 2–4. Fruit a fleshy to almost dry, 1-seeded drupe. Seed nearly plano-convex. Seedling with epigeal germination; cotyledons fleshy; hypocotyl elongated; first leaves opposite or whorled, subsequent ones alternate, conduplicate.

The nectar produced by the disk and the fragrance of the flowers attract insects. Flowers are protandrous. The fruits are dispersed by mammals and birds.

Ecology *Ziziphus* is generally found at low elevations, up to 1000 m altitude, in primary as well as secondary forest.

Management *Ziziphus* can be propagated by seed and by transplanting root suckers; propagation by cuttings failed. Grafting is used for cultivars of *Z. mauritiana* for fruit production.

Genetic resources *Ziziphus* species such as *Z. angustifolia* are relatively widespread, and are usually common and cannot be considered threatened. However, some species are restricted in

their distribution, and may be threatened with continued habitat degradation.

Prospects Little is known on the pharmacological properties of *Ziziphus*. Further research is needed to corroborate its traditional uses, such as in poulticing and to aid digestion.

Literature 181, 477, 671, 726, 883, 967.

Selection of species

Ziziphus angustifolia (Miq.) Hatus. ex v. Steenis

Nova Guinea 3: 13 (1960).

Synonyms *Ziziphus inermis* Merr. (1906), *Ziziphus forbesii* Baker f. (1923), *Ziziphus grewioides* (Warb.) L.M. Perry ex v. Steenis (1954).

Vernacular names Malaysia: kayu labu (Kadazan, Sabah), pasil-pasil (Bajau, Sabah). Papua New Guinea: manenea (Noupan, Buka Island, North Solomons Province). Philippines: ligaa (Bikol, Tagalog).

Distribution India, Burma (Myanmar), Thailand, throughout Malesia (except for Java and the Lesser Sunda Islands) and the Solomon Islands.

Ziziphus angustifolia (Miq.) Hatus. ex v. Steenis – 1, flowering twig; 2, flower; 3, fruit.

Uses In Papua New Guinea the scraped root barks of *Z. angustifolia* and a *Licuala* species are chewed with betel nut (*Areca catechu* L.) and lime. This is a powerful long-lasting means of contraconception for women.

Observations A small to medium-sized tree up to 30 m tall, bole up to 40 cm in diameter, branches unarmed; leaves oblong-elliptical to oblong-ovate, 12–20(–30) cm × 3–7 cm, base obtuse to acute, apex acute to acuminate, finely serrate, chartaceous to subcoriaceous; inflorescence an axillary branched cyme up to 3 cm long; flowers 4–6 mm in diameter, greenish to yellowish; fruit a globose to obovoid drupe 1–2 cm in diameter. *Z. angustifolia* occurs in primary and secondary forests up to 600 m altitude.

Selected sources 347, 460, 877, 883.

Ziziphus elegans Wallich

Roxb., Fl. ind. 2: 366 (1824).

Distribution Peninsular Malaysia and Sumatra.

Uses In Peninsular Malaysia a decoction of the root bark was used as a remedy for fever.

Observations A slender shrub with climbing branches, nearly unarmed; leaves ovate, 5–7.5 cm × 2–3 cm, base rounded, apex bluntly acuminate, minutely serrate, membranous; inflorescence a dichotomous, spreading cyme c. 1.5 cm long, pubescent; flowers c. 2.5 mm in diameter, white; fruit a subglobular compressed drupe c. 8 mm in diameter. *Z. elegans* occurs in open forest and on river banks at low elevations.

Selected sources 121, 731, 789.

Titi Juhaeti

3 Medicinal and poisonous plants with other primary use

List of species in other commodity groups (parenthesis), which are used also as medicinal and poisonous plant. Synonyms in the indented lines.

Abelmoschus esculentus (L.) Moench (vegetables)
    Hibiscus esculentus L.
Abelmoschus manihot (L.) Medikus (vegetables)
    Hibiscus manihot L.
Abelmoschus moschatus Medikus (essential-oil plants)
    Hibiscus abelmoschus L.
Abroma augusta (L.) L.f. (fibre plants)
Acacia catechu (L.f.) Willd. (dye and tannin-producing plants, timber trees)
    Acacia chundra Willd.
Acacia farnesiana (L.) Willd. (essential-oil plants)
    Acacia smallii Isely
    Mimosa farnesiana L.
    Vachellia farnesiana (L.) Wight & Arnott
Acacia glauca (L.) Moench (auxiliary plants)
    Acacia villosa (Sw.) Willd.
    Acaciella villosa (Sw.) Britton & Rose
    Mimosa glauca L.
Acacia leucophloea (Roxb.) Willd. (dye and tannin-producing plants, timber trees)
    Acacia melanochaetes Zoll.
    Delaportea ferox Gagnep.
    Delaportea microphylla Gagnep.
    Mimosa leucophloea Roxb.
Acacia nilotica (L.) Willd. ex Del. (dye and tannin-producing plants)
    Acacia arabica (Lamk) Willd.
Acacia tomentosa Willd. (auxiliary plants)
    Mimosa tomentosa (Willd.) Rottler
    Acacia chrysocoma Miq.
Acetabularia major G. Martens (cryptogams: algae)
    Acetabularia crenulata J.V. Lamour. var. *major* Sond.
    Acetabularia denudata Zanardini
    Acetabularia gigas Solms
Acronychia pedunculata (L.) Miq. (timber trees)
    Acronychia arborea Blume
    Acronychia laurifolia Blume
    Acronychia resinosa J.R. Forster ex Crevost & Lemarié
Acrostichum aureum L. (cryptogams: ferns and fern allies)

Actinodaphne moluccana Blume (timber trees)
Actinodaphne sesquipedalis (Wallich ex O. Kuntze) Hook.f. & Thomson ex Meissner (timber trees)
Laurus sesquipedalis Wallich ex O. Kuntze
Actinoscirpus grossus (L.f.) Goetgh. & D.A. Simpson (fibre plants)
Adenanthera intermedia Merr. (timber trees)
Adenanthera pavonina L. (timber trees)
Adenanthera gersenii Scheffer
Aegle marmelos (L.) Correa (edible fruits and nuts)
Aeschynomene afraspera J. Léonard (auxiliary plants)
Aeschynomene aspera auct. non L.
Sesbania leptocarpa auct. non DC.
Ageratina riparia (Regel) R.M. King & H. Robinson (auxiliary plants)
Eupatorium harrisii Urban
Eupatorium riparium Regel
Aglaia odoratissima Blume (essential-oil plants)
Aglaia affinis Merr.
Aglaia diepenhorstii Miq.
Aglaia heterophylla Merr.
Ailanthus excelsa Roxb. (auxiliary plants)
Pongelion excelsum (Roxb.) Pierre
Pongelion wightii van Tiegh.
Alangium salvifolium (L.f.) Wangerin (timber trees)
Alangium hexapetalum Lamk
Alangium lamarckii Thwaites
Alangium sundanum Miq.
Albizia lebbekoides (DC.) Benth. (dye and tannin-producing plants, timber trees)
Pithecolobium myriophyllum Gagnep.
Albizia procera (Roxb.) Benth. (timber trees, auxiliary plants)
Acacia procera (Roxb.) Willd.
Mimosa elata Roxb.
Mimosa procera Roxb.
Albizia saponaria (Lour.) Blume ex Miq. (timber trees)
Albizia nediana Kosterm.
Albizia tomentella Miq. var. *salajeriana* (Miq.) Koord.
Aleurites moluccana (L.) Willd. (spices)
Aleurites triloba J.R. Forster & J.G. Forster
Jatropha moluccana L.
Juglans camirium Lour.
Allophyllus cobbe (L.) Raeuschel (timber trees)
Allophyllus dimorphus Radlk.
Allophyllus fulvenervis (Blume) Blume
Allophyllus grossedentatus (Turcz.) Fern.-Vill.
Alpinia globosa (Lour.) Horan. (spices)
Amomum globosum Lour.
Alstonia pneumatophora Backer ex den Berger (timber trees)
Altinga excelsa Noroña (timber trees)
Alysicarpus vaginalis (L.) DC. (forages)

Alysicarpus nummularifolius (Willd.) DC.
Hedysarum vaginale L.
Amomum aromaticum Roxb. (spices)
Geocallis fasciculata Horan.
Amomum compactum Soland. ex Maton (spices)
Amomum cardamomum auct. non L.
Amomum kepulaga Sprague & Burkill
Amomum subulatum Roxb. (spices)
Cardamomum subulatum (Roxb.) O. Kuntze
Ampelopteris prolifera (Retz.) Copel. (cryptogams: ferns and fern allies)
Anabaena azollae Strasb. ex Wittr. (cryptogams: algae)
Anabaena oscillarioides Bory ex Bornet & Flahault
Anabaena variabilis status *azolla* Fjerd.
Anacardium occidentale L. (edible fruits and nuts)
Andira inermis (W. Wright) DC. (auxiliary plants)
Andira jamaicensis (W. Wright) Urban
Andira excelsa Kunth
Anethum graveolens L. (spices)
Anethum sowa Roxb. ex Fleming
Peucedanum graveolens (L.) Hiern
Peucedanum sowa (Roxb. ex Fleming) Kurz
Angiopteris evecta (G. Forster) Hoffmann (cryptogams: ferns and fern allies)
Anisophyllea disticha (Jack) Baillon (timber trees)
Annona cherimola Miller (edible fruits and nuts)
Annona glabra L. (edible fruits and nuts)
Annona palustris L.
Annona purpurea Sessé & Moc. ex Dunal (edible fruits and nuts)
Annona reticulata L. (edible fruits and nuts)
Annona squamosa L. (edible fruits and nuts)
Anodendron oblongifolium Hemsl. (fibre plants)
Anodendron paniculatum A.DC. (fibre plants)
Anogeissus latifolia (Roxb. ex DC.) Wallich ex Guill. & Perr. (timber trees)
Conocarpus latifolia Roxb. ex DC.
Anthocephalus chinensis (Lamk) A. Rich. ex Walpers (timber trees)
Anthocephalus cadamba (Roxb.) Miq.
Anthocephalus indicus A. Rich.
Neolamarckia cadamba (Roxb.) Bosser
Anthocephalus macrophyllus (Roxb.) Havil. (timber trees)
Bancalus macrophyllus (Roxb.) O. Kuntze
Nauclea macrophylla Roxb.
Neolamarckia macrophylla (Roxb.) Bosser
Anthriscus cerefolium (L.) G.F. Hoffmann (spices)
Anthriscus longirostris Bertol.
Chaerefolium cerefolium (L.) Schinz & Thell.
Scandix cerefolium L.
Antidesma bunius (L.) Sprengel (edible fruits and nuts, timber trees)
Antidesma dallachyanum Baillon
Antidesma rumphii Tulasne
Stilago bunius L.

Antidesma ghaesembilla Gaertner (edible fruits and nuts)
Aphanamixis polystachya (Wallich) R.N. Parker (timber trees)
Amoora aphanamixis Schultes & Schultes f.
Aphanamixis cumingiana (C.DC.) Harms
Aphanamixis grandifolia Blume
Aphanamixis rohituka (Roxb.) Pierre
Apium graveolens L. (vegetables)
Apium dulce Miller
Apium lusitanicum Miller
Apium rapaceum Miller
Aquilaria crassna Pierre ex H. Lecomte (essential-oil plants)
Aquilaria agallocha auct. non Roxb.
Aquilaria malaccensis Lamk (essential-oil plants)
Agallochum malaccense (Lamk) O. Kuntze
Aquilaria agallocha Roxb.
Aquilariella malaccensis (Lamk) v. Tiegh.
Archidendron bubalinum (Jack) I.C. Nielsen (timber trees)
Cylindrokelupha bubalina (Jack) Kosterm.
Ortholobium bubalinum (Jack) Kosterm.
Pithecellobium bubalinum (Jack) Benth.
Archidendron clypearia (Jack) I.C. Nielsen (timber trees)
Abarema clypearia (Jack) Kosterm.
Pithecellobium angulatum Benth.
Pithecellobium clypearia (Jack) Benth.
Archidendron ellipticum (Blume) I.C. Nielsen (timber trees)
Abarema elliptica (Blume) Kosterm.
Pithecellobium ellipticum (Blume) Hassk.
Pithecellobium waitzii Kosterm.
Archidendron jiringa (Jack) Nielsen (timber trees, vegetables)
Pithecellobium jiringa (Jack) Prain
Pithecellobium lobatum Benth.
Zygia jiringa (Jack) Kosterm.
Archidendron microcarpum (Benth.) I.C. Nielsen (timber trees)
Abarema microcarpa (Benth.) Kosterm.
Pithecellobium microcarpum Benth.
Ardisia elliptica Thunberg (vegetables)
Ardisia littoralis Andr.
Ardisia squamulosa Presl (spices)
Ardisia boissieri A.DC.
Ardisia drupacea (Blanco) Merr.
Ardisia humilis auct. non Vahl
Areca catechu L. (stimulants)
Arenga pinnata (Wurmb) Merr. (plants yielding non-seed carbohydrates)
Arenga saccharifera Labill.
Argusia argentea (L.f.) Heine (vegetables)
Messerschmidia argentea (L.f.) Johnston
Tournefortia argentea L.f.
Armoracia rusticana P.G. Gaertner (spices)
Armoracia lapathifolia Gilibert

Cochlearia armoracia L.
Nasturtium armoracia (L.) Fries
Artemisia dracunculus L. (spices)
Artemisia inodora Willd.
Artemisia redowskyi Ledeb.
Oligosporus condimentarius Cass.
Artocarpus altilis (Parkinson) Fosberg (edible fruits and nuts)
Artocarpus camansi Blanco
Artocarpus communis J.R. Forster & J.G. Forster
Artocarpus blancoi (Elmer) Merr. (timber trees)
Artocarpus communis J.R. Forster & J.G. Forster var. *blancoi* Elmer
Artocarpus dadah Miq. (timber trees)
Artocarpus inconstantissimus (Miq.) Miq.
Artocarpus rufescens Miq.
Artocarpus tampang Miq.
Artocarpus elasticus Reinw. ex Blume (fibre plants)
Artocarpus fretessii Teijsm. & Binnend. (timber trees)
Artocarpus dasyphyllus Miq.
Artocarpus leytensis Elmer
Artocarpus paloensis Elmer
Artocarpus gomezianus Wallich ex Trécul (timber trees)
Artocarpus masticatus Gagnep.
Artocarpus petiolaris Miq.
Artocarpus pomiformis Teijsm. & Binnend.
Artocarpus heterophyllus Lamk (edible fruits and nuts)
Artocarpus brasiliensis Gomez
Artocarpus maxima Blanco
Artocarpus philippensis Lamk
Artocarpus horridus Jarrett (timber trees)
Artocarpus communis J.R. Forster & J.G. Forster var. *pungens* J.J. Smith ex K. Heyne
Artocarpus lowii King (timber trees)
Artocarpus nitidus Trécul (edible fruits and nuts)
Artocarpus borneensis Merr.
Artocarpus eberhardtii Gagnep.
Artocarpus griffithii (King) Merr.
Artocarpus humilis Becc.
Artocarpus lingnanensis Merr.
Artocarpus parva Gagnep.
Artocarpus sampor Gagnep.
Artocarpus ovatus Blanco (timber trees)
Artocarpus acuminatissimus Merr.
Artocarpus cumingiana Trécul
Artocarpus rubrovenius Warb. (timber trees)
Arundo donax L. (fibre plants)
Asparagopsis taxiformis (Delile) Trevis. (cryptogams: algae)
Asparagopsis delile Mont.
Falkenbergia hildebrandii (Bornet) Falkenb.
Fucus taxiformis Delile

Asparagus cochinchinensis (Lour.) Merr. (plants yielding non-seed carbohydrates)
Asparagus lucidus Lindley
Melanthium cochinchinense Lour.
Asparagus racemosus Willd. (plants yielding non-seed carbohydrates)
Asparagopsis javanica Kunth
Asparagopsis schoberioides Kunth
Asparagus dubius Decne.
Atuna racemosa Raf. (timber trees)
Atuna elata (King) Kosterm.
Atuna excelsa (Jack) Kosterm.
Cyclandrophora excelsa (Jack) Kosterm.
Parinari glaberrimum (Hassk.) Hassk.
Averrhoa bilimbi L. (edible fruits and nuts)
Averrhoa carambola L. (edible fruits and nuts)
Avicennia alba Blume (timber trees)
Avicennia marina (Forsk.) Vierh. var. *alba* (Blume) Bakh.
Avicennia officinalis L. var. *alba* (Blume) Hook. ex Jafri
Avicennia spicata Kunth
Avicennia officinalis L. (timber trees)
Avicennia obovata Griffith
Avicennia oepata Hamilton
Azadirachta excelsa (Jack) Jacobs (timber trees)
Azadirachta integrifolia Merr.
Melia excelsa Jack
Azadirachta indica A.H.L. Juss. (timber trees, auxiliary plants)
Antelaea azadirachta (L.) Adelb.
Melia azadirachta L.
Melia indica (A.H.L. Juss.) Brandis
Baccaurea brevipes Hook.f. (edible fruits and nuts, timber trees)
Backhousia citriodora F. v. Mueller (essential-oil plants)
Balanophora elongata Blume (plants producing exudates)
Balanophora ungeriana Valeton
Balanophora fungosa J.R. Forster & J.G. Forster (plants producing exudates)
Balanophora gigantea Wallich ex Fawe
Balanophora globosa Jungh.
Balanophora indica (Arnott) Griffith
Bambusa bambos (L.) Voss (bamboos)
Arundo bambos L.
Bambusa arundinacea (Retz.) Willd.
Bambusa spinosa Roxb.
Bambusa tuldoides Munro (bamboos)
Bambusa longiflora W.T. Lin
Bambusa pallescens (Doell) Hackel
Bambusa ventricosa McClure
Barringtonia calyptrata (Miers) R.Br. ex F.M. Bailey (timber trees)
Barringtonia flava Lauterb.
Barringtonia scortechinii King (timber trees, spices)
Basella alba L. (vegetables)

Basella cordifolia Lamk
Basella lucida L.
Basella rubra L.
Bauhinia bidentata Jack (fibre plants)
Bauhinia malabarica Roxb. (timber trees)
Piliostigma acidum (Reinw. ex Korth.) Benth.
Piliostigma malabaricum (Roxb.) Benth.
Bauhinia scandens L. (fibre plants)
Bauhinia vahlii Wight & Arnott (dye and tannin-producing plants)
Benincasa hispida (Thunberg ex Murray) Cogniaux (vegetables)
Benincasa cerifera Savi
Cucurbita hispida Thunberg ex Murray
Berrya cordifolia Roxb. (timber trees)
Berrya ammonilla Roxb.
Beta vulgaris L. (vegetables)
Betaphycus gelatinus (Esper) Doty ex P.C. Silva (cryptogams: algae)
Euchema gelatinum (Esper) J. Agardh
Fucus gelatinus Esper
Sphaerococcus gelatinus (Esper) C. Agardh
Bixa orellana L. (dye and tannin-producing plants)
Boehmeria nivea (L.) Gaudich. (fibre plants)
Boesenbergia rotunda (L.) Mansfeld (spices)
Boesenbergia pandurata (Roxb.) Schlechter
Curcuma rotunda L.
Gastrochilus pandurata (Roxb.) Ridley
Kaempferia pandurata Roxb.
Borago officinalis L. (spices)
Borassus flabellifer L. (plants yielding non-seed carbohydrates)
Borassus flabelliformis L.
Brassica nigra (L.) W.D.J. Koch (vegetables, spices)
Brassica sinapoides Roth
Sinapis nigra L.
Sisymbrium nigrum (L.) Prantl
Bridelia stipularis (L.) Blume (dye and tannin-producing plants)
Bridelia tomentosa Blume (timber trees)
Bridelia glabrifolia Merr.
Bridelia lancifolia Roxb.
Bridelia monoica Merr.
Broussonetia papyrifera (L.) L'Hér. ex Vent. (fibre plants)
Bruguiera gymnorhiza (L.) Savigny (dye and tannin-producing plants, timber trees)
Bruguiera rheedii Blume
Bruguiera conjugata Merr.
Bruguiera sexangula (Lour.) Poiret (timber trees, auxiliary plants)
Bruguiera eriopetala Wight & Arnott ex Arnott
Rhizophora sexangula Lour.
Buchanania arborescens (Blume) Blume (timber trees)
Buchanania florida Schauer
Buchanania lucida Blume

Buchanania platyphylla Merr.
Buchanania latifolia Roxb. (edible fruits and nuts)
Buchanania lanzan Sprengel
Cajanus cajan (L.) Millsp. (pulses)
Cajanus indicus Sprengel
Cytisus cajan L.
Calamus castaneus Becc. (rattans)
Calamus javensis Blume (rattans)
Calamus filiformis Becc.
Calamus longispathus Ridley (rattans)
Calamus ornatus Blume (rattans)
Calathea allouia (Aublet) Lindley (plants yielding non-seed carbohydrates)
Curcuma americana Lamk
Maranta allouia Aublet
Callerya atropurpurea (Wallich) Schot (timber trees)
Adinobotrys atropurpurea (Wallich) Dunn
Millettia atropurpurea (Wallich) Benth.
Whitfordiodendron pubescens (Craib) Burkill
Callicarpa arborea Roxb. (timber trees)
Callicarpa magna Schauer
Callicarpa tomentosa auct. non (L.) Murr.
Caloglossa leprieurii (Mont.) G. Martens (cryptogams: algae)
Caloglossa leprieurii var. *hookeri* E. Post
Caloglossa mnioides Harv. ex J. Agardh
Delesseria leprieurii Mont.
Calophyllum calaba L. (timber trees)
Calophyllum canum Hook.f. (timber trees)
Calophyllum borneense Vesque
Calophyllum dioscurii P.F. Stevens (timber trees)
Calophyllum pisiferum Planchon & Triana (timber trees)
Calophyllum retusum auct. non Wallich ex Choisy
Calophyllum rubiginosum M.R. Henderson & Wyatt-Smith (timber trees)
Calophyllum muscigerum Boerl. & Koord. ex K. Heyne
Camellia sasanqua Thunberg ex Murray (vegetable oils and fats)
Sasanqua vulgaris Nees
Thea sasanqua (Thunberg ex Murray) Cels
Cananga odorata (Lamk) Hook.f. & Thomson (essential-oil plants)
Cananga scortechinii King
Canangium odoratum (Lamk) Baillon
Uvaria odorata Lamk
Canarium hirsutum Willd. (timber trees, plants producing exudates)
Canarium hispidum Blume
Canarium multipinnatum Llanos
Canarium subcordatum Ridley
Canarium luzonicum (Blume) A. Gray (timber trees, plants producing exudates)
Canarium carapifolium Perkins
Canarium oliganthum Merr.
Canarium polyanthum Perkins

Canarium oleosum (Lamk) Engl. (timber trees)
Canarium laxiflorum Decne.
Canarium microcarpum Willd.
Canarium pilosum Bennett (edible fruits and nuts, timber trees)
Canarium grandiflorum Bennett
Canarium hirtellum Bennett
Canarium motleyanum Engl.
Canarium pimela Leenh. (edible fruits and nuts)
Pimela nigra Lour.
Canarium vulgare Leenh. (timber trees, plants producing exudates)
Canarium commune L.
Canavalia ensiformis (L.) DC. (forages)
Canavalia gladiata (Jacq.) DC. var. *ensiformis* (L.) Benth.
Dolichos ensiformis L.
Canavalia gladiata (Jacq.) DC. (vegetables)
Canavalia ensiformis auct. non (L.) DC.
Canavalia ensiformis (L.) DC. var. *gladiata* (Jacq.) O. Kuntze
Dolichos gladiatus Jacq.
Canavalia maritima (Aublet) du Petit-Thouars (auxiliary plants)
Canavalia obtusifolia (Lamk) DC.
Canavalia rosea (Sw.) DC.
Dolichos maritimus Aublet
Canna indica L. (plants yielding non-seed carbohydrates)
Canna coccinea P. Miller
Canna edulis Ker Gawl.
Canna orientalis Roscoe
Capparis spinosa L. (spices)
Capparis cordifolia Lamk
Capparis mariana Jacq.
Capparis sandwichiana DC.
Careya arborea Roxb. (timber trees)
Carica papaya L. (edible fruits and nuts)
Carissa carandas L. (edible fruits and nuts)
Carissa congesta Wight
Carthamus tinctorius L. (vegetable oils and fats)
Carum carvi L. (spices)
Carum velenovskyi Rohlena
Casearia grewiaefolia Vent. (timber trees)
Casearia hexagona Decne.
Casearia laurina Blume
Casearia leucolepis Turcz.
Casimiroa edulis Llave & Lex. (edible fruits and nuts)
Cassia auriculata L. (dye and tannin-producing plants)
Cassia densistipulata Taubert
Cassia obtusifolia L. (vegetables)
Castanospermum australe A. Cunn. & C. Fraser ex Hook. (timber trees)
Castanospermum cunninghamii J. Wood
Casuarina equisetifolia L. (timber trees, auxiliary plants)
Casuarina equisetifolia J.R. Forster & J.G. Forster

Casuarina litorea L.
Casuarina muricata Roxb.
Caulerpa lentillifera J. Agardh (cryptogams: algae)
Caulerpa kilneri J. Agardh
Caulerpa longistipitata (Weber Bosse) Sved.
Caulerpa racemosa (Forssk.) J. Agardh (cryptogams: algae)
Caulerpa clavifera (Turner) C. Agardh
Caulerpa uvifera C. Agardh
Fucus racemosus Forssk.
Caulerpa sertularioides (S.G. Gmelin) M. Howe (cryptogams: algae)
Caulerpa plumaris Forssk
Fucus sertularioides S.G. Gmelin
Caulerpa taxifolia (Vahl) C. Agardh (cryptogams: algae)
Fucus taxifolius Vahl
Ceiba pentandra (L.) Gaertner (fibre plants)
Celtis latifolia (Blume) Planchon (timber trees)
Celtis kajewskii Merr. & L.M. Perry
Celtis zippelii (Blume) Planchon
Solenostigma latifolium Blume
Celtis philippensis Blanco (timber trees)
Celtis collinsae Craib
Celtis strychnoides Planchon
Celtis wightii Planchon
Celtis timorensis Spanoghe (timber trees)
Celtis cinnamomea Lindley ex Planchon
Celtis crenato-serrata Merr.
Celtis waitzii Blume
Ceratopteris thalictroides (L.) Brongn. (cryptogams: ferns and fern allies)
Cerbera floribunda K. Schumann (timber trees)
Ceriops tagal (Perr.) C.B. Robinson (dye and tannin-producing plants)
Ceriops candolleana Arnott
Chaetomorpha crassa (C. Agardh) Kütz. (cryptogams: algae)
Conferva crassa C. Agardh
Chamaecrista mimosoides (L.) E. Greene (auxiliary plants)
Cassia angustissima Lamk
Cassia mimosoides L.
Cassia procumbens auct. non L.
Champereia manillana (Blume) Merr. (vegetables)
Champereia griffithii Planchon ex Kurz
Cheilanthes tenuifolia (Burm.f.) Sw. (cryptogams: ferns and fern allies)
Chisocheton cumingianus (C.DC) Harms (vegetable oils and fats, timber trees)
Chisocheton morobeanus Harms
Chisocheton paniculatus Hiern
Chisocheton thorelli Pierre
Chisocheton macrophyllus King (vegetable oils and fats, timber trees)
Chisocheton pentandrus (Blanco) Merr. (vegetable oils and fats, timber trees)
Chisocheton beccarianus (Baillon) Harms
Chisocheton microcarpus Koord. & Valeton
Chisocheton spicatus Hiern

Chloranthus erectus (Buch.-Ham.) Verdc. (stimulants)
Chloranthus elatior Link
Chloranthus officinalis Blume
Cryphaea erecta Buch.-Ham.
Chloranthus spicatus (Thunberg) Makino (stimulants, essential-oil plants)
Chloranthus inconspicuus Sw.
Chloranthus indicus Wight
Chloranthus obtusifolius Miq.
Chromolaena odorata (L.) R.M. King & H. Robinson (auxiliary plants)
Eupatorium conyzoides Vahl
Eupatorium odoratum L.
Osmia odorata (L.) Schultz-Bip.
Chrysanthemum coronarium L. (vegetables)
Chrysanthemum spatiosum L.H. Bailey
Matricaria coronaria (L.) Desr.
Pinardia coronaria Lessing
Chrysobalanus icaco L. (edible fruits and nuts)
Chrysophyllum cainito L. (edible fruits and nuts, timber trees)
Chukrasia tabularis A.H.L. Juss. (timber trees)
Chickrassia tabularis (A.H.L. Juss.) A.H.L. Juss.
Chukrasia velutina (Wallich) Roemer
Cibotium barometz (L.) J. Smith (cryptogams: ferns and fern allies)
Cinnamomum camphora (L.) J.S. Presl (essential-oil plants)
Laurus camphora L.
Cinnamomum celebicum Miq. (timber trees)
Cinnamomum culitlawan (L.) Kosterm. (spices)
Cinnamomum culilaban (L.) J.S. Presl
Cinnamomum culilawan (Roxb.) J.S. Presl
Laurus culitlawan L.
Cinnamomum eugenoliferum Kosterm. (timber trees)
Cinnamomum gigaphyllum Kosterm.
Cinnamomum hentyi Kosterm.
Cinnamomum grandiflorum Kosterm. (timber trees)
Cinnamomum massoia Schewe
Cinnamomum iners Reinw. ex Blume (timber trees)
Cinnamomum eucalyptoides T. Nees
Cinnamomum nitidum Blume
Cinnamomum paraneuron Miq.
Cinnamomum javanicum Blume (timber trees)
Cinnamomum neglectum Blume
Cinnamomum sulphuratum C. Nees
Cinnamomum mercadoi S. Vidal (timber trees)
Cinnamomum mollissimum Hook.f. (timber trees)
Cinnamomum pendulum Cammerl. (timber trees)
Cinnamomum endlicheriaecarpum Kosterm.
Cinnamomum porrectum (Roxb.) Kosterm. (timber trees)
Cinnamomum glanduliferum C. Nees
Cinnamomum parthenoxylon (Jack) C. Nees
Cinnamomum sumatranum (Miq.) Meissner

Cinnamomum rhynchophyllum Miq. (spices)
Cinnamomum lampongum Miq.
Cinnamomum sintoc Blume (timber trees)
Cinnamomum calophyllum Reinw. ex C. Nees
Cinnamomum camphoratum Blume
Cinnamomum cinereum Gamble
Cinnamomum verum J.S. Presl (spices)
Cinnamomum zeylanicum Blume
Laurus cinnamomum L.
Cissus javana DC. (vegetables)
Cissus discolor Blume
Vitis discolor (Blume) Dalz.
Cissus repens Lamk (vegetables)
Vitis quadricornuta Miq.
Vitis repens Wight & Arnott
×*Citrofortunella microcarpa* (Bunge) Wijnands (edible fruits and nuts)
×*Citrofortunella mitis* (Blanco) J. Ingram & H.E. Moore
Citrus microcarpa Bunge
Citrus mitis Blanco
Citrullus lanatus (Thunberg) Matsum. & Nakai (vegetables)
Citrullus vulgaris Schrader ex Ecklon & Zeyher
Colocynthis citrullus (L.) O. Kuntze
Momordica lanata Thunberg
Citrus aurantifolia (Christm. & Panzer) Swingle (edible fruits and nuts)
Citrus javanica Blume
Citrus notissima Blanco
Limonia aurantifolia Christm. & Panzer
Citrus aurantium L. (edible fruits and nuts)
Citrus hystrix DC. (edible fruits and nuts)
Citrus limon (L.) Burm.f. (edible fruits and nuts)
Citrus maxima (Burm.) Merr. (edible fruits and nuts)
Citrus aurantium L. var. *grandis* L.
Citrus decumana L.
Citrus grandis (L.) Osbeck
Citrus medica L. (edible fruits and nuts)
Citrus aurantium L. var. *medica* Wight & Arnott
Citrus crassa Hassk.
Claoxylon indicum (Reinw. ex Blume) Hassk. (spices)
Claoxylon polot Merr.
Erytrochilus indicus Reinw. ex Blume
Clausena anisum-olens (Blanco) Merr. (essential-oil plants)
Clausena laxiflora Quis. & Merr.
Clausena sanki (Perr.) Molino
Cookia anisum-olens Blanco
Clibadium surinamense L. (auxiliary plants)
Baillieria aspera Aubl.
Clibadium asperum (Aubl.) DC.
Clibadium surinamense L. var. *asperum* (Aubl.) Baker
Clitoria ternatea L. (forages)

Clitoria mearnsii De Wild.
Clitoria tanganicensis Micheli
Clitoria zanzibarensis Vatke
Coccinia grandis (L.) Voigt (vegetables)
Bryonia grandis L.
Coccinia cordifolia auct. non (L.) Cogn.
Coccinia indica Wight & Arnott
Cocos nucifera L. (vegetable oils and fats)
Cocos nana Griffith
Coix lacryma-jobi L. (cereals)
Coix agrestis Lour.
Coix arundinacea Lamk
Coix lacryma L.
Corchorus aestuans L. (fibre plants)
Corchorus capsularis L. (fibre plants)
Cordia alliodora (Ruiz & Pavón) Oken (auxiliary plants)
Cerdana alliodora Ruiz & Pavón
Cordia cerdana (Ruiz & Pavón) Roemer & Schultes
Lithocardium alliodorum (Ruiz & Pavón) O. Kuntze
Coriandrum sativum L. (spices)
Coriandrum diversifolium Gilib.
Coriandrum globosum Salisb.
Coriandrum majus Gouan
Coriandrum testiculatum Lour. non L.
Corymbia citriodora (Hook.) K.D. Hill & L.A.S. Johnson (essential-oil plants)
Eucalyptus citriodora Hook.
Eucalyptus maculata Hook. var. *citriodora* (Hook.) Bailey
Eucalyptus melissiodora Lindley
Corypha utan Lamk (plants yielding non-seed carbohydrates)
Corypha elata Roxb.
Corypha gembanga (Blume) Blume
Cosmos caudatus Kunth (vegetables)
Cosmos bipinnatus Ridley non Cav.
Costus speciosus (Koenig) J.E. Smith (plants yielding non-seed carbohydrates)
Banksia speciosa Koenig
Costus nepalensis Roscoe
Costus sericeus Blume
Crocus sativus L. (dye and tannin-producing plants)
Crotalaria incana L. (auxiliary plants)
Crotalaria pubescens Moench
Crotalaria laburnifolia L. (auxiliary plants)
Crotalaria pallida Aiton (auxiliary plants)
Crotalaria mucronata Desv.
Crotalaria siamica Williams
Crotalaria striata DC.
Crotalaria quinquefolia L. (auxiliary plants)
Crotalaria heterophylla L.f.
Crotalaria retusa L. (auxiliary plants)
Crotalaria spectabilis Roth (auxiliary plants)

Crotalaria sericea Retz. non Burm.f.
Crotalaria verrucosa L. (auxiliary plants)
Crotalaria caerulaea Jacq.
Cryptocarya massoy (Oken) Kosterm. (timber trees)
Cinnamomum massoy Oken
Cryptocarya aromatica (Becc.) Kosterm.
Cryptocarya novoguineensis Teschner
Cucumis sativus L. (vegetables)
Cuminum cyminum L. (spices)
Cuminum odorum Salisb.
Ligusticum cuminum (L.) Crantz
Curculigo latifolia Dryand. (fibre plants)
Cyamopsis tetragonoloba (L.) Taubert (auxiliary plants)
Cyamopsis psoraloides (Lamk) DC.
Cyanotis axillaris (L.) Sweet (cereals)
Amischophacelus axillaris (L.) Rolla Rao & Kammathy
Commelina axillaris L.
Tradescantia axillaris L.
Cycas rumphii Miq. (edible fruits and nuts)
Cycas circinalis L.
Cymbopogon citratus (DC.) Stapf (essential-oil plants)
Andropogon ceriferus Hackel
Andropogon citratus DC.
Andropogon nardus (L.) Rendle var. *ceriferus* Hackel
Cymbopogon flexuosus (Nees ex Steudel) J.F. Watson (essential-oil plants)
Andropogon flexuosus Nees ex Steudel
Andropogon nardus L. var. *flexuosus* (Nees ex Steudel) Hackel
Cymbopogon travancorensis Bor
Cymbopogon martini (Roxb.) J.F. Watson (essential-oil plants)
Andropogon martini Roxb.
Cymbopogon martini (Roxb.) J.F. Watson var. *motia* auct.
Cymbopogon motia Gupta
Cymbopogon winterianus Jowitt (essential-oil plants)
Cymbopogon nardus (L.) Rendle var. *mahapangiri* auct.
Cyperus pedunculatus (R.Br.) Kern (auxiliary plants)
Mariscus pedunculatus (R.Br.) Koyama
Remirea maritima Aubl.
Remirea pedunculata R.Br.
Cyrtandra pendula Blume (spices)
Cyrtosperma merkusii (Hassk.) Schott (plants yielding non-seed carbohydrates)
Cyrtosperma chamissonis (Schott) Merr.
Cyrtosperma edule Schott ex Seem.
Cyrtosperma lasioides Griffith
Dactyladenia barteri (Hook.f. ex Oliver) G.T. Prance & F. White (auxiliary plants)
Acioa barteri (Hook.f. ex Oliver) Engl.
Griffonia barteri Hook.f. ex Oliver
Daemonorops didymophylla Becc. (rattans)
Dalbergia parviflora Roxb. (essential-oil plants)

Dalbergia cumingiana Benth.
Dalbergia zollingeriana Miq.
Decaspermum parviflorum (Lamk) A.J. Scott (timber trees)
Decaspermum fruticosum auct. non J.R. Forster & J.G. Forster
Decaspermum paniculatum (Lindley) Kurz
Derris microphylla (Miq.) B.D. Jackson (auxiliary plants)
Brachypterum microphyllum Miq.
Deguelia microphylla (Miq.) Valeton
Derris dalbergioides Baker
Desmostachya bipinnata (L.) Stapf (auxiliary plants)
Eragrostis cynosuroides (Retz.) P. Beauv.
Pogonarthria bipinnata (L.) Chiov.
Stapfiola bipinnata (L.) O. Kuntze
Dichrostachys cinerea (L.) Wight & Arnott (timber trees)
Dicliptera laevigata (Vahl) Juss. (vegetables)
Dicliptera javanica Nees
Justicia laevigata Vahl
Dicranopteris linearis (Burm.f.) Underw. (cryptogams: ferns and fern allies)
Dictyopteris jamaicensis W.R. Taylor (cryptogams: algae)
Dictyosphaeria cavernosa (Forssk.) Børgesen (cryptogams: algae)
Dictyosphaeria favulosa (C. Agardh) Decne. ex Endl.
Ulva cavernosa Forssk.
Valonia favulosa C. Agardh
Digenea simplex (Wulfen) C. Agardh (cryptogams: algae)
Conferva simplex Wulfen
Digenia wulfenii Kütz.
Digitaria milanjiana (Rendle) Stapf (forages)
Digitaria endlichii Mez
Digitaria mombasana C.E. Hubbard
Digitaria polevansii Stent subsp. *peterana* Henrard
Digitaria setivalva Stent
Digitaria swynnertonii Rendle
Dillenia excelsa (Jack) Gilg (timber trees)
Wormia excelsa Jack
Wormia oblonga Wallich ex Hook.f. & Thomson
Wormia tomentella Martelli
Dillenia indica L. (timber trees)
Dillenia speciosa Thunberg
Dillenia obovata (Blume) Hoogl. (timber trees)
Dillenia aurea auct. non J.E. Smith
Dillenia ovata Wallich ex Hook.f. & Thomson (timber trees)
Dillenia pentagyna Roxb. (timber trees)
Dillenia baillonii Pierre ex Lanessan
Dillenia philippinensis Rolfe (timber trees)
Dillenia catmon Elmer
Dimocarpus longan Lour. (edible fruits and nuts)
Euphoria cinerea Radlk.
Euphoria gracilis Radlk.
Euphoria longana Lamk

Euphoria malaiensis Radlk.
Euphoria morigera Gagnep.
Euphoria nephelioides Radlk.
Euphoria scandens Winit & Kerr.
Nephelium longana Cambess.
Nephelium malaiense Griffith

Dioscorea esculenta (Lour.) Burkill (plants yielding non-seed carbohydrates)
Dioscorea aculeata L.
Dioscorea tiliifolia Kunth
Oncus esculentus Lour.

Dioscorea hispida Dennst. (plants yielding non-seed carbohydrates)
Dioscorea daemona Roxb.
Dioscorea hirsuta Dennst.
Dioscorea triphylla L.

Dioscorea laurifolia Wallich ex Hook.f. (plants yielding non-seed carbohydrates)

Dioscorea piscatorum Prain & Burkill (plants yielding non-seed carbohydrates)
Dioscorea borneensis R. Knuth

Dioscorea prainiana R. Knuth (plants yielding non-seed carbohydrates)
Dioscorea deflexa Hook.f. non Grisebach
Dioscorea maliliensis R. Knuth

Dioscorea pyrifolia Kunth (plants yielding non-seed carbohydrates)
Dioscorea diepenhorstii Miq.
Dioscorea oppositifolia auct.
Dioscorea zollingeriana Kunth

Dioscoreophyllum cumminsii (Stapf) Diels (spices)
Dioscoreophyllum lobatum Diels
Rhophalandria cumminsii Stapf
Rhophalandria lobatum C.H. Wright

Diospyros decandra Lour. (edible fruits and nuts)

Diospyros digyna Jacq. (edible fruits and nuts, timber trees)
Diospyros ebenaster Hiern non Retz.
Diospyros nigra (J.F. Gmelin) Perrottet

Diospyros ebenum Koenig (timber trees)
Diospyros glaberrima Rottb.

Diospyros kaki L.f. (edible fruits and nuts)

Diospyros lanceifolia Roxb. (timber trees)
Diospyros clavigera C.B. Clarke var. *pachyphylla* (C.B. Clarke) Ridley
Diospyros lucida Wallich ex A.DC.
Diospyros pachyphylla C.B. Clarke

Diospyros malabarica (Desr.) Kostel. (dye and tannin-producing plants, timber trees)
Diospyros embryopteris Pers. var. *siamensis* (Hochr.) Lecomte
Diospyros globularia (Miq) Koord. & Valeton
Diospyros glutinifera Roxb.
Diospyros peregrina Guerke
Diospyros siamensis Hochr.

Diospyros maritima Blume (timber trees)
Diospyros camarinensis Merr.

Diospyros laxa (R.Br.) Bailey
Diospyros liukiuensis Makino
Diospyros rufa King & Gamble (timber trees)
Diospyros toposia Buch.-Ham. (timber trees)
Diospyros collinsae Craib
Diospyros foveo-reticulata Merr.
Diospyros incisa Buch.-Ham. ex Wallich
Diploknema butyracea (Roxb.) H.J. Lam (vegetable oils and fats)
Aisandra butyracea (Roxb.) Baehni
Bassia butyracea Roxb.
Madhuca butyracea (Roxb.) J.F. Macbride
Dipteris conjugata Reinw. (cryptogams: ferns and fern allies)
Dipteryx odorata (Aublet) Willd. (spices)
Baryosma tonga Gaertner
Coumarouna odorata Aublet
Dipteryx tetraphylla Spruce ex Benth.
Dolichandrone spathacea (L.f.) K. Schumann (timber trees)
Donax canniformis (G. Forster) K. Schumann (fibre plants)
Dracontomelon dao (Blanco) Merr. & Rolfe (edible fruits and nuts, timber trees)
Dracontomelon edule (Blanco) Skeels
Dracontomelon mangiferum (Blume) Blume
Dracontomelon puberulum Miq.
Dracontomelon sylvestre Blume
Dryobalanops sumatrensis (J.F. Gmelin) Kosterm. (timber trees)
Dryobalanops aromatica Gaertner f.
Dryobalanops camphora Colebr.
Durio oxleyanus Griffith (timber trees)
Durio zibethinus Murray (edible fruits and nuts, timber trees)
Durio acuminatissima Merr.
Eclipta alba (L.) Hassk. (dye and tannin-producing plants)
Eclipta prostrata (L.) L.
Elaeagnus triflora Roxb. (edible fruits and nuts)
Elaeagnus philippensis Perr.
Eleiodoxa conferta (Griffith) Burret (edible fruits and nuts)
Salacca conferta Griffith
Eleocharis dulcis (Burm.f.) Trinius ex Henschel (plants yielding non-seed carbohydrates)
Eleocharis plantaginea Roemer & Schultes
Eleocharis tuberosa Roemer & Schultes
Heleocharis plantaginoidea W.F. Wight
Elettaria cardamomum (L.) Maton (spices)
Alpinia cardamomum (L.) Roxb.
Amomum cardamomum L.
Amomum repens Sonnerat
Eleusine coracana (L.) Gaertner (cereals)
Cynosurus coracan L.
Emilia sonchifolia (L.) DC. (vegetables)
Cacalia sonchifolia L.

Senecio sonchifolius (L.) Moench
Endospermum diadenum (Miq.) Airy Shaw (timber trees)
Endospermum beccarianum Pax & Hoffm.
Endospermum borneense Benth.
Endospermum malaccense Benth.
Endospermum moluccanum (Teijsm. & Binnend.) Kurz (timber trees)
Endospermum formicarum Becc.
Endospermum labios Schodde
Engelhardtia roxburghiana Lindley ex Wallich (timber trees)
Engelhardtia chrysolepis Hance
Engelhardtia polystachya Radlk.
Engelhardtia wallichiana Lindley ex C.DC.
Enhalus acoroides (L.f.) Royle (fibre plants)
Enydra fluctuans Lour. (vegetables)
Enydra longifolia (Blume) DC.
Enydra paludosa (Reinw.) DC.
Equisetum ramossissimum Desf. (cryptogams: ferns and fern allies)
Eriobotrya japonica (Thunberg) Lindley (edible fruits and nuts, timber trees)
Eruca sativa Miller (spices)
Brassica eruca L.
Eruca foetida Moench
Eruca vesicaria (L.) Cav. subsp. *sativa* (Miller) Thellung
Eryngium foetidum L. (spices)
Eryngium antihystericum Rottler
Erythrina poeppigiana (Walpers) O.F. Cook (auxiliary plants)
Erythrina micropteryx Poeppig ex Walpers
Micropteryx poeppigiana Walpers
Erythroxylum cuneatum (Miq.) Kurz (timber trees)
Erythroxylum burmanicum Griffith
Erythroxylum densinerve O.E. Schulz
Erythroxylum platyphyllum Merr.
Erythroxylum ecarinatum Burck (timber trees)
Erythroxylum salomonense C.T. White
Etlingera punicea (Roxb.) R.M. Smith (edible fruits and nuts)
Achasma coccineum (Blume) Valeton
Amomum coccineum (Blume) K. Schumann
Hornstedtia macrocheilus Ridley
Etlingera walang (Blume) R.M. Smith (spices)
Achasma walang (Blume) Valeton
Amomum walang (Blume) Valeton
Donacodes walang Blume
Eucalyptus camaldulensis Dehnh. (timber trees, auxiliary plants)
Eucalyptus rostrata Schlechtendal
Eugenia dombeyi (Sprengel) Skeels (edible fruits and nuts)
Eugenia brasiliensis Lamk non Aublet
Myrtus dombeyi Sprengel
Eugenia uniflora L. (edible fruits and nuts)
Eugenia michelii Lamk
Eupatorium chinense L. (spices)

Buphthalmum oleraceum Lour.
Eupatorium japonicum Thunberg ex Murray
Eurya acuminata DC. (auxiliary plants)
Eurya japonica auct. non Thunberg
Eurya monticola Ridley
Eurya wrayi King
Eusideroxylon zwageri Teijsm. & Binnend. (timber trees)
Bihania borneensis Meissner
Exocarpos latifolius R.Br. (essential-oil plants)
Exocarpos luzonensis (Presl) A.DC.
Exocarpos ovatus Blume
Xylophyllos latifolius (R.Br.) O. Kuntze
Fagraea berteriana A. Gray ex Benth. (timber trees)
Fagraea affinis S. Moore
Fagraea novae-guineae Cammerl.
Fagraea sair Gilg & Gilg-Ben.
Fagraea bodenii Wernham (timber trees)
Fagraea ampla S. Moore
Fagraea papuana Merr. & Perry
Fagraea suaveolens Cammerl.
Fagraea elliptica Roxb. (timber trees)
Fagraea javanensis (Blume) Bakh.f.
Fagraea speciosa (Blume) Blume
Fagraea sumatrana Miq.
Fagraea fragrans Roxb. (timber trees)
Fagraea cochinchinensis A. Chev.
Fagraea gigantea Ridley
Fagraea wallichiana Benth.
Fagraea racemosa Jack ex Wallich (timber trees)
Fagraea maingayi C.B. Clarke
Fagraea morindaefolia (Reinw.) Blume
Fagraea subreticulata Blume
Faidherbia albida (Del.) A.Chev. (auxiliary plants)
Acacia albida Del.
Ferula assa-foetida L. (spices)
Ferula pseudalliacea Rech.f.
Ferula rubicaulis Boissier
Narthex polakii Stapf & Wettst.
Fibraurea tinctoria Lour. (dye and tannin-producing plants)
Fibraurea chloroleuca Miers
Fibraurea trotteri Watt ex Diels
Ficus altissima Blume (fibre plants)
Ficus drupacea Thunberg (edible fruits and nuts, timber trees)
Ficus chrysochlamys Lauterb. & K. Schumann
Ficus chrysocoma Blume
Ficus payapa Blanco
Ficus pilosa Reinw. ex Blume
Ficus edelfeltii King (fibre plants)
Ficus minahassae (Teijsm. & de Vriese) Miq. (fibre plants)

Ficus montana Burm.f. (edible fruits and nuts)
Ficus quercifolia Roxb.
Ficus padana Burm.f. (plants producing exudates)
Ficus elegans Hassk.
Ficus toxicaria L.
Ficus pseudopalma Blanco (vegetables)
Ficus blancoi Elmer
Ficus racemosa L. (edible fruits and nuts, timber trees)
Ficus glomerata Roxb.
Ficus semicostata F.M. Bailey
Ficus vesca F. v. Mueller ex Miq.
Ficus retusa L. (plants producing exudates)
Ficus truncata Miq.
Ficus virgata Reinw. ex Blume (spices)
Ficus decaisneana Miq.
Ficus philippinensis Miq.
Ficus trymatocarpa Miq.
Fimbristylis umbellaris (Lamk) Vahl (fibre plants)
Finschia chloroxantha Diels (edible fruits and nuts)
Grevillea densiflora White
Flacourtia indica (Burm.f.) Merr. (edible fruits and nuts)
Flacourtia ramontchi L'Hérit.
Flacourtia jangomas (Lour.) Raeuschel (edible fruits and nuts)
Flacourtia rukam Zoll. & Moritzi (edible fruits and nuts)
Flacourtia euphlebia Merr.
Flagellaria indica L. (fibre plants)
Foeniculum vulgare Miller (spices)
Anethum foeniculum L.
Foeniculum capillaceum Gilib.
Foeniculum officinale Allioni
Fragaria vesca L. (edible fruits and nuts)
Fraxinus griffithii C.B. Clarke (stimulants)
Fraxinus eedenii Boerl. & Koord.
Fraxinus formosana Hayata
Fraxinus philippensis Merr.
Funtumia elastica (P. Preuss) Stapf (plants producing exudates)
Kickxia elastica P. Preuss
Galactia striata (Jacq.) Urban (auxiliary plants)
Galactia tenuiflora (Klein ex Willd.) Wight & Arnott
Glycine striata Jacq.
Glycine tenuiflora Klein ex Willd.
Ganonema farinosum (J.V. Lamour.) K.C. Fan & Yung C. Wang (cryptogams: algae)
Liagora cheyneana Harv.
Liagora farinosa J.V. Lamour.
Ganophyllum falcatum Blume (timber trees)
Dictyoneura integerrima Radlk.
Garcinia hanburyi Hook.f. (dye and tannin-producing plants)
Garcinia morella Desr. var. *pedicellata* Hanbury

Garcinia hombroniana Pierre (edible fruits and nuts, timber trees)
Garcinia indica (Thouars) Choisy (vegetable oils and fats)
Brindonia indica Thouars
Garcinia microstigma Kurz
Garcinia mangostana L. (edible fruits and nuts, timber trees)
Mangostana garcinia Gaertner
Garcinia morella (Gaertner) Desr. (plants producing exudates, vegetable oils and fats)
Garcinia gaudichaudii Planchon & Triana
Garcinia gutta Wight
Garcinia lateriflora Blume
Mangostana morella Gaertner
Gardenia jasminoides Ellis (dye and tannin-producing plants)
Gardenia augusta (L.) Merr.
Gardenia florida L.
Gardenia grandiflora Lour.
Garuga floribunda Decne. (timber trees)
Garuga abilo Merr.
Garuga littoralis Merr.
Garuga pacifica Burkill
Gaultheria leucocarpa Blume (essential-oil plants)
Brossaea leucocarpa (Blume) O. Kuntze
Gaultheria crenulata Kurz
Gaultheria cumingiana Vidal
Gaultheria punctata Blume (essential-oil plants)
Brossaea fragrantissima O. Kuntze
Gaultheria fragrantissima auct. non Wallich
Gaultheria fragrantissima Wallich var. *punctata* (Blume) J.J. Smith
Genipa americana L. (edible fruits and nuts)
Geodorum nutans (Presl) Ames (plants producing exudates)
Arethusa glutinosa Blanco
Dendrobium nutans Presl
Geodorum semicristatum Lindley
Glinus oppositifolius (L.) DC. (vegetables)
Mollugo oppositifolia L.
Gliricidia sepium (Jacq.) Kunth ex Walpers (forages, auxiliary plants)
Gliricidia maculata (Kunth) Kunth ex Walpers
Gluta wallichii (Hook.f.) Ding Hou (timber trees)
Melanorrhoea maingayi Hook.f.
Melanorrhoea wallichii Hook.f.
Melanorrhoea woodsiana Scort. ex King
Glycine max (L.) Merr. (pulses)
Glycine hispida (Moench) Maxim.
Phaseolus max L.
Soja max (L.) Piper
Gnetum campestre Gamble ex Ridley (fibre plants)
Gnetum tenuifolium Ridley (edible fruits and nuts)
Gomphia serrata (Gaertner) Kanis (timber trees)
Campylospermum serratum (Gaertner) Bittrich & M.C.E. Amaral

Gomphia sumatrana Jack
Ouratea angustifolia (Vahl) Baillon & Lanessan
Goniothalamus giganteus Hook.f. & Thomson (fibre plants)
Gonocaryum calleryanum (Baillon) Becc. (timber trees)
Gonocaryum diospyrosifolium Hayata
Gonocaryum tarlacense S. Vidal
Gonocaryum teysmannianum R. Scheffer
Gonystylus keithii Airy Shaw (timber trees)
Gonystylus maingayi Hook.f. (timber trees)
Gordonia amboinensis (Miq.) Merr. (timber trees)
Gordonia brassii Kobuski
Gordonia papuana Kobuski
Gordonia rumphii Merr.
Gordonia excelsa (Blume) Blume (timber trees)
Gordonia acuminata Choisy
Gracilaria blodgettii Harv. (cryptogams: algae)
Gracilaria cylindrica Børgesen
Gracilaria edulis (S.G. Gmelin) P.C. Silva (cryptogams: algae)
Fucus edulis S.G. Gmelin
Hydropunctia fastigiata (C.F. Chang & B.M. Xia) M.J. Wynne
Polycavernosa fastigiata C.F. Chang & B.M. Xia
Gracilaria euchematoides Harv. (cryptogams: algae)
Gracilaria salicornia (C. Agardh) E.Y. Dawson (cryptogams: algae)
Corallopsis salicornia (C. Agardh) Grev.
Gracilaria minor (Sond.) Durair.
Sphaerococcus salicornia C. Agardh
Gracilaria tenuistipitata C.F. Chang & B.M. Xia (cryptogams: algae)
Gracilaria verrucosa (Huds.) Papenf. (cryptogams: algae)
Gracilaria gracilis (Stackh.) Steentoft
Gracilariopsis longissima (S.G. Gmelin) Steentoft
Gracilariopsis heteroclada C.F. Zhang & B.M. Xia (cryptogams: algae)
Gracilaria bailinae (C.F. Zhang & B.M. Xia) C.F. Zhang & B.M. Xia
Gracilaria heteroclada C.F. Zhang & B.M. Xia non (Mont.) Feldmann & Feldm.-Maz.
Gracilariopsis bailinae C.F. Zhang & B.M. Xia
Grateloupia filicina (J.V. Lamour.) C. Agardh (cryptogams: algae)
Delesseria filicina J.V. Lamour.
Fucus filicina Wulfen
Grewia acuminata Juss. (fibre plants)
Grewia asiatica L. (edible fruits and nuts, timber trees)
Grewia conferta Warb. ex Burret
Grewia hainesiana Hole
Grewia humilis Wallich ex Masters
Grewia subinaequalis DC.
Grewia vestita Masters
Guettarda speciosa L. (timber trees)
Guioa diplopetala (Hassk.) Radlk. (timber trees)
Guioa bullata Radlk.
Guioa fuscidula (Kurz) Radlk.

Guioa squamosa Radlk.
Guioa koelreuteria (Blanco) Merr. (timber trees)
Guioa mindorensis Merr.
Guioa perrottetii (Blume) Radlk.
Guioa salicifolia Radlk.
Guioa pleuropteris (Blume) Radlk. (timber trees)
Guioa aptera Radlk.
Guioa lasiothyrsa Radlk.
Guioa subapiculata Radlk.
Guizotia abyssinica (L.f.) Cass. (vegetable oils and fats)
Guizotia oleifera (DC.) DC.
Polimnia abyssinica L.f.
Ramtilla oleifera DC.
Gymnacranthera farquhariana (Wallich ex Hook.f. & Thomson) Warb. (timber trees)
Gymnopetalum chinense (Lour.) Merr. (edible fruits and nuts)
Gymnopetalum cochinchinense (Lour.) Kurz
Gymnopetalum leucostictum Miq.
Gymnopetalum quinquelobum Miq.
Gynotroches axillaris Blume (timber trees)
Haematoxylum campechianum L. (dye and tannin-producing plants)
Halimeda cylindracea Dec. (cryptogams: algae)
Halimeda polydactylis J. Agardh
Halimeda gigas W.R. Taylor (cryptogams: algae)
Halimeda gracilis Harv. ex J. Agardh (cryptogams: algae)
Halimeda incrassata (J. Ellis) J.V. Lamour. (cryptogams: algae)
Corallina incrassata J. Ellis
Halimeda opuntia (L.) J.V. Lamour. (cryptogams: algae)
Corallina opuntia L.
Fucus prolifer M. Blanco
Halimeda cordata J. Agardh
Halimeda simulans N. Howe (cryptogams: algae)
Halimeda incrassata (J. Ellis) J.V. Lamour. var. *simulans* Børgesen
Halimeda tuna (J. Ellis & Sol.) J.V. Lamour. (cryptogams: algae)
Corallina tuna J. Ellis & Sol.
Halimeda platydisca Dec.
Harpullia arborea (Blanco) Radlk. (timber trees)
Harpullia imbricata (Blume) Thwaites
Harpullia pedicellaris Radlk.
Harpullia tomentosa Ridley
Harpullia cupanioides Roxb. (timber trees)
Harpullia confusa Blume
Harpullia rupestris (Blume) Blume
Harpullia thanatophora Blume
Helicteres isora L. (fibre plants)
Helminthostachys zeylanica (L.) Hook. (cryptogams: ferns and fern allies)
Hemionitis arifolia (Burm.f.) T. Moore (cryptogams: ferns and fern allies)
Heritiera littoralis Aiton (timber trees)
Heritiera minor (Gaertner) Lamk

Hernandia nymphaeifolia (Presl) Kubitzki (timber trees)
Hernandia peltata Meissn.
Hibiscus cannabinus L. (fibre plants)
Hodgsonia macrocarpa (Blume) Cogn. (edible fruits and nuts)
Hodgsonia capniocarpa Ridley
Homonoia riparia Lour. (auxiliary plants)
Adelia neriifolia Heyne ex Roth
Lumanaja fluviatilis Blanco
Ricinus salicinus Hassk.
Houttuynia cordata Thunberg (vegetables)
Hullettia dumosa King ex Hook.f. (edible fruits and nuts)
Huperzia carinata (Desv. ex Poir.) Trevis. (cryptogams: ferns and fern allies)
Huperzia phlegmaria (L.) Rothm. (cryptogams: ferns and fern allies)
Huperzia serrata (Thunberg ex Murray) Trevis. (cryptogams: ferns and fern allies)
Hydroclathrus clathratus (C. Agardh) M. Howe (cryptogams: algae)
Encoelium clathratum C. Agardh
Hydroclathrus cancellatus Bory
Hydroclathrus tenuis C.K. Tseng & B. Ren Lu (cryptogams: algae)
Hydrocotyle sibthorpioides Lamk (vegetables)
Hydrocotyle benguetensis Elmer
Hydrocotyle delicata Elmer
Hydrocotyle rotundifolia DC.
Hymenaea courbaril L. (plants producing exudates)
Hymenaea candolleana Kunth
Hymenaea retusa Willd. ex Hayne
Inga megacarpa M.E. Jones
Hypolepis punctata (Thunberg) Mett. ex Kuhn (cryptogams: ferns and fern allies)
Ichnocarpus frutescens (L.) R.Br. (fibre plants)
Iguanura geonomiformis (Griffith) Mart. (stimulants)
Iguanura malaccensis Becc.
Iguanura wallichiana (Wallich ex Mart.) Hook.f. subsp. *malaccensis* (Becc.) Kiew var. *elatior* Kiew
Iguanura wallichiana (Wallich ex Mart.) Hook.f. subsp. *malaccensis* (Becc.) Kiew var. *malaccensis*
Ilex cymosa Blume (timber trees)
Ilex bogorensis Loes.
Ilex javanica Koord. & Valeton
Ilex pleiobrachiata Loes.
Ilex paraguariensis A. St.-Hil. (stimulants)
Ilex domestica Reissek
Ilex mate A. St.-Hil.
Ilex paraguensis D. Don
Illicium verum Hook.f. (spices)
Badianifera officinarum O. Kuntze
Illicium anisatum Lour. non L.
Indigofera hirsuta L. (auxiliary plants)
Indigofera angustifolia Blanco

Indigofera ferruginea Schum. & Thonn.
Indigofera indica Miller
Indigofera suffruticosa Miller (dye and tannin-producing plants)
Indigofera anil L.
Indigofera guatemalensis Moc., Sessé & Cerv. ex Backer
Inocarpus fagifer (Parkinson) Fosberg (auxiliary plants)
Inocarpus edulis J.R. Forster & J.G. Forster
Intsia bijuga (Colebr.) O. Kuntze (timber trees)
Afzelia bijuga (Colebr.) A. Gray
Intsia amboinensis DC.
Intsia retusa (Kurz) O. Kuntze
Intsia palembanica Miq. (timber trees)
Afzelia palembanica (Miq.) Baker
Intsia bakeri (Prain) Prain
Intsia plurijuga Harms
Ixonanthes icosandra Jack (timber trees)
Ixonanthes dodecandra Griffith
Ixonanthes lucida (Blume) Blume
Ixonanthes obovata Hook.f.
Jasminum grandiflorum L. (essential-oil plants)
Jasminum floribundum R.Br. ex Fresen
Jasminum officinale L. var. *grandiflorum* (L.) Stokes
Jasminum officinale L. f. *grandiflorum* (L.) Kobuski
Jessinia bataua (Mart.) Burret (vegetable oils and fats)
Jessinia polycarpa Karsten
Jessinia repanda Engel
Oenocarpus bataua Mart.
Juncus effusus L. (fibre plants)
Khaya grandifoliola C.DC. (timber trees)
Khaya grandis Stapf
Khaya kerstingii Engl.
Khaya punchii Stapf
Khaya senegalensis (Desr.) A. Juss. (timber trees)
Swietenia senegalensis Desr.
Kleinhovia hospita L. (auxiliary plants)
Knema furfuracea (Hook.f. & Thomson) Warb. (timber trees)
Koompassia excelsa (Becc.) Taubert (timber trees)
Koompassia parvifolia Prain ex King
Koordersiodendron pinnatum (Blanco) Merr. (timber trees)
Koordersiodendron celebicum Engl.
Koordersiodendron papuanum Kaneh. & Hatus.
Lannea speciosa (Blume) Engl. ex Perk.
Kummerowia striata Thunberg ex Murray (auxiliary plants)
Desmodium striatum (Thunberg ex Murray) DC.
Hedysarum striatum Thunberg ex Murray
Lespedeza striata (Thunberg ex Murray) Hook. & Arnott
Lactuca indica L. (vegetables)
Lactuca brevirostris Champ. ex Benth.
Lactuca sativa L. (vegetables)

Lactuca scariola L. var. *hortensis* Bisch.
Lactuca scariola L. var. *sativa* Boiss.
Lactuca serriola L. var. *sativa* Moris
Lagenaria siceraria (Molina) Standley (vegetables)
Cucurbita lagenaria L.
Lagenaria leucantha Rusby
Lagenaria vulgaris Seringe
Lagerstroemia speciosa (L.) Pers. (timber trees)
Lagerstroemia flos-reginae Retz.
Lansium domesticum Correa (edible fruits and nuts)
Aglaia aquea (Jack) Kosterm.
Aglaia domestica (Correa) Pellegrin
Aglaia dookoo Griffith
Lasia spinosa (L.) Thwaites (vegetables)
Lathyrus sativus L. (pulses)
Laurencia cartilaginea Yamada (cryptogams: algae)
Laurencia patentiramea (Mont.) Kütz. (cryptogams: algae)
Chondria obtusa (Huds.) C. Agardh var. *paniculata* C. Agardh
Chondria obtusa (Huds.) C. Agardh var. *patentiramea* Mont.
Laurencia paniculata (C. Agardh) J. Agardh
Laurencia snackeyi (Weber Bosse) Masuda (cryptogams: algae)
Laurencia obtusa (Huds.) J.V. Lamour. var. *snackeyi* (Weber Bosse) Yamada
Laurencia paniculata (C. Agardh) J. Agardh var. *snackeyi* Weber Bosse
Laurus nobilis L. (spices)
Laurus undulata Miller
Lavandula stoechas L. (essential-oil plants)
Lawsonia inermis L. (dye and tannin-producing plants)
Lawsonia alba Lamk
Lawsonia spinosa L.
Lens culinaris Medikus (pulses)
Lens esculenta Moench
Lepisanthes fruticosa (Roxb.) Leenh. (edible fruits and nuts)
Otophora cambodiana Pierre
Otophora fruticosa Blume
Otophora resecta Radlk.
Lepisanthes rubiginosa (Roxb.) Leenh. (timber trees)
Erioglossum edule (Blume) Blume
Erioglossum rubiginosum (Roxb.) Blume
Lepisanthes hirta Ridley
Leuconotis eugenifolius A.DC. (plants producing exudates)
Leuconotis cuspidatus Blume
Limonia acidissima L. (edible fruits and nuts)
Feronia elephantum Correa
Feronia limonia (L.) Swingle
Lindera lucida (Blume) Boerl. (timber trees)
Lindera malaccensis Hook.f.
Lindera selangorensis Ridley
Litsea lucida Blume

Linum usitatissimum L. (fibre plants)
Lippia graveolens Kunth (spices)
Lippia berlandieri J. Schauer
Litchi chinensis Sonn. (edible fruits and nuts)
Dimocarpus litchi Lour.
Euphoria didyma Blanco
Litchi philippinensis Radlk.
Litchi sinense J. Gmelin
Nephelium litchi Cambess.
Litsea cubeba (Lour.) Pers. (essential-oil plants)
Laurus cubeba Lour.
Litsea citrata Blume
Tetranthera polyantha Wallich ex Nees var. *citrata* Meissner
Litsea elliptica Blume (timber trees)
Litsea clarissae (Teschner) Kosterm.
Litsea nigricans (Meissn.) Boerl.
Litsea odorifera Valeton
Litsea petiolata Hook.f.
Litsea glutinosa (Lour.) C.B. Robinson (timber trees)
Litsea chinensis Lamk
Litsea geminata Blume
Litsea glabraria A.L. Juss.
Litsea tetranthera (Willd.) Pers.
Litsea monopetala (Roxb.) Pers. (timber trees)
Litsea polyantha A.L. Juss.
Tetranthera alnoides Miq.
Tetranthera monopetala Roxb.
Litsea penangiana Hook.f. (timber trees)
Litsea pipericarpa (Miq.) Kosterm. (essential-oil plants)
Lindera pipericarpa (Miq.) Boerl.
Polyadenia pipericarpa Miq.
Litsea timoriana Span. (timber trees)
Litsea kauloensis Teschner
Litsea pallida (Blume) Boerl.
Litsea stickmanii Merr.
Litsea tuberculata (Blume) Boerl.
Litsea umbellata (Lour.) Merr. (timber trees)
Litsea amara Blume
Litsea hexantha A.L. Juss.
Litsea utilis (Meissn.) Boerl.
Lonchocarpus cyanescens (Schum. & Thonn.) Benth. (dye and tannin-producing plants)
Lophopetalum javanicum (Zoll.) Turcz. (timber trees)
Lophopetalum fuscescens Kurz
Lophopetalum oblongifolium King
Lophopetalum toxicum Loher
Lophopetalum pallidum M. Lawson (timber trees)
Lophopetalum curtisii King
Solenospermum pallidum (M. Lawson) Loes.

Lumnitzera littorea (Jack) Voigt (timber trees)
Lumnitzera coccinea Wight & Arnott
Lumnitzera racemosa Willd. (timber trees)
Lycianthes laevis (Dunal) Bitter (vegetables)
Solanum blumii Nees ex Blume
Lycium chinense Miller (vegetables)
Lycium rhombifolium (Moench) Dippel
Lycopodiella cernua (L.) Pic. Serm. (cryptogams: ferns and fern allies)
Lycopodium clavatum L. (cryptogams: ferns and fern allies)
Lycopodium complanatum L. (cryptogams: ferns and fern allies)
Maclura cochinchinensis (Lour.) Corner (dye and tannin-producing plants)
Cudrania cochinchinensis (Lour.) Kudo & Masam.
Cudrania javanensis Trécul
Maclura javanica Blume
Macrolenes muscosa (Blume) Bakh.f. (edible fruits and nuts)
Marumia muscosa Blume
Macrotyloma uniflorum (Lamk.) Verdc. (pulses)
Dolichos biflorus auct. non L.
Dolichos uniflorus Lamk
Madhuca betis (Blanco) J.F. Macbr. (timber trees)
Madhuca philippinensis Merr.
Maesopsis eminii Engl. (auxiliary plants)
Maesopsis berchemioides (Pierre) A. Chev.
Magnolia macklottii (Korth.) Dandy (timber trees)
Magnolia aequinoctialis Dandy
Magnolia javanica Koord. & Valeton
Michelia beccariana Agostini
Malachra capitata (L.) L. (fibre plants)
Malachra fasciata Jacq. (fibre plants)
Malpighia glabra L. (edible fruits and nuts)
Malpighia punicifolia L.
Mammea americana L. (edible fruits and nuts, timber trees)
Mammea siamensis (Miq.) T. Anderson (timber trees)
Calysaccion siamense Miq.
Ochrocarpos siamensis (Miq.) T. Anderson
Mangifera foetida Lour. (edible fruits and nuts, timber trees)
Mangifera horsfieldii Miq.
Mangifera indica L. (edible fruits and nuts, timber trees)
Mangifera minor Blume (edible fruits and nuts, timber trees)
Mangifera odorata Griffith (edible fruits and nuts, timber trees)
Mangifera foetida Lour. var. *odorata* (Griffith) Pierre
Mangifera oblongifolia Hook.f.
Manilkara kauki (L.) Dubard (timber trees)
Mimusops kauki L.
Manilkara zapota (L.) P. van Royen (edible fruits and nuts)
Achras zapota L.
Nispero achras (Miller) Aubréville
Pouteria mammosa (L.) Cronquist
Mansonia gagei J.R. Drummond ex Prain (essential-oil plants)

Maranta arundinacea L. (plants yielding non-seed carbohydrates)
Maranta sylvatica Roscoe ex J.E. Smith
Marsdenia tinctoria R.Br. (dye and tannin-producing plants)
Asclepias tinctoria Roxb.
Marsilea crenata C. Presl (cryptogams: ferns and fern allies)
Matricaria recutita L. (stimulants)
Chamomilla recutita (L.) Rauschert
Matricaria chamomilla auct. non L.
Matricaria courrantiana DC.
Melaleuca alternifolia (Maiden & Betche) Cheel (essential-oil plants)
Melaleuca liniariifolia Smith var. *alternifolia* Maiden & Betche
Melaleuca cajuputi Powell (essential-oil plants)
Melaleuca leucadendron (L.) L. var. *minor* (Smith) Duthie
Melaleuca minor Smith
Myrtus saligna Burm.f.
Melaleuca quinquenervia (Cav.) S.T. Blake (essential-oil plants)
Melaleuca viridiflora Sol. ex Gaertner var. *angustifolia* (L.f.) N.B. Byrnes non Blume
Melaleuca viridiflora Sol. ex Gaertner var. *rubriflora* Brong. & Gris
Metrosideros quinquenervia Cav.
Melanamansia glomerata (C. Agardh) R.E. Norris (cryptogams: algae)
Amansia glomerata C. Agardh
Melia azedarach L. (auxiliary plants)
Melia composita Willd.
Melia dubia Cav.
Melia sempervirens (L.) Sw.
Melicope confusa (Merr.) Liu (timber trees)
Euodia confusa Merr.
Melicope latifolia (DC.) T.G. Hartley (timber trees)
Euodia latifolia DC.
Melilotus suavolens Ledeb. (auxiliary plants)
Meliosma sumatrana (Jack) Walpers (timber trees)
Meliosma cuspidata Blume
Meliosma nitida Blume
Meliosma philippinensis Merr. & L.M. Perry
Melissa officinalis L. (spices)
Melissa altissima J.E. Smith
Melissa inodora Bornm. non Hassk.
Memecylon dichotomum (C.B. Clarke) King (timber trees)
Memecylon curtisii Burkill & Hend.
Memecylon eugeniiflora Ridley
Memecylon gracilipes Ridley
Memecylon edule Roxb. (timber trees)
Memecylon globiferum Wallich
Memecylon ovatum Smith (dye and tannin-producing plants)
Merrillia caloxylon (Ridley) Swingle (timber trees)
Murraya caloxylon Ridley
Mesona palustris Blume (stimulants)
Geniosperum parviflorum Wallich ex Benth.

Mesona parviflorum (Wallich ex Benth.) Briq.
Mesona wallichiana Benth.
Mesua ferrea L. (timber trees)
Mesua lepidota T. Anderson (plants producing exudates)
Kayea lepidota (T. Anderson) Pierre
Kayea parviflora Ridley
Metadina trichotoma (Zoll. & Moritzi) Bakh.f. (timber trees)
Adina polycephala Benth.
Adina zschokkei Elmer
Nauclea trichotoma Zoll. & Moritzi
Michelia champaca L. (timber trees, essential-oil plants)
Michelia pilifera Bakh.f.
Michelia pubinervia Blume
Michelia velutina Blume
Michelia ×alba DC. (timber trees, essential-oil plants)
Michelia longifolia Blume
Microcos paniculata L. (timber trees, stimulants)
Grewia glabra Jack
Grewia microcos L.
Grewia ulmifolia Roxb.
Mikania cordata (Burm.f.) B.L. Robinson (forages, auxiliary plants)
Eupatorium cordatum Burm.f.
Mikania scandens Hook.f. non (L.) Willd.
Mikania volubilis (Vahl) Willd.
Mimusops elengi L. (timber trees)
Mimusops parvifolia R.Br.
Mischocarpus sundaicus Blume (auxiliary plants)
Cupania erythrorhachis Miq.
Mischocarpus lessertianus Ridley
Schleichera revoluta Turcz.
Monodora myristica (Gaertner) Dunal (spices)
Annona myristica Gaertner
Monodora grandiflora Benth.
Xylopia undulata P. Beauv.
Monostroma nitidum Wittr. (cryptogams: algae)
Monostroma latissimum Wittr.
Moringa oleifera Lamk (vegetables)
Guilandina moringa L.
Moringa polygona DC.
Moringa pterygosperma Gaertner
Mundulea sericea (Willd.) A. Chev. (auxiliary plants)
Cytisus sericeus Willd.
Tephrosia suberosa DC.
Muntingia calabura L. (edible fruits and nuts)
Murraya exotica L. (timber trees)
Murraya paniculata (L.) Jack var. *exotica* (L.) Huang
Murraya paniculata (L.) Jack (timber trees)
Chalcas paniculata L.
Murraya odorata Blanco

Murraya sumatrana Roxb.
Musa textilis Née (fibre plants)
Myrica esculenta Buch.-Ham. (dye and tannin-producing plants)
Myrica farquhariana Wallich
Myrica nagi auct. non Thunberg
Myrica sapida Wallich
Myristica fatua Houtt. (timber trees)
Myristica plumeriifolia Elmer
Myristica spadicea Blume
Myristica tomentosa Thunberg
Myristica fragrans Houtt. (spices)
Myristica aromatica Lamk
Myristica moschata Thunberg
Myristica officinalis L.f.
Myroxylon balsamum (L.) Harms (plants producing exudates)
Myroxylon pereirae (Royle) Klotzsch
Myroxylon toluiferum Kunth
Toluifera balsamum L.
Nauclea orientalis (L.) L. (timber trees)
Nauclea coadunata Roxb. ex J.E. Smith
Sarcocephalus cordatus Miq.
Sarcocephalus undulatus Miq.
Neesia altissima (Blume) Blume (timber trees)
Neesia ambigua Becc.
Nelumbo nucifera Gaertner (plants yielding non-seed carbohydrates)
Nelumbium nelumbo (L.) Druce
Nelumbium speciosum Willd.
Nymphaea nelumbo L.
Neolitsea cassiaefolia (Blume) Merr. (timber trees)
Litsea acerina Blume
Litsea cassiaefolia Blume
Nepenthes ampullaria Jack (fibre plants)
Nepenthes boschiana Korth. (fibre plants)
Nepenthes reinwardtiana Miq. (fibre plants)
Nephelium lappaceum L. (edible fruits and nuts, timber trees)
Nephelium chryseum Blume
Nephelium obovatum Ridley
Nephelium sufferrugineum Radlk.
Neptunia oleracea Lour. (vegetables)
Neptunia natans (L.f.) Druce
Neptunia prostrata (Lamk) Baillon
Nicotiana rustica L. (stimulants)
Nicotiana asiatica Schultes
Nicotiana humilis Link
Nicotiana rugosa Miller
Nicotiana tabacum L. (stimulants)
Nicotiana mexicana Schlecht.
Nicotiana pilosa Moc. & Sessé ex Dun
Nicotiana virginica C. Agardh

Nigella sativa L. (spices)
Nigella cretica Miller
Nigella indica Roxb. ex Fleming
Nothofagus grandis v. Steenis (timber trees)
Nyctanthes arbor-tristis L. (dye and tannin-producing plants)
Nyctanthes dentata Blume
Nypa fruticans Wurmb (plants yielding non-seed carbohydrates)
Cocos nypa Lour.
Nipa fruticans Thunberg
Nipa litoralis Blanco
Ochanostachys amentacea Masters (timber trees)
Ochanostachys bancana (Becc.) Valeton
Petalinia bancana Becc.
Ocimum americanum L. (vegetables)
Ocimum africanum Lour.
Ocimum brachiatum Blume
Ocimum canum Sims
Ocimum basilicum L. (spices)
Ocimum gratissimum L. (essential-oil plants)
Ocimum suave Willd.
Ocimum viride Willd.
Ocimum viridiflorum Roth
Ocimum tenuiflorum L. (spices)
Ocimum brachiatum Hassk.
Ocimum flexuosum Blanco
Ocimum sanctum L.
Octomeles sumatrana Miq. (timber trees)
Octomeles moluccana Teijsm. & Binnend. ex Hassk.
Oenanthe javanica (Blume) DC. (vegetables)
Oenanthe stolonifera DC.
Sium javanicum Blume
Oldenlandia umbellata L. (dye and tannin-producing plants)
Hedyotis umbellata (L.) Lamk
Oleandra neriiformis Cav. (cryptogams: ferns and fern allies)
Oncosperma horridum (Griffith) R. Scheffer (timber trees)
Onychium siliculosum (Desv.) C.Chr. (cryptogams: ferns and fern allies)
Ophioglossum pendulum L. (cryptogams: ferns and fern allies)
Ophioglossum reticulatum L. (cryptogams: ferns and fern allies)
Oreocnide integrifolia Miq. (fibre plants)
Villebrunea integrifolia Gaudich.
Oreocnide rubescens Miq. (fibre plants)
Oryza sativa L. (cereals)
Oryza aristata Blanco
Oryza glutinosa Lour.
Oryza montana Lour.
Oryza praecox Lour.
Osmoxylon palmatum (Lamk) Philipson (vegetables)
Boerlagiodendron palmatum (Zipp. ex Boerl.) Harms
Ottelia alismoides (L.) Pers. (auxiliary plants)

Ottelia condorensis Gagnep.
Ottelia japonica Miq.
Ottelia javanica Miq.
Oxalis corymbosa DC. (spices)
Oxalis debilis Kunth var. *corymbosa* (DC.) Lourteig
Oxalis martiana Zucc.
Oxalis violacea auct. non L.
Pachira aquatica Aubl. (vegetable oils and fats)
Bombax aquaticum (Aubl.) K. Schumann
Carolinea princeps L.f.
Pachira macrocarpa (Schlechtendal & Cham.) Walpers
Pachyrhizus erosus (L.) Urban (plants yielding non-seed carbohydrates)
Dolichos bulbosus L.
Dolichos erosus L.
Dolichos palmatilobus Moc. & Sessé ex DC.
Pachyrhizus angulatus Rich. ex DC.
Pachyrhizus bulbosus (L.) Kurz
Pachyrhizus palmatilobus (Moc. & Sessé ex DC.) Benth.
Pajanelia longifolia (Willd.) K. Schumann (timber trees)
Pajanelia multijuga (Wallich) DC.
Pajanelia rheedii Wight
Palaquium gutta (Hook.f.) Baillon (timber trees, plants producing exudates)
Croixia gutta (Hook.f.) Baehni
Palaquium acuminatum Burck
Palaquium oblongifolium (Burck) Burck
Palaquium optimum Becc.
Pandanus amaryllifolius Roxb. (spices)
Pandanus hasskarlii Merr.
Pandanus latifolius Hassk.
Pandanus odorus Ridley
Pandanus furcatus Roxb. (fibre plants)
Pandanus tectorius Parkins. (fibre plants)
Panicum maximum Jacq. (forages)
Panicum polygamum Sw.
Parartocarpus venenosus (Zoll. & Moritzi) Becc. (edible fruits and nuts, timber trees)
Gymnartocarpus venenosa (Zoll. & Moritzi) Boerl.
Parartocarpus triandra (J.J. Smith) J.J. Smith
Parartocarpus woodii (Merr.) Merr.
Parkia speciosa Hassk. (timber trees, vegetables)
Parkia harbesonii Elmer
Parkia macrocarpa Miq.
Paspalum conjugatum Bergius (forages)
Passiflora biflora Lamk (vegetables)
Passiflora lunata Willd.
Passiflora incarnata L. (edible fruits and nuts)
Pastinaca sativa L. (vegetables)
Paullinia cupana Kunth (stimulants)
Paullinia sorbilis Martius

Payena leerii (Teijsm. & Binnend.) Kurz (timber trees, plants producing exudates)
Madhuca leerii (Teijsm. & Binnend.) Merr.
Payena croixiana Pierre
Payena lucida (Wallich ex G. Don) A.DC. (timber trees)
Madhuca lucida (Wallich ex G. Don) Baehni
Payena dasyphylla (Miq.) Pierre var. *glabrata* King & Gamble
Payena glutinosa Pierre
Pelargonium L'Hérit. cv. group Rosat
Pelargonium ×asperum Ehrh. ex Willd.
Pelargonium graveolens auct.
Pelargonium roseum auct.
Peltophorum dasyrhachis (Miq.) Kurz (auxiliary plants)
Caesalpinia dasyrhachis Miq.
Peltophorum grande Prain
Peltophorum tonkinense (Pierre) Gagnep.
Peltophorum pterocarpum (DC.) Backer ex K. Heyne (dye and tannin-producing plants)
Peltophorum ferrugineum (Decne.) Benth.
Peltophorum inerme (Roxb.) Naves & Villar
Pentadesma butyracea Sabine (vegetable oils and fats)
Pentadesma leucantha A.Chev.
Perilla frutescens (L.) Britton (spices)
Ocimum frutescens L.
Perilla nankinensis (Lour.) J. Decne.
Perilla ocymoides L.
Peristrophe bivalvis (L.) Merr. (dye and tannin-producing plants)
Peristrophe tinctoria (Roxb.) Nees
Peristrophe roxburghiana (Schultes) Bremek.
Peristrophe paniculata (Forssk.) Brummitt (auxiliary plants)
Justicia bicalyculata (Retz.) Vahl
Peristrophe bicalyculata (Retz.) Nees
Peronema canescens Jack
Peronema heterophyllum Miq.
Persea americana Miller (edible fruits and nuts)
Persea drymifolia Schlecht. & Cham.
Persea gratissima Gaertner f.
Persea nubigena L.O. Williams
Persea thunbergii (Sieb. & Zucc.) Kosterm. (vegetable oils and fats)
Machilus arisanensis (Hayata) Hayata
Machilus thunbergii Sieb. & Zucc.
Persea arisanensis (Hayata) Kosterm.
Persicaria hydropiper (L.) Spach (spices)
Polygonum flaccidum Meisner
Polygonum gracile R. Br.
Polygonum hydropiper L.
Persicaria odorata (Lour.) Soják (spices)
Polygonum odoratum Lour.
Persicaria perfoliata (L.) H. Gross (vegetables)

Polygonum perfoliatum L.
Persicaria pubescens (Blume) Hara (spices)
Polygonum leptostachyum de Bruyn
Polygonum pubescens Blume
Polygonum roettleri Merr. non Roth
Petersianthus quadrialatus (Merr.) Merr. (timber trees)
Combretodendron quadrialatum (Merr.) Knuth
Petroselinum crispum (Miller) Nyman ex A.W. Hill (spices)
Petroselinum hortense Hoffm.
Petroselinum sativum Hoffm.
Petroselinum vulgare J. Hill
Phaleria capitata Jack (fibre plants)
Phaseolus lunatus L. (pulses)
Phaseolus bipunctatus Jacq.
Phaseolus limensis Macfad.
Phoebe grandis (Nees) Merr. (timber trees)
Phoebe cuneata (Blume) Blume
Phoebe kunstleri Gamble
Phoebe multiflora Blume
Phoebe opaca Blume
Phormium tenax J.R. Forster & J.G. Forster (fibre plants)
Phyllanthus gomphocarpus Hook.f. (edible fruits and nuts)
Phyllanthus accrescens J.J. Smith
Physalis peruviana L. (edible fruits and nuts)
Pimelodendron amboinicum Hassk. (timber trees)
Daphniphyllum conglutinosum Hemsl.
Pimelodendron papuanum Warb.
Pimenta dioica (L.) Merr. (spices)
Myrtus dioica L.
Myrtus pimenta L.
Pimenta officinalis Lindley
Pimenta racemosa (Miller) J.W. Moore (essential-oil plants)
Caryophyllus racemosus Miller
Myrtus acris Sw.
Pimenta acris (Sw.) Kostel.
Pimpinella anisum L. (spices)
Anisum officinarum Moench
Anisum vulgare Gaertner
Apium anisum (L.) Crantz
Pimpinella pruatjan Molkenb. (spices)
Pimpinella alpina Koord.-Schum. non Host
Piper aduncum L. (spices)
Artanthe adunca (L.) Miq.
Piper angustifolium Ruiz & Pavón
Piper elongatum Vahl
Piper bantamense Blume (stimulants)
Piper attenuatum auct. non Miq.
Piper betle L. (stimulants)
Chavica betle (L.) Miq.

Piper pinguispicum C.DC. & Koord.
Piper caninum Blume (spices)
Piper banksii Miq.
Piper lauterbachii C.DC.
Piper macrocarpum C.DC.
Piper cubeba L.f. (spices)
Cubeba officinalis Raf.
Piper lolot C.DC. (spices)
Piper longum L. (spices)
Chavica roxburghii Miq.
Piper latifolium Hunter
Piper methysticum G. Forster (stimulants)
Macropiper latifolium Miq.
Macropiper methysticum (G. Forster) Hook. & Arnott
Piper nigrum L. (spices)
Piper aromaticum Lamk
Piper retrofractum Vahl (spices)
Chavica retrofracta (Vahl) Miq.
Piper chaba Hunter
Piper officinarum (Miq.) C.DC.
Piper sarmentosum Roxb. ex Hunter (spices)
Chavica sarmentosa (Roxb. ex Hunter) Miq.
Pithecellobium dulce (Roxb.) Benth. (edible fruits and nuts)
Inga dulcis (Roxb.) Willd.
Mimosa dulcis Roxb.
Pittosporum ferrugineum Aiton (timber trees)
Pittosporum nativitatis Baker
Pittosporum rufescens Turcz.
Pittosporum versteeghii Merr. & L.M. Perry
Pittosporum pentandrum (Blanco) Merr. (timber trees, essential-oil plants)
Aquilaria pentandra Blanco
Pittosporum brachysepalum Turcz.
Pittosporum fernandezii Fern.-Vill.
Pittosporum pseudostipitatum Merr.
Pittosporum resiniferum Hemsl. (vegetable oils and fats)
Pittosporum acuminatissimum Merr.
Pittosporum epiphyticum Merr.
Pityrogramma calomelanos (L.) Link (cryptogams: ferns and fern allies)
Planchonia papuana Knuth (timber trees)
Platycerium bifurcatum (Cav.) C.Chr. (cryptogams: ferns and fern allies)
Platymitra arborea (Blanco) Kessler (timber trees)
Alphonsea arborea (Blanco) Merr.
Alphonsea philippinensis Merr.
Plectranthus rotundifolius (Poiret) Sprengel (plants yielding non-seed carbohydrates)
Coleus parviflorus Benth.
Coleus tuberosus (Blume) Benth.
Solenostemon rotundifolius (Poiret) J.K. Morton
Pleocnemia irregularis (C.Presl) Holttum (cryptogams: ferns and fern allies)

Ploiarium alternifolium (Vahl) Melchior (timber trees)
Archytaea alternifolia (Vahl) Szyszyl.
Archytaea vahlii Choisy
Ploiarium elegans Korth.
Podocarpus neriifolius D. Don (timber trees)
Podocarpus decipiens N.E. Gray
Podocarpus discolor Blume
Podocarpus leptostachya Blume
Podocarpus neglecta Blume
Podocarpus polyantha (Wasscher) Gaussen
Pogostemon benghalensis (Burm.f.) O. Kuntze (essential-oil plants)
Origanum benghalense Burm.f.
Pogostemon parviflorus Benth.
Pogostemon plectranthoides auct. non Desf.
Pogostemon cablin (Blanco) Benth. (essential-oil plants)
Pogostemon comosus Miq.
Pogostemon javanicus Backer ex Adelb.
Pogostemon patchouly Pellet.
Polyscias nodosa (Blume) Seem. (timber trees)
Eupteron nodosa (Blume) Miq.
Pometia pinnata J.R. Forster & J.G. Forster (timber trees)
Pongamia pinnata (L.) Pierre (auxiliary plants)
Derris indica (Lamk) J.J. Bennett
Millettia novo-guineensis Kanehira & Hatusima
Pongamia glabra Ventenat
Portulaca oleracea L. (vegetables)
Potentilla indica (H.C. Andrews) Wolf (edible fruits and nuts)
Duchesnea indica (H.C. Andrews) Focke
Fragaria indica H.C. Andrews
Pouteria obovata (R.Br.) Baehni (timber trees)
Planchonella obovata (R.Br.) Pierre
Sideroxylon ferrugineum Hook. & Arnott
Pouteria sapota (Jacq.) H.E. Moore & Stearn (edible fruits and nuts)
Calocarpum sapota (Jacq.) Merr.
Lucuma mammosa (L.) Gaertner f.
Pouzolzia sanguinea (Blume) Merr. (fibre plants)
Premna cordifolia Roxb. (timber trees)
Prosopis juliflora (Sw.) DC. (auxiliary plants)
Mimosa juliflora Sw.
Prosopis vidaliana Naves
Prunus arborea (Blume) Kalkman (timber trees)
Pygeum arboreum (Blume) Blume
Pygeum parviflorum Teijsm. & Binnend.
Pygeum stipulaceum King
Prunus marsupialis Kalkman (timber trees)
Pygeum glandulosum Merr.
Pygeum pubescens Merr.
Pseudarthria viscida (L.) Wight & Arnott (auxiliary plants)
Desmodium timoriense DC.

Desmodium viscidum (L.) DC.
Hedysarum viscidum L.
Psidium cujavillus Burm.f. (edible fruits and nuts)
Psidium pumilum Vahl
Psidium guajava L. (edible fruits and nuts)
Psidium aromaticum Blanco
Psidium guineense Sw. (edible fruits and nuts)
Psophocarpus scandens (Endl.) Verdc. (auxiliary plants)
Mucuna comorensis Vatke
Psophocarpus longepedunculatus Hassk.
Psophocarpus palustris auct. non Desv.
Pteridium aquilinum (L.) Kuhn (cryptogams: ferns and fern allies)
Pternandra coerulescens Jack (timber trees)
Ewyckia medinilliformis Naudin
Pternandra capitellata Jack
Pternandra latifolia (Blume) Triana
Pternandra echinata Jack (timber trees)
Kibessia acuminata Decne.
Kibessia angustifolia Blume
Kibessia echinata (Jack) Cogn.
Pueraria lobata (Willd.) Ohwi (plants yielding non-seed carbohydrates)
Dolichos montanus Lour.
Pueraria hirsuta (Thunberg) Matsumura
Pueraria montana (Lour.) Merr.
Pueraria thomsoni Benth.
Pueraria thunbergiana (Sieb. & Zucc.) Benth.
Pueraria tonkinensis Gagnepain
Pueraria triloba (Houtt.) Makino
Pueraria phaseoloides (Roxb.) Benth. (forages, auxiliary plants)
Dolichos phaseoloides Roxb.
Pueraria javanica (Benth.) Benth.
Punica granatum L. (edible fruits and nuts)
Quararibea funebris (La Llave) Vischer (spices)
Lexarza funebris La Llave
Myrodia funebris (La Llave) Benth.
Raphia hookeri G. Mann & H. Wendl. (fibre plants)
Reissantia cassinoides (DC.) Ding Hou (auxiliary plants)
Hippocratea beccarii Tuyn.
Hippocratea glaga Korth.
Reutealis trisperma (Blanco) Airy Shaw (vegetable oils and fats)
Aleurites saponaria Blanco
Aleurites trisperma Blanco
Rheum ×*cultorum* Thorsrud & Reisaeter (vegetables)
Rhizophora apiculata Blume (auxiliary plants)
Rhizophora candelaria DC.
Rhizophora conjugata Arnott non L.
Rhizophora mucronata Poiret (dye and tannin-producing plants)
Rhizophora latifolia Miq.
Rhizophora macrorrhiza Griffith

Rhizophora mucronata var. *typica* A. Schimper
Rhodamnia cinerea Jack (timber trees)
Rhodamnia trinervia auct. non (J.E. Smith) Blume
Rhodomyrtus tomentosa (Aiton) Hassk. (edible fruits and nuts)
Myrtus tomentosa Aiton
Ricinus communis L. (vegetable oils and fats)
Rollinia emarginata Schlechtendal (edible fruits and nuts)
Rollinia salacifolia Schlechtendal
Rollinia mucosa (Jacq.) Baillon (edible fruits and nuts)
Rollinia deliciosa Safford
Rollinia orthopetala A.DC.
Rorippa heterophylla (Blume) Williams (vegetables)
Nasturtium heterophyllum Blume
Rorippa dubia (Pers.) Hara
Rosa L. cv. group Damascus (essential-oil plants)
Rosa damascena Miller
Rosa gallica L. var. *damascena* Voss
Rosmarinus officinalis L. (spices)
Rosmarinus angustifolius Miller
Rosmarinus latifolius Miller
Salvia rosmarinus Schleiden
Rubia cordifolia L. (dye and tannin-producing plants)
Rubia javana DC.
Rubia mitis Miq.
Rubia munjista Roxb.
Rubus ellipticus J.E. Smith (edible fruits and nuts)
Sagittaria trifolia L. (plants yielding non-seed carbohydrates)
Sagittaria hirundinacea Blume
Sagittaria sagittifolia L. subsp. *leucopetala* (Miq.) Hartog
Sagittaria sinensis Sims
Salacia chinensis L. (edible fruits and nuts)
Salacia latifolia Wallich ex Lawson
Salacia prinoides DC.
Salacia grandiflora Kurz (edible fruits and nuts)
Salacia korthalsiana Miq. (edible fruits and nuts)
Salacia philippinensis Merr.
Salacia macrophylla Blume (edible fruits and nuts)
Salacia flavescens Kurz
Salix tetrasperma Roxb. (auxiliary plants)
Salix azaolana Blanco
Salix horsfieldiana Miq.
Salvia hispanica L. (vegetable oils and fats)
Kiosmina hispanica (L.) Rafin
Salvia chia Sessé & Moc.
Salvia schiedeana Stapf
Salvia officinalis L. (spices)
Salvia chromatica Hoffsgg.
Salvia papillosa Hoffsgg.
Sandoricum koetjape (Burm.f.) Merr. (edible fruits and nuts, timber trees)

Melia koetjape Burm.f.
Sandoricum indicum Cav.
Sandoricum maingayi Hiern
Sandoricum nervosum Blume
Sandoricum vidalii Merr.
Sansevieria trifasciata Prain (fibre plants)
Santalum album L. (essential-oil plants)
Santalum myrtifolium (L.) Roxb.
Santalum ovatum R.Br.
Sirium myrtifolium L.
Santalum spicatum (R.Br.) A.DC. (essential-oil plants)
Eucarya spicata (R.Br.) Sprague & Summerh.
Santalum cygnorum Miq.
Santalum diversifolium (Miq.) A.DC.
Saraca indica L. (timber trees, vegetables)
Saraca bijuga Prain
Saraca harmandiana Pierre
Saraca kunstleri Prain
Saraca minor (Zoll. & Moritzi) Miq.
Sarcandra glabra (Thunberg) Nakai (stimulants)
Bladhia glabra Thunberg
Chloranthus brachystachys Blume
Sarcandra hainanensis (Pei) Swamy & Bailey
Satureja hortensis L. (spices)
Clinopodium hortense O. Kuntze
Satureja laxiflora K. Koch
Satureja pachyphylla K. Koch
Scaphium macropodum (Miq.) Beumée ex K. Heyne (timber trees)
Scaphium affinis (Masters) Pierre
Scaphium beccarianum Pierre
Scaphium lychnophorum (Hance) Pierre
Scaphium scaphigerum (Wallich ex G. Don) Guibourt & Planchon (timber trees)
Scaphium wallichii Schott & Endl.
Schima wallichii (DC.) Korth. (timber trees)
Schima bancana Miq.
Schima crenata Korth.
Schima noronhae Reinw. ex Blume
Schizaea dichotoma (L.) Smith (cryptogams: ferns and fern allies)
Schleichera oleosa (Lour.) Oken (auxiliary plants)
Cussambium oleosum O. Kuntze
Pistacia oleosa Lour.
Schleichera trijuga Willd.
Schoenoplectus lacustris (L.) Palla (fibre plants)
Scorodocarpus borneensis (Baillon) Becc. (timber trees)
Ximenia borneensis Baillon
Scorzonera hispanica L. (vegetables)
Scyphiphora hydrophyllacea Gaertner f. (timber trees)
Securinega flexuosa (Müll. Arg.) Müll. Arg. (timber trees)

Securinega acuminatissima (C.B. Rob.) C.B. Rob.
Securinega keyensis Warb.
Securinega samoana Croizat
Securinega virosa (Roxb. ex Willd.) Baillon (dye and tannin-producing plants)
Fluggea microcarpa Blume
Fluggea virosa (Roxb. ex Willd.) Baillon
Selliguea feei Bory (cryptogams: ferns and fern allies)
Semecarpus anacardium L.f. (edible fruits and nuts)
Semecarpus cassuvium Roxb. (edible fruits and nuts, timber trees)
Senna didymobotrya (Fresenius) Irwin & Barneby (auxiliary plants)
Cassia didymobotrya Fresenius
Cassia nairobiensis L.H. Bailey
Cassia verdickii de Wildeman
Senna hirsuta (L.) Irwin & Barneby (auxiliary plants)
Cassia hirsuta L.
Cassia leptocarpa Benth.
Senna occidentalis (L.) Link (stimulants)
Cassia foetida Pers.
Cassia occidentalis L.
Ditremexa occidentalis (L.) Britton & Rose ex Britton & Wilson
Senna siamea (Lamk) Irwin & Barneby (timber trees, auxiliary plants)
Cassia florida Vahl
Cassia siamea Lamk
Senna sumatrana (Roxb. ex Hornem.) Roxb.
Senna surattensis (Burm.f.) Irwin & Barneby (auxiliary plants)
Cassia glauca Lamk
Cassia suffruticosa Heyne ex Roth
Cassia surattensis Burm.f.
Senna timoriensis (DC.) Irwin & Barneby (timber trees)
Cassia timoriensis DC.
Sesbania grandiflora (L.) Poiret (forages)
Aeschynomene grandiflora (L.) L.
Agati grandiflora (L.) Desv.
Robinia grandiflora L.
Sesbania sesban (L.) Merr. (forages)
Aeschynomene sesban L.
Sesbania aegyptiaca Poiret
Setaria italica (L.) P. Beauv. cv. group Foxtail Millet (cereals)
Panicum italicum L.
Setaria viridis (L.) P. Beauv. subsp. *italica* (L.) Briquet
Simmondsia chinensis (Link) C.K. Schneider (vegetable oils and fats)
Buxus chinensis Link
Simmondsia californica Nuttall
Sinapis alba L. (spices)
Brassica alba (L.) Rabenhorst
Brassica hirta Moench
Sindora coriacea Maingay ex Prain (timber trees)
Sindora leiocarpa Backer ex K. Heyne (timber trees)
Sindora sumatrana Miq. (timber trees, plants producing exudates)

Sindora supa Merr. (timber trees, plants producing exudates)
Sindora velutina J.G. Baker (timber trees, plants producing exudates)
    Sindora parvifolia Symington
Sindora wallichii Graham ex Benth. (timber trees)
    Sindora intermedia (J.G. Baker) Prain ex King
Solanum americanum Miller (vegetables)
    Solanum nigrum auct. non L.
    Solanum nodiflorum Jacq.
Solanum melongena L. (vegetables)
    Solanum coagulans Forssk.
    Solanum cumingii Dunal
    Solanum pressum Dunal
Solanum torvum Sw. (vegetables)
    Solanum ferrugineum Jacq.
    Solanum largiflorum C. White
Sonchus oleraceus L. (vegetables)
    Sonchus sundaicus Blume
Sonchus wightianus DC. (vegetables)
Sonneratia caseolaris (L.) Engl. (timber trees, vegetables)
    Rhizophora caseolaris L.
    Sonneratia acida L.f.
    Sonneratia obovata Blume
Sonneratia ovata Backer (timber trees, auxiliary plants)
    Sonneratia alba auct. non J. Smith
Spatholobus gyrocarpus Benth. (fibre plants)
Sphaerocoryne aberrans Ridley (edible fruits and nuts)
    Polyalthia aberrans Maingay
    Popowia aberrans Pierre
    Unona mesnyi Pierre
Sphaerostephanos heterocarpus (Blume) Holttum (cryptogams: ferns and fern allies)
Sphenomeris chinensis (L.) Maxon (cryptogams: ferns and fern allies)
Spilanthes paniculata Wallich ex DC. (vegetables)
    Spilanthes acmella auct. non (L.) Murr.
    Spilanthes pseudo-acmella auct. non (L.) Murr.
Spondias cytherea Sonnerat (edible fruits and nuts, timber trees)
    Spondias dulcis Soland. ex J.G. Forster
Spondias malayana Kosterm. (spices)
    Poupartia pinnata Blanco
    Spondias pinnata auct. non (Koenig ex L.f.) Kurz
    Spondias wirtgenii Hassk.
Spondias pinnata (L.f.) Kurz (timber trees, spices)
    Mangifera pinnata L.f.
    Spondias amara Lamk
    Spondias mangifera Willd.
Spondias purpurea L. (edible fruits and nuts, timber trees)
    Spondias dulcis Blanco non Soland. ex J.G. Forster
Stachys sieboldii Miq. (plants yielding non-seed carbohydrates)
    Stachys affinis Bunge

Stachys tuberifera Naudin
Stelechocarpus burahol (Blume) Hook.f. & Thomson (edible fruits and nuts)
Uvaria burahol Blume
Stenochlaena palustris (Burm.f.) Bedd. (cryptogams: ferns and fern allies)
Sterculia cordata Blume (timber trees)
Sterculia foetida L. (timber trees)
Sterculia polyphylla R.Br.
Sterculia macrophylla Vent. (timber trees)
Sterculia crassiramea Merr.
Sterculia oncinocarpa F. v. Mueller & Forbes
Sterculia pachyclados K. Schumann
Sterculia parkinsonii F. v. Mueller
Stereospermum chelonoides (L.f.) DC. (timber trees)
Stereospermum suaveolens (Roxb.) A.DC.
Stereospermum colais (Buch.-Ham. ex Dillw.) Mabb. (timber trees)
Stereospermum chelonoides auct. non (L.f.) DC.
Stereospermum personatum (Hassk.) Chatterjee
Stereospermum tetragonum A.DC.
Stereospermum fimbriatum (Wallich ex G. Don) A.DC. (timber trees)
Stereospermum mekongense Dop.
Stevia rebaudiana (Bertoni) Bertoni (spices)
Eupatorium rebaudianum Bertoni
Stevia rebaudiana (Bertoni) Hemsley
Styrax benzoin Dryand. (plants producing exudates)
Benzoin officinale Hayne
Cyrta dealbata Miers
Plagiospermum benzoin Pierre
Styrax parallelloneurum Perkins (plants producing exudates)
Styrax sumatranus J.J. Smith
Styrax tonkinensis (Pierre) Craib ex Hartwich (plants producing exudates)
Anthostyrax tonkinense Pierre
Styrax hypoglaucus Perkins
Styrax macrothyrsus Perkins
Sympetalandra schmutzii v. Steenis (timber trees)
Syzygium aqueum (Burm.f.) Alston (edible fruits and nuts)
Eugenia aquea Burm.f.
Eugenia javanica Lamk p.p.
Eugenia mindanaensis C.B. Robinson
Syzygium aromaticum (L.) Merr. & Perry (spices)
Caryophyllus aromaticus L.
Eugenia aromatica (L.) Baillon
Eugenia caryophyllus (Sprengel) Bullock & Harrison
Syzygium chloranthum (Duthie) Merr. & Perry (timber trees)
Eugenia chlorantha Duthie
Syzygium cumini (L.) Skeels (edible fruits and nuts)
Eugenia cumini (L.) Druce
Eugenia jambolana Lamk
Myrtus cumini L.
Syzygium jambolanum (Lamk) DC.

Syzygium jambos (L.) Alston (edible fruits and nuts)
Eugenia jambos L.
Syzygium longiflorum K. Presl (timber trees)
Eugenia lineata (Blume) Duthie
Eugenia longiflora (K. Presl) Fern.-Vill.
Eugenia teysmannii (Miq.) Koord. & Valeton
Jambosa lineata (Blume) DC.
Myrtus lineata Blume non Sw.
Syzygium lineatum (Blume) Merr. & Perry
Syzygium malaccense (L.) Merr. & Perry (edible fruits and nuts)
Eugenia domestica Baillon
Eugenia malaccensis L.
Jambosa malaccensis (L.) DC.
Syzygium polyanthum (Wight) Walpers (timber trees, spices)
Eugenia balsamea Ridley
Eugenia nitida Duthie
Eugenia polyantha Wight
Syzygium pustulatum (Duthie) Merr. (timber trees)
Eugenia pustulata Duthie
Syzygium samarangense (Blume) Merr. & Perry (edible fruits and nuts)
Eugenia javanica Lamk p.p.
Eugenia mananquil Blanco
Jambosa alba Blume
Myrtus samarangensis Blume
Tacca leontopetaloides (L.) O. Kuntze (plants yielding non-seed carbohydrates)
Tacca involucrata (Limpr.) Schum. & Thonn.
Tacca pinnatifida J.R. Forster & J.G. Forster
Tacca viridis Hemsley
Taenitis blechnoides (Willd) Sw. (cryptogams: ferns and fern allies)
Talinum triangulare (Jacq.) Willd. (vegetables)
Portulaca racemosa L.
Portulaca triangularis Jacq.
Talinum racemosum (L.) Rohrb.
Tamarindus indica L. (edible fruits and nuts)
Tamarindus occidentalis Gaertner
Tamarindus officinalis Hook.
Tectona grandis L.f. (timber trees)
Tectona theka Lour.
Teijsmanniodendron pteropodum (Miq.) Bakh. (timber trees)
Vitex peralata King
Vitex philippinensis Merr.
Vitex pteropoda Miq.
Tephrosia candida (Roxb.) DC. (auxiliary plants)
Kiesera sericea Reinw.
Robinia candida Roxb.
Xiphocarpus candidus (Roxb.) Endl. ex Hassk.
Tephrosia noctiflora Bojer ex Baker (auxiliary plants)
Tephrosia hookeriana Wight & Arnott var. *amoena* Prain
Tephrosia subamoena Prain

Tephrosia purpurea (L.) Pers. (auxiliary plants)
Cracca purpurea L.
Tephrosia diffusa (Roxb.) Wight & Arnott
Tephrosia wallichii Graham ex Fawc. & Rendle
Tephrosia villosa (L.) Pers. (auxiliary plants)
Galega villosa L.
Tephrosia incana (Roxb.) Sweet
Tephrosia vogelii Hook.f. (auxiliary plants)
Cracca vogelii (Hook.f.) O. Kuntze
Terminalia alata Heyne ex Roth (timber trees)
Terminalia coriacea (Roxb.) Wight & Arnott
Terminalia macrocarpa Steudel
Terminalia tomentosa (Roxb.) Wight & Arnott
Terminalia arjuna (Roxb.) Wight & Arnott (dye and tannin-producing plants)
Terminalia berryi Wight & Arnott
Terminalia glabra (Roxb.) Wight & Arnott
Terminalia bellirica (Gaertner) Roxb. (dye and tannin-producing plants, timber trees)
Terminalia laurinoides Teijsm. & Binn. ex Miq.
Terminalia punctata Roth
Terminalia calamansanai (Blanco) Rolfe (timber trees)
Terminalia blancoi Merr.
Terminalia latialata C.T. White
Terminalia pyrifolia (Presl) Kurz
Terminalia catappa L. (dye and tannin-producing plants, timber trees)
Terminalia latifolia Blanco non Sw.
Terminalia mauritiana Blanco
Terminalia moluccana Lamk
Terminalia procera Roxb.
Terminalia chebula Retz. (dye and tannin-producing plants, timber trees)
Terminalia parviflora Thwaites
Terminalia tomentella Kurz
Terminalia zeylanica van Heurck & Müll. Arg.
Terminalia citrina (Gaertner) Roxb. ex Fleming (timber trees)
Terminalia arborea Koord. & Valeton
Terminalia comintana Merr.
Terminalia curtisii Ridley
Terminalia microcarpa Decne. (timber trees)
Terminalia edulis Blanco
Terminalia foveolata C.T. White & Francis ex Lane-Poole
Terminalia hypargyrea K. Schumann & Lauterb.
Terminalia javanica Miq.
Terminalia triptera Stapf (timber trees)
Terminalia nigrovenulosa Pierre ex Gagnep.
Terminalia obliqua Craib
Terminalia tripteroides Craib
Ternstroemia cherryi (F.M. Bailey) Merr. (timber trees)
Garcinia cherryi F.M. Bailey
Ternstroemia rehderana Kobuski

Tetrameles nudiflora R.Br. (timber trees)
Tetrameles grahamiana Wight
Tetrameles horsfieldii Steudel
Tetrapanax papyriferus (Hook.) K. Koch (fibre plants)
Tetrastigma harmandii Planchon (edible fruits and nuts)
Tetrastigma papillosum (Blume) Planchon (fibre plants)
Thespesia lampas (Cav.) Dalzell & A. Gibson (fibre plants)
Thespesia populnea (L.) Soland. ex Corrêa (timber trees, auxiliary plants)
Hibiscus bacciferus J.G. Forster
Hibiscus populneoides Roxb.
Hibiscus populneus L.
Malvaviscus populneus (L.) Gaertner
Thespesia macrophylla Blume
Thymus vulgaris L. (spices)
Thymus aestivus Reuter ex Willk. & Lange
Thymus ilerdensis F. Gonzalez ex Costa
Thymus webbianus Rouy
Timonius timon (Sprengel) Merr. (timber trees)
Timonius rumphii DC.
Timonius sericeus (Desf.) K. Schumann
Tithonia diversifolia (Hemsley) A. Gray (auxiliary plants)
Mirasolia diversifolia Hemsley
Toddalia asiatica (L.) Lamk (spices)
Paullinia asiatica L.
Toddalia aculeata (Smith) Pers.
Toona calantas Merr. & Rolfe (timber trees)
Cedrela calantas (Merr. & Rolfe) Burkill
Toona paucijuga Merr.
Toona ciliata M.J. Roemer (timber trees)
Cedrela toona Roxb. ex Rottler & Willd.
Toona australis Harms
Toona microcarpa (C.DC.) Harms
Toona ternatensis (Miq.) Bahadur
Toona sinensis (Adr. Juss.) M.J. Roemer (timber trees)
Cedrela serrata Royle
Cedrela sinensis Adr. Juss.
Toona serrata (Royle) M.J. Roemer
Toona serrulata (Miq.) Harms
Toona sureni (Blume) Merr. (timber trees)
Cedrela febrifuga Blume
Cedrela sureni (Blume) Burkill
Toona febrifuga (Blume) M.J. Roemer
Trachyspermum roxburghianum (DC.) H. Wolff (spices)
Carum roxburghianum (DC.) Benth.
Ptychotis roxburghiana DC.
Trachyspermum involucratum (Royle) H. Wolff
Trewia nudiflora L. (timber trees)
Mallotus cardiophyllus Merr.
Trewia macrophylla Roth

Trewia macrostachya Klotzsch
Triadica sebiferum (L.) Small (vegetable oils and fats)
Croton sebiferum L.
Sapium sebiferum (L.) Roxb.
Stillingia sebifera (L.) Michx.
Trichomanes javanicum Blume (cryptogams: ferns and fern allies)
Tridax procumbens L. (auxiliary plants)
Trigonella foenum-graecum L. (spices)
Triphasia trifolia (Burm.f.) P. Wilson (edible fruits and nuts)
Triphasia aurantiola Lour.
Tropaeolum tuberosum Ruiz & Pavón (plants yielding non-seed carbohydrates)
Tropaeolum mucronatum Meyen
Trophaeum tuberosum (Ruiz & Pavón) O. Kuntze
Trophis scandens (Lour.) Hook. & Arnott (fibre plants)
Turpinia ovalifolia Elmer (timber trees)
Turpinia lucida Nakai
Turpinia trifoliata Ridley
Turpinia pentandra (Schlechter) B.L. Linden (timber trees)
Turpinia brachypetala (Schlechter) B.L. Linden
Turpinia papuana Merr. & L.M. Perry
Turpinia versteeghii Merr. & L.M. Perry
Uncaria gambir (Hunter) Roxb. (dye and tannin-producing plants)
Uraria crinita (L.) Desv. ex DC. (auxiliary plants)
Hedysarum crinitum L.
Uraria lagopodioides (L.) Desv. ex DC. (auxiliary plants)
Hedysarum lagopodioides L.
Uraria alopecuroides (Roxb.) Sweet
Urophyllum arboreum (Reinw. ex Blume) Korth. (spices)
Urophyllum hirsutum (Wight) Hook.f. (timber trees)
Vallaris solanacea (Roth) O. Kuntze (vegetables)
Vallaris heynei Sprengel
Vanilla griffithii Reichb.f. (edible fruits and nuts)
Vanilla planifolia H.C. Andrews (spices)
Vanilla fragrans (Salisb.) Ames
Vanilla mexicana P. Miller
Vanilla viridiflora Blume
Vernicia fordii (Hemsl.) Airy Shaw (vegetable oils and fats)
Aleurites fordii Hemsl.
Vernonia arborea Buch.-Ham. (timber trees)
Vernonia celebica DC.
Vernonia javanica DC.
Vernonia wallichii Ridley
Vetiveria zizanioides (L.) Nash (essential-oil plants)
Andropogon muricatus Retz.
Andropogon zizanioides (L.) Urban
Phalaris zizanioides L.
Vigna aconitifolia (Jacq.) Marechal (pulses)
Phaseolus aconitifolius Jacq.
Vigna angularis (Willd.) Ohwi & Ohashi (pulses)

Phaseolus angularis (Willd.) W.F. Wight
Vigna mungo (L.) Hepper (pulses)
Phaseolus mungo L.
Vigna umbellata (Thunberg) Ohwi & Ohashi (pulses)
Azukia umbellata (Thunberg) Ohwi
Phaseolus calcaratus Roxb.
Vigna calcarata (Roxb.) Kurz
Vitex altissima L.f. (timber trees)
Vitex parviflora A.L. Juss. (timber trees)
Vitex littoralis Decne.
Vitex timoriensis Walpers
Vitex pinnata L. (timber trees)
Vitex pubescens Vahl
Vitis flexuosa Thunberg (edible fruits and nuts)
Walsura pinnata Hassk. (timber trees)
Napeodendron altissimum Ridley
Walsura aherniana Perkins
Walsura neurodes Hiern
Wikstroemia androsaemifolia Decne. (essential-oil plants)
Wikstroemia candolleana Meisner
Wikstroemia junghuhnii Miq.
Wikstroemia spanoghii Decne.
Wikstroemia indica (L.) C.A. Meyer (fibre plants)
Wikstroemia lanceolata Merr. (fibre plants)
Wikstroemia ovata C.A. Meyer (fibre plants)
Willughbeia angustifolia (Miq.) Markgr. (plants producing exudates)
Willughbeia apiculata Miq.
Willughbeia elmeri Merr.
Willughbeia rufescens Dyer ex Hook.f.
Willughbeia coriacea Wallich (plants producing exudates)
Willughbeia firma Blume
Willughbeia minutiflora (Pierre) K. Schumann
Willughbeia nodosa (Pierre) K. Schumann
Willughbeia edulis Roxb. (plants producing exudates)
Willughbeia cochinchinensis (Pierre) K. Schumann
Willughbeia curtisiana (Pierre) K. Schumann
Willughbeia dulcis Ridley
Willughbeia flavescens Dyer ex Hook.f. (plants producing exudates)
Urnularia flavescens (Hook.f.) Stapf
Willughbeia beccarii (Pierre) K. Schumann
Willughbeia stapfii Merr.
Willughbeia oblonga Dyer ex Hook.f. (plants producing exudates)
Ancylocladus oblongus (Hook.f.) O. Kuntze
Willughbeia tenuiflora Dyer ex Hook.f. (plants producing exudates)
Ancylocladus tenuiflorus (Hook.f.) O. Kuntze
Wissadula periplocifolia (L.) Presl ex Thwaites (fibre plants)
Wrightia arborea (Dennst.) Mabberley (timber trees)
Wrightia hamiltoniana Wallich
Wrightia tomentosa (Roxb.) Roemer & Schultes

Wrightia wallichii A.DC.
Wrightia pubescens R.Br. (timber trees)
Wrightia tinctoria R.Br. (dye and tannin-producing plants)
Xanthophyllum lanceatum (Miq.) J.J. Smith (timber trees, vegetable oils and fats)
Skaphium lanceatum Miq.
Xanthophyllum glaucum Wallich ex Hassk.
Xanthophyllum microcarpum Chodat
Xerospermum laevigatum Radlk. (edible fruits and nuts, timber trees)
Xerospermum acuminatum Radlk.
Xerospermum unijugum Radlk.
Xerospermum noronhianum (Blume) Blume (edible fruits and nuts, timber trees)
Xerospermum intermedium Radlk.
Xerospermum muricatum Radlk.
Xerospermum wallichii King
Xylia xylocarpa (Roxb.) Taubert (timber trees)
Xylia dolabriformis Benth.
Xylocarpus granatum J. König (dye and tannin-producing plants, timber trees)
Carapa granatum (J. Koenig) Alston
Carapa obovata Blume
Xylocarpus obovata (Blume) A. Juss.
Xylocarpus moluccensis (Lamk) M. Roemer (dye and tannin-producing plants, timber trees)
Carapa moluccensis Lamk
Xylocarpus australasicus Ridley
Xylocarpus gangeticus (Prain) C.E. Parkinson
Xylocarpus mekongensis Pierre
Xylopia ferruginea (Hook.f. & Thomson) Hook.f. & Thomson (timber trees)
Xylopia altissima Boerl.
Xylopia oxyantha Hook.f. & Thomson
Xylopia malayana Hook.f. & Thomson (timber trees)
Xylopia maingayi Hook.f. & Thomson
Xylopia mucronata Boerl.
Xylopia pustulata Hook.f. & Thomson
Zehneria marginata (Blume) Keraudren (edible fruits and nuts)
Melothria affinis King
Melothria marginata (Blume) Cogn.
Zingiber chrysostachys Ridley (spices)
Zingiber griffithii Baker (spices)
Zingiber montanum (Koenig) Dietrich (spices)
Amomum montanum Koenig
Zingiber cassumunar Roxb.
Zingiber purpureum Roscoe
Zingiber officinale Roscoe (spices)
Amomum zingiber L.
Zingiber ottensii Valeton (spices)
Zingiber spectabile Griffith (spices)
Zingiber zerumbet (L.) J.E. Smith (spices)

Amomum zerumbet L.
Zingiber amaricans Blume
Zingiber aromaticum Valeton
Zingiber littorale Valeton
Zizania latifolia (Griseb.) Turcz. ex Stapf (vegetables)
Hydropyrum latifolium Griseb.
Limnochloa caduciflora Turcz. ex Trinius
Zizania caduciflora (Trinius) Handel-Mazzetti
Ziziphus mauritiana Lamk (edible fruits and nuts, timber trees)
Rhamnus jujuba L.
Ziziphus jujuba (L.) Gaertner non Miller
Ziziphus oenoplia (L.) Miller (dye and tannin-producing plants)
Ziziphus rufula Miq.

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Acronyms of organizations

- ASEAN: Association of South-East Asian Nations (Jakarta, Indonesia).
- CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora (Lausanne, Switzerland).
- DGIS: Directorate-General for International Cooperation of the Netherlands Ministry of Foreign Affairs (Den Haag, the Netherlands).
- FAO: Food and Agriculture Organization of the United Nations (Rome, Italy).
- FRIM: Forest Research Institute Malaysia (Kepong, Malaysia).
- IEBR: Institute of Ecology and Biological Resources (Hanoi, Vietnam).
- IPGRI: International Plant Genetic Resources Institute (Rome, Italy).
- IUCN: World Conservation Union (Gland, Switzerland).
- LIPI: Indonesian Institute of Sciences (Jakarta, Indonesia).
- PCARRD: Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (Los Baños, the Philippines).
- PROSEA: Plant Resources of South-East Asia (Bogor, Indonesia).
- RDCB: Research and Development Centre for Biology (Bogor, Indonesia).
- TISTR: Thailand Institute of Scientific and Technological Research (Bangkok, Thailand).
- UNDP: United Nations Development Programme (New York, United States).
- UNESCO: United Nations Educational, Scientific and Cultural Organization (Paris, France).
- UNITECH: Papua New Guinea University of Technology (Lae, Papua New Guinea).
- UPLB: University of the Philippines at Los Baños (Los Baños, the Philippines).
- WHO: World Health Organization (Geneva, Switzerland).
- WU (formerly WAU): Wageningen University (Wageningen, the Netherlands).
- WWF: World Wide Fund for Nature (Gland, Switzerland).

Glossary

abortifacient: causing abortion; an agent that causes abortion

abortive: imperfectly developed; effecting an abortion (abortifacient)

abortivum: agent inducing abortion

abscess: a swollen, inflamed area in body tissues, in which pus gathers

acaulescent: lacking a visible stem

accession: in germplasm collections: plant material of a particular collection, usually indicated with a number

accrescent: increasing in size with age

acetates: a large group of secondary metabolites, in which acetylcoenzyme A ('acetate') is the building block; acetate itself is derived from primary metabolism carbohydrates via pyruvic acid

acetogenins: a group of long-chain aliphatic compounds, ending with a 'gamma' lactone, most often unsaturated and cyclized into one or two tetrahydrofuran rings that may or may not be adjacent

achene: a small dry indehiscent one-seeded fruit

acne: inflammatory disease affecting hair follicles and glands of the skin; frequently used to designate acne vulgaris, with lesions on the face, chest and back

actinomorphic: radially symmetrical; applied to flowers which can be bisected in more than one vertical plane

acuminate: ending in a narrowed, tapering point with concave sides

acute: in botany: sharp; ending in a point with straight or slightly convex sides; in medicine: with a short and relatively severe course

acute toxicity: toxicity characterized by a sudden onset, sharp rise and short course

adaptogenic: strengthening the resistance of the body to stress

adaxial: on the side facing the axis (ventral)

adenocarcinoma: carcinoma derived from glandular tissue or in which the tumour cells form recognizable glandular structures

adherent: the union of parts usually separate

adnate: united with another part; with unlike parts fused, e.g. ovary and calyx tube

adrenoceptor: adrenergic receptor, i.e. postulated site on effector organs innervated by adrenergic fibres of the sympathetic nervous system

adventitious: not in the usual place, e.g. roots on stems, or buds produced in other than terminal or axillary positions on stems

aerial root: any root that grows above the ground

aestivation: the arrangement of sepals and petals in the bud

aglycones: the non-sugar part of glycosides is called the aglycone part or simply the aglycone; aglycones and their glycosides may be present in the same plant; furthermore, the combination of aglycone and sugar will alter the properties of the molecule

agonist: a drug that has affinity for and stimulates physiological activity at cell receptors normally stimulated by naturally occurring substances (see also antagonist)

agroforestry: land-use systems in which trees or shrubs are grown in association with crops (agricultural crops or pastures) in a spatial arrangement or a rotation and in which there are both ecological and economic interactions between the trees and the other components of the system

ague: a fever of malarial character marked by paroxysms of chills, fever, and sweating that recur at regular intervals

AIDS: acquired immune deficiency syndrome, an epidemic, transmissible retroviral disease due to infection with HIV (human immunodeficiency virus), in severe cases manifested as a profound depression of cell-mediated immunity

air layering: a form of layering in which soil (rooting medium) is brought to the branch to be layered; the ball of soil in a polyethene cover is wrapped around the girdled branch; after adventitious roots grow out above the girdle, the layer can be separated

albumen: the nutritive material stored within the seed, and in many cases surrounding the embryo (endosperm)

alkaloids: large group of organic bases containing nitrogen and usually oxygen that occur for the most part in the form of salts; usually optically and biologically active

allergenic: acting as an allergen; inducing allergy

allergic: pertaining to, caused by, affected with, or of the nature of allergy

allergy: a state of hypersensitivity induced by exposure to a particular antigen (allergen) resulting in harmful immunological reactions on subsequent exposures

alluvium: soil material deposited by running water in recent geological time

alopecia: baldness; absence of the hair from skin areas where it is normally present

alterative: tending to change gradually the condition of the body to a normal state; a drug having this effect

alternate: leaves, etc., inserted at different levels along the stem, as distinct from opposite or whorled

alveolate: marked as though honeycombed

Alzheimer's disease: dementia of insidious onset and gradually progressive course, usually occurring after the age of 50

amenorrhoea: abnormal absence or suppression of the menses

amoebiasis: the state of being affected by amoebae, especially with *Entamoeba histolytica*

amplexicaul: stem-clasping, when the base of a sessile leaf or a stipule is dilated at the base, and embraces the stem

anaemia: a condition in which the blood is deficient in red blood cells, in haemoglobin, or in total volume

anaesthetic: producing loss of sensation; producing loss of the ability to feel pain; an agent used to abolish the sensation of pain

analgesia: absence of sensibility to pain; the relief of pain without loss of consciousness

analgesic: relieving pain; not sensitive to pain; an agent alleviating pain without causing loss of consciousness

androgen: any substance that promotes masculinization

angina pectoris: a paroxysmal thoracic pain, often radiating to the arms. It is most often due to deficiency of blood in the myocardium and precipitated by effort or excitement

angiotensin: any of a family of polypeptide hormones formed by the catalytic action of renin on renin substrate and stimulating contraction of the muscular tissue of the capillaries and arteries

aniline: an oily liquid poisonous amine, colourless when pure

annual: a plant which completes its life cycle in one year

annular: used of any organs disposed in a circle

annulus: a ring or a ring-like part

anodyne: relieving pain; a medicine that relieves pain

antagonist: a substance that tends to nullify the action of another, as a drug that binds to a cell receptor without eliciting a biological response (see also agonist)

anterior: of time, previous; of place, position in front, or turned away from the axis

anthelmintic: destructive to worms: a drug or agent that destroys worms

anther: the part of the stamen containing the pollen

anthesis: the time the flower is expanded, or, more strictly, the time when pollination may take place

anthocyanidins: the aglycone part of anthocyanins, compounds closely related to the flavonoids but derived from the 2-phenyl benzopyrylium cation

anthocyanins: glycosides of the anthocyanidins

anthraquinones: a subgroup of the quinones, in which the dione is conjugated to the condensed polycyclic aromatic system of anthracene

anti-inflammatory: suppressing or counteracting inflammation; an agent that suppresses or counteracts the inflammatory process

anti-oestrogen: a substance capable of inhibiting the biological effects of female sex hormones

anti-ulcerogenic: preventing the production of ulcers

antibiotic: any of a large class of substances produced by various micro-organisms and fungi and having the power of arresting the growth of other micro-organisms or destroying them; a chemical, produced by plants, animals or synthetically, having similar properties

anticomplementary: reducing or destroying the power of a complement (a complex system of heat-sensitive proteins present in serum and reacting with antibodies to destroy antigens)

antidiabetic: preventing or alleviating diabetes

antidiarrhoeal: counteracting diarrhoea

antidote: anything counteracting the effects of a poison

antidysenteric: preventing, alleviating or curing dysentery

antifebrile: = antipyretic

antifeedant: preventing something from being eaten

antifilarial: effective against filaria
antigastralgic: preventing or alleviating gastric colic
antihepatotoxic: counteracting injuries to the liver
antihistamine: a drug that counteracts the action of histamine; often used against allergy
antileishmanial: effective against leishmania
antileprotic: therapeutically effective against leprosy
antileukaemic: preventing or alleviating leukaemia
antimicrobial: killing micro-organisms, or suppressing their growth or multiplication; an agent acting so
antimitotic: inhibiting or preventing mitosis
antineoplastic: inhibing or preventing the development of neoplasms (tumours)
antinociceptive: having an analgesic effect
antioxidant: a substance that opposes oxidation or inhibits reactions promoted by oxygen or peroxides; many of these substances are used as preservatives in various products
antiphlogistic: counteracting inflammation and fever; an agent counteracting inflammation and fever
antiplasmodial: destroying plasmodia
antiproliferative: preventing or inhibiting the reproduction of similar cells
antiprotozoal: destroying protozoa, or checking their growth or reproduction
antipruritic: relieving or preventing itching
antipyretic: relieving or reducing fever; an agent that relieves or reduces fever
antirheumatic: relieving or preventing rheumatism
antiscorbutic: relieving or preventing scurvy; a remedy for scurvy
antisecretory: inhibiting or diminishing secretion
antiseptic: pertaining to asepsis (prevention of contact with micro-organisms); preventing decay or putrefaction; a substance inhibiting the growth and development of micro-organisms without necessarily killing them
antispasmodic: relieving spasm; an agent that relieves spasm
antispermatogenic: preventing or inhibiting the production of semen or spermatozoa
antithrombotic: preventing or interfering with the formation of thrombi
antitussive: preventing or relieving cough; an agent that prevents or relieves cough
antrorse: directed upwards (opposed to retrorse)
anuria: complete suppression of urinary secretion by the kidneys
anxiolytic: reducing anxiety
aperient: a mild or gentle purgative; also called laxative
apex (plural: apices): the tip or summit of an organ
aphrodisiac: stimulating sexual desire; a drug arousing the sexual instinct
aphthae: plural of aphtha; recurrent inflammation of the oral mucous membranes, characterized by the presence of small ulcers
apical: at the apex of any structure
apiculate: ending abruptly in a short point
apomixis: reproduction by seed formed without sexual fusion (apomictic)
apoptosis: fragmentation of a cell into membrane-bound particles, which are eliminated by phagocytosis
aporphine alkaloids: a subgroup of the alkaloids; see also alkaloids
appendage: a part added to another; attached secondary or subsidiary part, sometimes projecting or hanging
appendix (botany): a name given to appendages of any kind, e.g. in *Araceae* the sterile top part of the spadix
appressed: lying flat for the whole length of the organ
arachnoid: like a cobweb
architectural model: model describing the branching habit of a tree as determined by the pattern of activity of axes, the pattern including timing, positioning and fate (e.g. terminating in an inflorescence) of active axes
areole: an irregular square or angular space marked out on a surface, e.g. of a fruit; a small cell or cavity
areolate: with irregular squares or angular spaces marked out on a surface, e.g. of a fruit; with small cells or cavities
aril: an expansion of the funicle enveloping the seed, arising from the placenta; sometimes occurring as a pulpy cover (arillus)
arillode: a false aril, a coat of the seed not arising from the placenta
arilloid: like an aril
armed: bearing some form of spines
arrhythmia: any variation from the normal rhythm of the heartbeat
arteriosclerosis: a group of diseases characterized by thickening and loss of elasticity of arterial walls
arthritis: inflammation of a joint or joints
article: a segment of a constricted pod or fruit, as in *Desmodium*
articulate: jointed, or with places where separation takes place naturally

articulation: a joint, popularly applied to nodes of grasses
ascending: curving or sloping upwards
ascites: effusion and accumulation of serous fluid in the abdominal cavity
asexual: sexless; not involving union of gametes
asthma: a chronic disorder characterized by paroxysms of the bronchi, shortness of breath, wheezing, a suffocating feeling, and laboured coughing to remove tenacious mucus from the air passages
astringent: an agent or substance causing constriction of the skin, mucous membranes or raw or exposed tissues; as such, ethanol is used in skin-toning lotions and aluminium chlorohydrate in anti-perspirants
atherosclerosis: an extremely common form of arteriosclerosis in which deposits of yellowish plaques containing mainly cholesterol and lipoid material are formed on the walls of large and medium-sized arteries
atonic: lacking normal tone or strength
attenuate: gradually tapering
auct.: auctorum (Latin); of authors
auct. non: auctorum, non (Latin); of authors not ... (author name); used after a scientific name when this name is erroneously applied by several authors to material actually belonging to a different species than the species described by the author mentioned
auricle: a small lobe or ear
auriculate: eared, having auricles
awn: a bristle-like appendage, especially occurring on the glumes of grasses
axil: the upper angle between the leaf and the stem
axile: (placenta) belonging to or situated in an axis
axillary: arising from the axil
axis: the main or central line of development of a plant or organ
Ayurvedic: traditional Hindu system of medicine based largely on homeopathy and naturopathy
baccate: berrylike; pulpy or fleshy
bactericidal: destroying bacteria
bark: the tissue external to the vascular cambium collectively, being the secondary phloem, cortex and periderm
basionym: the synonym of a scientific name that supplies the epithet for the correct name
batik: an Indonesian method of hand-printing textiles by coating parts of the fabric with wax to resist dye, dipping in a cold dye solution, boiling off the wax, and repeating the process for each colour used
beak: a long, prominent and substantial point, applied particularly to prolongations of fruits
beaked: used of fruits which end in a long point
bearded: awned; having tufts of hairs
bechic: a remedy or treatment of cough
benzenoids: chemical compounds containing a characteristic benzene ring, often represented as a C_6 ring with 3 double bonds alternating with single bonds between the C-atoms
benzoquinones: quinones with the dione conjugated to an aromatic nucleus
beri-beri: a disease caused by a deficiency of thiamine (vitamin B1), marked by inflammatory or degenerative changes of the nerves and heart, and oedema
berry: a juicy indehiscent fruit with the seeds immersed in pulp; usually several-seeded without a stony layer surrounding the seed
biennial: a plant which flowers, fruits and dies in its second year or season
bifid: forked, divided in two but not to the base
bilabiate: two-lipped
biliousness: a symptom complex with nausea, abdominal discomfort, headache and constipation, formerly attributed to excessive secretion of bile
bilocular: with two compartments or cells
biogenic: having origins in biological processes
bipinnate: when the primary divisions (pinnae) of a pinnate leaf are themselves pinnate
bisbenzylisoquinoline alkaloids: a subgroup of the isoquinoline alkaloids; see also alkaloids
bisexual: having both sexes present and functional in the same flower
blade: the expanded part, e.g. of a leaf or petal
blennorrhoea: an excessive discharge of mucus; former name for gonorrhoea
blight: a general term applied to any of a wide range of unrelated plant diseases
blister: a small swelling of the skin, filled with watery matter and caused by burning or rubbing
blotched: see variegated
bole: the main trunk of a tree, generally from the base up to the first main branch
bract: a reduced leaf subtending a flower, flower stalk or the whole or part of an inflorescence
bracteole: a secondary bract on the pedicel or close under the flower
bradycardia: slowness of the heartbeat, as evidenced by a slowing of the pulse rate to less than 60 in an adult
breeding: the propagation of plants or animals to improve certain characteristics
bristle: a stiff hair or a hair-like stiff slender body
bronchitis: inflammation of one or more bronchi

bronchospasm: spasmodic contraction of the smooth muscles of the bronchi, as occurs in asthma

bud: the nascent state of a flower or branch; often applied to those primordial vegetative or reproductive branches that are enclosed in a prophyllum and have a resting stage

budding: the process of inserting a scion, which consists of the bud in a leaf axil on a shield of rind, with or without a small piece of wood attached, into a plant (rootstock) with the intention that it will unite and grow there, usually in order to propagate a desired cultivar

bulb: an underground storage organ with a much-shortened stem bearing fleshy leaf bases or scale leaves enclosing the next year's bud

bulbil: an aerial bulb or bud produced in a leaf axil or replacing the flower, which, on separation, is capable of propagating the plant

bullate: surface much blistered or puckered

bush: a low thick shrub without a distinct trunk

buttress: the enlargement of the base of trunks of tropical trees that ranges from a small spur or swelling to massive structures, partly root, partly stem, reaching as high as 10 m up the stem, thin and flat to thick, twisted or anastomose

cachexia: general ill health and malnutrition

caducous: falling off

caespitose: forming mats or spreading tufts

callus: in plants, small hard outgrowth at the base of spikelets in some grasses, or tissue that forms over cut or damaged plant surface; in humans, localized hyperplasia of the horny layer of the epidermis due to pressure or friction, or an unorganized meshwork of woven bone which is formed after a fracture of a bone

calyptrate: operculate, having a deciduous lid

calyx: the outer envelope of the flower, consisting of sepals, free or united

campanulate: bell-shaped

canaliculate: channelled, with a longitudinal groove

cancer: a malignant neoplasm or tumour, characterized by a morbid proliferation of epithelial cells in different parts of the body, resulting in progressive degeneration and often ending fatally

canopy: the uppermost leafy layer of a tree, forest or crop

capitate: headed, like the head of a pin in some stigmas, or collected into compact headlike clusters as in some inflorescences

capsule: in botany: a dry dehiscent fruit composed of two or more carpels and either splitting when ripe into valves, or opening by slits or pores; in medicine: a structure in which something is enclosed, e.g. a hard or soft, soluble container enclosing a dose of medicine

carbohydrates: compounds formed from water and carbondioxide; they can be grouped into sugars and polysaccharides

carbuncle: a necrotizing infection of skin and subcutaneous tissue consisting of a cluster of boils, and with multiple formed or incipient drainage sinuses; it is usually caused by *Staphylococcus aureus*

carcinogenesis: the production of carcinoma

carcinogenic: producing carcinoma

carcinoma: a malignant new growth consisting of epithelial cells, which tends to infiltrate surrounding tissues and give rise to metastases

cardenolides: cardiac glycosides in which the side chain of the steroid aglycone is a 5-membered lactone ring; see also cardiac glycosides

cardiac: pertaining to, situated near, or affecting the heart; pertaining to the opening between the oesophagus and the stomach

cardioactive: having an effect on the heart

cardiotonic: having a tonic effect on the heart; an agent that has a tonic effect on the heart

cardiovascular: pertaining to the heart and blood vessels

carinate: keeled

cariogenic: leading to the production of caries

carminative: relieving flatulence; an agent relieving flatulence and assuaging pain

carotenoids: a subgroup of the terpenoids, containing 8 isoprene units (C_{40}) named after β-carotene

carpel: one of the foliar units of a compound pistil or ovary; a simple pistil has only one carpel

carpophore: the part of the receptacle which is prolonged between the carpels as a central axis

cartilaginous: hard and tough

caruncle: an outgrowth of a seed near the hilum

caryopsis: the fruit of a grass, in which the outer layer (testa) of the seed proper is fused to the ovary wall

cataplasm: poultice or soft external application

catarrh: inflammation of the lining tissue of various organs, particularly of the nose, throat, and air passages, and characterized by an outpouring of mucus

cathartic: causing evacuation of the bowels; an agent that causes evacuation of the bowels by increasing bulk, stimulating peristaltic action etc.; also called purgative

catkin: a close bracteate, often pendulous spike,

usually with unisexual flowers
caudate: with a tail-like appendage
cauliflorous: with the flowers borne on the trunk
cauline: belonging to the stem or arising from it
chalaza: the basal part of the ovule or seed where it is attached to the funicle and the point at which vascular tissues enter and spread into the ovule
chalcones: a subgroup of the flavonoids; see also flavonoids
channelled: grooved, hollowed out like a gutter
chartaceous: papery
chemotype: taxon which is morphologically similar to another one but with different chemical content
chlorophyll: green pigment in plants which absorbs light for photosynthesis
cholagogue: an agent that promotes an increased flow of bile
cholera: acute, infectious inflammation of the intestine, caused by an enterotoxin elaborated by *Vibrio cholerae*, and characterized by severe, watery diarrhoea
choleretic: stimulating the production of bile by the liver
cholinergic: stimulated, activated or transmitted by acetylcholine; applied to the sympathetic and parasympathetic nerve fibres that liberate acetylcholine at a synapse when a nerve impulse passes
chromosome: a structural unit in the nucleus which carries the genes in a linear constant order; the number is typically constant in any species
chronic: persisting over a long period of time
cicatrizant: an agent that promotes the formation of a scar
ciliate: with a fringe of hairs along the edge
ciliolate: fringed with small hairs
cincinnus: a monochasial cymose inflorescence with branches alternating from one side of the vertical axis to the other and normally curved to one side
circinnate: coiled into a ring or partially so
circumscissile: dehiscing or falling off along a circular line
cirrhosis: liver disease characterized by diffuse, interlacing bands of fibrous tissue that divide the hepatic parenchyma into nodular areas
clavate: club-shaped or thickened towards the end
claw: the basal, narrow part of a petal or sepal
clawed: furnished with a basal, narrow part (the claw)
cleft: cut halfway down
cleistogamous: pollination and fertilization taking place within the unopened flower
clone: a group of plants originating by vegetative propagation from a single plant and therefore of the same genotype
clustered: compactly gathered together; with several stems
coherent: the incorporation of one part with another, as the petals to form a tubular corolla
colic: acute, spasmodic pain in the bowels; pertaining to the bowels
collar: the boundary between the above- and underground portions of the axis of a plant
colleter: a multicellular glandular hair
column (botany): a cylindrical body, e.g. a tube of connate stamen filaments or the central axis of a fruit
coma: in medicine: a state of unconsciousness from which the patient cannot be aroused; in botany: the hairs at the end of some seeds; a tuft of leafy bracts or leaves at the top of an inflorescence (e.g. pineapple)
comose (of seeds): tufted with hairs at the end
compatibility: in floral biology: capable of cross- or self-fertilization; in plant propagation: stock–scion combinations resulting in a lasting union
compound: in botany: of two or more similar parts in one organ, as in a compound leaf or compound fruit; in chemistry: a substance consisting of 2 or more elements combined chemically in fixed proportions
concave: hollow
concoction: a combination of crude materials that are prepared (cooked) together
conduplicate: folded lengthwise
cone: the fruit of a pine or fir tree (gymnosperms), largely made up of imbricated scales
confluent: blended into one, passing by degrees from one into the other
congeneric: belonging to the same genus or forming a single genus
conical: having the shape of a cone (cone-shaped)
conjunctivitis: inflammation of the conjunctiva
connate: united or joined
connective (botany): tissue between the pollen sacs of an anther
connivent: having a gradually inward direction, as in many petals (convergent)
conspecific: belonging to the same species
constipation: a condition of the bowels in which the expulsion of waste matter is infrequent and difficult
contiguous: touching but not united, directly bordering

contorted: twisted or bent
contraceptive: reducing the likelihood of or preventing conception; an agent that reduces the likelihood of or prevents conception
convex: having a more or less rounded surface
convulsant: producing or causing convulsions
convulsion: a violent and involuntary contraction of the voluntary muscles
coppice: a small wood which is regularly cut at stated intervals; the new growth arising from the stools
cordate: heart-shaped, as seen at the base of a leaf, etc., which is deeply notched
core: central part; the seeds and integuments of a pome, such as an apple; pith in dicotyledonous plants
coriaceous: of leathery texture
corm: in botany: a solid, short, swollen underground stem, usually erect and tunicated, of one year's duration, with that of the next year at the top or close to the old one
cormel: diminutive of corm, often indicating a secondary corm or tuberous side-rhizome
corolla: the inner envelope of the flower consisting of free or united petals
corona: any appendage or extrusion that stands between the corolla and stamens; crown; the remains of the calyx limb on e.g. apples or pears
corticosteroid: any of the 21-carbon steroids elaborated by the adrenal cortex (excluding sex hormones of adrenal origin) in response to the release of ACTH or angiotensin II; used clinically for hormone replacement therapy, for suppression of ACTH secretion, for suppression of immune responses and as antineoplastic, anti-allergic and anti-inflammatory agents
corymb: a flat-topped indeterminate inflorescence in which the branches or pedicels sprout from different points, but attain approximately the same level, with the outer flowers opening first
corymbose: flowers arranged to resemble a corymb
cotyledon: seed-leaf, the primary leaf; dicotylous embryos have two cotyledons and monocotylous embryos have one
coumarins: benzo-α-pyrone (α-chromone) derivatives
cover crop: a close-growing crop primarily grown for the purpose of protecting and improving soil between periods of regular crop production or between trees or vines in orchards and plantations
crenate: the margin notched with blunt or rounded teeth
crenulate: slightly crenate, with small teeth
crest: an elevation or ridge upon the summit of an organ
crown: the aerial expanse of a tree, not including the trunk; corona; a short rootstock with leaves; the base of a tufted, herbaceous, perennial grass
crown shaft: in palms, a conspicuous cylinder formed by tubular leaf sheaths at the top of the stem
crustaceous: of hard but brittle texture
cryptocotylar: of germination, condition in which the cotyledons remain enveloped in the persistent fruit wall and/or testa
crystalline: of the nature of or relating to a crystal or crystals
culm: the stem of grasses and sedges
cultigen: a plant species or race that has arisen or is known only in cultivation
cultivar (cv., plural: cvs): an agricultural or horticultural variety that has originated and persisted under cultivation, as distinct from a botanical variety; a cultivar name should be written with an initial capital letter and given single quotation marks (e.g. banana 'Gros Michel') unless preceded by 'cv.' (e.g. cv. Gros Michel)
cuneate: wedge-shaped; triangular, with the narrow end at the point of attachment, as the bases of leaves or petals
cupular: furnished with or subtended by a cupule
cupule: a small cup-like structure; the cup of such fruits as the acorn, consisting of an involucre composed of adherent bracts
cupuliform: cupule-shaped
cusp: a sharp, rigid but small point
cuspidate: abruptly tipped with a sharp rigid point
cutting: a portion of a plant, used for vegetative propagation
cyanogenic glycosides: a group of secondary metabolites that form hydrocyanic acid on hydrolysis
cyme: a determinate inflorescence, often flat-topped, in which each growing point ends in a flower and the central flowers open first
cymose: bearing cymes or inflorescences related to cymes
cymule: a diminutive, usually few-flowered cyme or portion of one
cystitis: inflammation of the urinary bladder
cystolith (botany): mineral concretions, usually of calcium carbonate on a cellulose stalk
cytokine: generic term for nonantibody proteins released by a cell population on contact with a specific antigen and acting as intercellular mediators
cytotoxic: pertaining to or exhibiting a destructive effect on certain cells

deciduous: shedding, applied to leaves, petals, etc.
declinate: bent or curved downward or forward
decoction: a medicinal preparation or other substance made by boiling, especially in water
decumbent: reclining or lying on the ground, but with the summit ascending
decurrent: extending down and adnate to the petiole or stem, as occurs in some leaves
decussate: of leaves, arranged in opposite pairs on the stem, with each pair perpendicular to the preceding pair
deflexed: abruptly recurved; bent downwards or backwards
dehiscent: opening spontaneously when ripe, e.g. of capsules, anthers
deltoid: shaped like an equilateral triangle
demulcent: allaying the irritation of abraded or inflamed body surfaces, soothing; a soothing, mucilaginous or oily medicine or application
dendritic: dendroid, tree-like in form or branching
dentate: margin prominently toothed with the pointed teeth directed outwards
denticulate: minutely toothed
depressant: diminishing functional activity; a medicine or drug which lowers functional activity and vital energy in general
depressed: sunk down, as if flattened from above
depurative: tending to purify or cleanse
dermatitis: inflammation of the skin
dermatomycosis: superficial fungal infection of the skin or its appendages, with the term including dermatophytosis
dermatophyte: a fungus parasitic on the skin
diabetes: a general term referring to disorders characterized by the excretion of excessive amounts of urine. When used alone, usually referring to diabetes mellitus, i.e. a chronic syndrome of impaired carbohydrate, protein and fat metabolism owing to insufficient secretion of insulin or tissue insulin resistance
diaphoretic: pertaining to, characterized by, or promoting (profuse) perspiration; an agent inducing sweating, having the power to increase perspiration
diarrhoea: a profuse, frequent, and loose discharge from the bowels
dichasium (plural: dichasia): a cymose inflorescence with 2 equal or nearly equal lateral branches arising below the terminal flower, this pattern being repeated or not (compound and simple dichasium respectively)
dichotomous: forked, parted by pairs
dicotyledon: angiosperm with two cotyledons or seed-leaves
didynamous: with the stamens in two pairs, two long and two short ones
digestibility: the percentage of a foodstuff taken into the digestive tract that is absorbed into the body
dilated (botany): expanded into a flat structure
dimer: a compound formed by combination of two identical simpler molecules
dimeric: showing the characteristics of a dimer
dimorphic: of two forms, as may occur with branches, etc.
dioecious: with unisexual flowers and with the staminate and pistillate flowers on different plants (dioecy)
diosgenin: a complex steroid obtained from certain species of yam and which can be converted into 16-dehydropregnenolone, one of the main active ingredients in oral contraceptives
dipterocarp forest: woodland dominated by trees belonging to the family *Dipterocarpaceae*
disciform: shaped like a disk
discoid: resembling a disk or discus, being flat and circular, e.g. of a leaf with a round thickened lamina and rounded margins
disjunct: separated
disk (botany): a fleshy or elevated development of the receptacle within the calyx, corolla or stamens, often lobed and nectariferous
dispersal: the various ways by which seeds are scattered, e.g. by wind, water or animals
dissected: divided into many slender segments
distal: situated farthest from the place of attachment
distichous: regularly arranged in two opposite rows on either side of an axis
diterpenes: a subgroup of the isoprenoids, formed by coupling of 4 C_5 units
diuretic: tending to increase the flow of urine; an agent that promotes the excretion of urine
divaricate: extremely divergent
domatium (plural: domatia): a modified projection that provides shelter for other organisms
dormancy: a term used to denote the inability of a resting plant or plant part (e.g. the seed, bulb, tuber, or in tree crops usually the buds) to grow or to leaf out, even under favourable environmental conditions
dorsal: back; referring to the back or outer surface of a part or organ (abaxial)
double blind: pertaining to a clinical trial or other experiment in which neither the subject nor the person administering treatment knows which treatment any particular subject is receiving
dropsy: oedema

drupaceous: resembling a drupe, whether actually a drupe or not
drupe: a fleshy one-seeded indehiscent fruit with the seed enclosed in a strong endocarp
drupelet: a small drupe
dysentery: any of various diseases characterized by inflammation of the intestines, abdominal pain and frequent bloody, mucous faeces
dysmenorrhoea: painful menstruation
dyspepsia: a condition of disturbed digestion
dyspnoea: laboured or difficult breathing
dysuria: difficult or painful urination
ebracteate: without bracts
EC_{50}: median effective concentration, i.e. the concentration that produces the desired effect in fifty percent of a test population
ecbolic: increasing uterine contractions and aiding in or hastening expulsion or delivery of child during birth; an agent acting so
echinate: bearing spines or bristles
ectomycorrhiza: see mycorrhiza
eczema: a disease of the skin characterized by inflammation, redness, itching, and the formation of vesicles which exude a watery substance that evaporates and leaves the skin covered with crusts
ED_{50}: median effective dose, i.e. the dose that produces the desired effect in fifty percent of a population
elaiosome: a seed or fruit outgrowth in which oil is stored; serves as food for ants
ellipsoid: a solid which is elliptical in outline
elliptical: oval in outline but widest about the middle
emarginate: notched at the extremity
embrocation: a liquid ointment
embryo: in plants, the rudimentary plant within a seed, developed from a zygote (sexual) or from other nuclei in the embryo sac or cells of the nucellus or integuments (apomictic); in animals, those derivatives of the fertilized ovum that will become the offspring, during their period of most rapid development; in humans, the developing organism from the end of the 2nd week after fertilization to the end of the 8th week
emergent: of a tree, one of which the crown reaches distinctly above the forest canopy; of cotyledons, becoming free from the seed coat and other external tissues
emetic: tending to induce or cause vomiting; an agent that induces or causes vomiting
emmenagogue: a substance or measure that induces menstruation
emollient: soothening and softening; an agent that soothes or softens the skin or soothes an irritated internal surface
encephalitis: inflammation of the brain
endemic: exclusively native to a specified or comparatively small region; also used as a noun for a taxon thus distributed
endocarp: the innermost layer of the pericarp or fruit wall
endogenous: originating from within the organism
endosperm: the starchy or oily nutritive material stored within some seeds, sometimes referred to as albumen; it is triploid, having arisen from the triple fusion of a sperm nucleus and the two polar nuclei of the embryo sac
endotrophic: in mycorrhizae, finding nourishment from inside
energy value: the heat produced by the combustion of a unit weight of a fuel or food (= calorific value)
ensiform: sword-shaped
enteritis: inflammation of the small intestine
entire (botany): with an even margin without teeth, lobes, etc.
epicotyl: the young stem above the cotyledons
epidermis: in plants, the true cellular skin or covering of a plant below the cuticle; in humans, the outermost and nonvascular layer of the skin
epidermoid: belonging to or resembling the epidermis
epididymis: the cordlike structure at the posterior part of the testis, whose coiled duct provides for storage, transit and maturation of spermatozoa
epigeal: above the ground; in epigeal germination the cotyledons are raised above the ground
epilepsy: any of a group of syndromes characterized by recurrent, transient disturbances of the brain function, with manifestations including unconsciousness and uncontrolled motion
epipetalous: borne upon or placed before the petals
epiphyte: a plant that grows on another plant but without deriving nourishment from it
erect: directed towards summit, not decumbent
erysipelas: an acute, superficial form of dermatitis, usually caused by group A streptococci and characterized by a spreading, red, hot plaque
erythema: name applied to skin redness produced by congestion of the capillaries
essential oil: a volatile product, obtained from a natural source, which agrees with that source in odour and name; in a narrow sense, only volatile products obtained by steam or water distillation are called essential oils
eutrophic: providing adequate or with a large supply of nutrition

evergreen: bearing foliage all year long; a plant that changes its leaves gradually
ex situ: in an artificial environment or unnatural habitat
exocarp: the outer layer of the pericarp or fruit wall
expectorant: promoting the ejection of mucus or other fluids from the respiratory tract; an agent tending to promote discharge of mucus or other fluids from the respiratory tract
exserted: protrude beyond, as stamens beyond the tube of the corolla
exstipulate: without stipules
extract: a concentrated preparation of a vegetal or animal drug obtained by removing the active constituents with a suitable solvent
extraction: any process for separating aroma compounds from animal or plant matter using a volatile solvent; the product is called a concrete; the composition, and hence odour quality, of an aromatic extract depends strongly on the nature of the solvent used
extrafloral: of nectaries, beyond the flower
exudate: the secreted substance
falcate: sickle-shaped
fallow: land resting from cropping, often covered by natural vegetation or planted with fast growing herbs, shrubs or trees (fallow crop)
fascicle: a cluster of flowers, leaves, etc., arising from the same point
fasciculate: connected or drawn into a fascicle
febrifuge: an agent serving to reduce fever
ferruginous: rust-coloured
fertile: in plants: capable of completing fertilization and producing seed; producing seed capable of germination; having functional sexual organs; in humans: having the capacity to reproduce; capable of developing into a new individual (said of ova)
fertilization (biology): union of the gametes (egg and sperm) to form a zygote
fibrinolytic: pertaining to, characterized by or causing fibrinolysis, i.e. the dissolution of fibrin by enzymatic action
fibroblast: connective tissue cell
fibrosarcoma: a malignant tumour consisting of cells and fibres derived from fibroblasts
fibrosis: the formation of fibrous tissue
fibrous: composed of or containing fibres
fig: the fleshy multiple fruit, derived from the inflorescence of *Ficus* spp. (syconium)
filament: thread; the stalk supporting the anther
filaria: a nematode parasite invading the tissues and body cavities
filiform: slender; threadlike
fimbriate: fringed
fissured: provided with fissures (cracks of considerable length and depth), e.g. in the bark of some trees
fixed oil: a non-volatile oil, chemically a triglyceride of fatty acids; many fixed oils from plants have faint odours, even when purified, showing that they contain traces of volatile compounds
flabellate: fan-shaped, dilated in a wedge-shape, sometimes plaited (folded)
flaky: lamelliform, in the shape of a plate or scale
flatulence: the presence of excessive amounts of air or gases in the intestine
flavanones: a subgroup of the flavonoids; see also flavonoids
flavones: a subgroup of the flavonoids; see also flavonoids
flavonoids: a group of natural products in which the basic structure is the 2-phenyl-chromane skeleton
fleshy: succulent
flexuous: zigzag; bent alternately in opposite directions
floccose: covered with dense hairs that fall away in tufts, locks or flocci
floret: a small flower, one of a cluster as in grasses or *Compositae*; a grass floret typically consists of a lemma, palea, 2 lodicules, 3 stamens and a pistil with 2 plumose stigmas
flush: a brief period of rapid shoot growth, with unfolding of the leaf primordia which had accumulated during the previous quiescent period
fluted: of a bole, with rounded grooves and folds
fodder: something fed to domesticated animals, especially coarse, dried food from plants (hay, straw, leaves)
foliaceous: leaf-like
foliolate: 2-, 3-, 4- etc., with 2-, 3-, 4- leaflets
follicle: in plants: a dry, unicarpellate fruit, dehiscing by the ventral suture to which the seeds are attached; in humans: a sac or pouchlike depression or cavity, e.g. hair follicle
fomentation: treatment by the application of warm, moist substances; the substance thus applied
forage: grassland and fodder plants suitable as feed for herbivores, usually with lower nutrient concentration and digestibility than concentrates such as grain
foveolate: with small pits
fractionation, fractional distillation: a distillation process in which a fractionating column is interposed between the distillation vessel and the

condenser; during fractionation of a homogeneous mixture of volatile components of different boiling point, components with a lower boiling point move up the column faster than components with a higher boiling point and the components distil over in sequence

framboesia: see yaws

free: neither adhering nor united

fringed: fimbriate; with hair-like appendages along the margin

frugivorous: feeding on fruit

fruit: the ripened ovary with adnate parts

fugacious: withering or falling off rapidly or early

fulvous: yellow, tawny

fungicidal: destroying fungi

fungicide: an agent that destroys fungi or inhibits their growth

funicle (funiculus): the little cord which attaches the ovule or seed to the placenta

funnelform: salver-shaped; tubular with a spreading limb

furuncle: a painful nodule in the skin caused by inflammation of the dermis and subcutaneous tissue, enclosing a central core; it is caused by staphylococci which enter through hair follicles

fusiform: spindle-shaped; tapering towards each end from a swollen centre

galactagogue: promoting the flow of milk; an agent that promotes the flow of milk

gallery forest: fringing forest, forest growing along a watercourse in an otherwise non-forested area

gamopetalous: with united petals either throughout their length or at the base

gamophyllous: with leaves which are united by their edges

gargle: to rinse or medicate the throat and mouth with a liquid kept in motion by the slow expulsion of air from the lungs; a solution used for rinsing or medicating the throat and mouth

gastralgia: gastric colic

gastric: pertaining to, originating in, or affecting the stomach

gastritis: inflammation of the stomach

genetic erosion: the decline or loss of genetic variability

geniculate: abruptly bent so as to resemble the knee-joint

genotoxic: damaging to DNA, thereby causing mutations or cancer

genus (plural: genera): the smallest natural group containing distinct species

germplasm: the genetic material that provides the physical basis of heredity

gingivitis: inflammation of the gums

glabrescent: becoming glabrous or nearly so

glabrous: devoid of hairs

glandular: in botany: having or bearing secreting organs or glands; in medicine: pertaining to or of the nature of a gland

glaucoma: a group of eye diseases characterized by an increased intraocular pressure which causes pathological changes in the eye and impaired vision, and which may lead to blindness

glaucous: pale bluish-green, or with a whitish bloom which rubs off

globose: spherical or nearly so

glomerule: a condensed head of almost sessile flowers; a cluster of heads in a common involucre

glucosidase: an enzyme that hydrolyses a glucoside

glucoside: compound that is an acetal derivative of sugars and that on hydrolysis yields glucose

glume: the chaffy or membranous two-ranked members of the inflorescence of grasses and similar plants; lower glume and upper glume, two sterile bracts at the base of a grass spikelet

glutinous: sticky

glycoside: compound that is an acetal derivative of sugars and that on hydrolysis yields one or more molecules of a sugar and often a noncarbohydrate

goitre: an enlargement of the thyroid gland, resulting in a swelling in the front part of the neck

gonorrhoea: a venereal disease characterized by inflammation of the mucous membrane of the genitourinary tract and a discharge of mucus and pus

gout: a group of disorders of (purine) metabolism, characterized by inflammation of a joint, paroxysmal recurrent pain and an excess of uric acid in the blood

grafting: the process of inserting a scion, which consists of a piece of stem and two or more buds of the plant to be propagated, into another plant (rootstock) with the intention that it will unite and grow

grain: of wood, the general direction or arrangement of the fibres; texture

gram-negative: losing the stain or decolorized by alcohol in Gram's staining method, which is a primary characteristic for bacteria with a cell wall consisting of a thin layer of peptidoglycan with an outer membrane of lipoprotein and lipopolysaccharide

gram-positive: retaining the stain or resisting decolorization by alcohol in Gram's staining method, which is a primary characteristic for

bacteria with a cell wall consisting of a thick layer of peptidologlycan with attached teichoic acids

granular: divided into or bearing little knots or tubercles (also granulate)

granulose (granular): composed of or covered with grain-like minute particles

green manure: green leafy material applied to and mostly worked into the soil to enrich the soil with nutrients and organic matter

gregarious: growing in associated groups or clusters but not matted; at the same time; in bamboos gregarious flowering is used to indicate that a whole population flowers over a period of 2–3 years and then dies, although sometimes the rhizomes remain alive

gum: a colloidal polysaccharide substance that is gelatinous when moist but hardens on drying; gum is exuded by plants or extracted from them

gynobasic: of a style, attached to a prolongation upwards of the receptacle between the carpels

gynophore: a stalk supporting the gynoecium formed by elongation of the receptacle

habit (botany): external appearance or way of growth of a plant

habitat: the kind of locality in which a plant grows

haematinic: improving the quality of the blood, increasing the haemoglobin level and the number of erythrocytes

haematuria: the presence of blood in the urine

haemolysis: disruption of the integrity of the red blood cell membrane, causing release of haemoglobin

haemolytic: pertaining to, characterized by, or producing haemolysis

haemoptysis: expectoration of blood or blood-stained sputum from some part of the respiratory tract

haemorrhage: bleeding; the escape of blood from blood vessels

haemostatic: arresting the flow of blood; an agent that checks the flow of blood

hallucinogenic: inducing hallucinations

hardwood: the wood of an angiospermous tree as distinguished from that of a coniferous tree

hastate: with more or less triangular basal lobes diverging laterally

head: a dense inflorescence of small crowded often stalkless flowers (a capitulum)

heartwood: wood from the inner portion of a tree in which the cells are dead and no longer engaged in sap conduction and food storage

heath forest: = kerangas

hemi-: prefix, meaning half

hemiparasite: a facultative parasite; a parasitic plant that contains some chlorophyll and is therefore capable of photosynthesis

hepatitis: inflammation of the liver

hepatocyte: liver cell

hepatoprotective: capable of protecting the liver

hepatotoxic: having a toxic effect on liver cells

herb: any vascular plant which is not woody

herbaceous: with the texture, colour and properties of a herb; not woody

herpes: any of several inflammatory diseases of the skin caused by a herpesvirus and characterized by clusters of vesicles

herpes simplex: group of acute infections caused by herpes simplex virus type 1 or type 2, characterized by the development of one or more small fluid-filled vesicles on the skin or mucous membrane, and occurring as a primary infection or recurring because of reactivation of a latent infection

heterodistylous: with two kinds of plants, having either short or long styles

heterogeneous: lacking in uniformity; exhibiting variability

heterostylous: having styles of two or more distinct forms or of different lengths

heterotristylous: with three kinds of plants, having long, short or intermediate styles

hexagonal: having six angles and six sides

hexaploid: having six sets of chromosomes ($6n$)

hilum: the scar left on a seed indicating its point of attachment

hirsute: with rather coarse stiff hairs

hispid: covered with long rigid hairs or bristles

histochemical: pertaining to the chemical components or activities of cells and tissues

histopathological: pertaining to the histology of diseased tissues

HIV (human immunodeficiency virus): a virus that is the aetiological agent of acquired immunodeficiency syndrome (AIDS). Two serotypes are distinguished: HIV-1, with a worldwide distribution, and HIV-2, which is largely confined to West Africa

hoarseness: to be rough or harsh in sound

homogeneous: uniform as to kind; showing no variability

hyaline: almost transparent

hybrid: the first generation offspring of a cross between two individuals of different species or taxa

hybridization: the crossing of individuals of different species or taxa

hydrolysis: a chemical reaction of water in which a

bond in the reactant other than water is split and hydrogen and hydroxyl are added

hydrophilic: having a strong affinity for water

hydrophobia: any morbid dread of water; rabies

hydrophobic: resistant to or avoiding wetting

hygroscopic: susceptible to extending or shrinking on application or removal of water or vapour

hypanthium: a cup-like receptacle usually derived from the fusion of the floral envelopes and androecium on which are seemingly borne the calyx, corolla and stamens

hyperacidity: excessive acidity

hypercholesterolaemia: an excess of cholesterol in the blood

hyperglycaemia: an abnormally increased glucose concentration in the blood

hyperglycaemic: pertaining to, characterized by, or causing hyperglycaemia

hyperplasia: the abnormal multiplication or increase in the number of normal cells in normal arrangement in a tissue

hypersalivation: excessive flow of saliva

hypertension: high arterial blood pressure

hypertensive: characterized by or causing increased tension or pressure, as abnormally high blood pressure

hypertrophy: the enlargement or overgrowth of an organ or part due to an increase in size of its constituent cells

hypocotyl: the young stem below the cotyledons

hypocrateriform: saucer-shaped, with a long and narrow tube and limbs at right angles to the tube

hypogeal: below ground; in hypogeal germination the cotyledons remain below ground within the testa

hypoglycaemic: pertaining to, characterized by, or producing an abnormally decreased glucose concentration in the blood (hypoglycaemia)

hypotension: an abnormally low blood pressure

hypothermia: a low body temperature

ichthyotoxic: poisonous to fishes

imbricate: overlapping like tiles; in a flower bud when one sepal or petal is wholly external and one wholly internal and the others overlapping at the edges only

immunomodulating, immunomodulatory: augmenting or diminishing immune responses

immunotoxic: coupling a toxin to an antibody or antigen molecule

imparipinnate: of leaves, pinnate with an unpaired terminal leaflet

impetigo: a contagious, purulent skin disease, caused by group A streptococci or *Staphylococcus aureus*, and mostly seen in children, usually on the face

implantation: the embedding of the fertilized egg in the uterus; the insertion or grafting of material into the body

impotence: lack of power, specifically lack of copulative power in the male due to failure to initiate or maintain an erection

impressed: marked with slight depressions

in vitro: outside the living body and in an artificial environment

incised: cut deeply

indehiscent: not opening when ripe

indigenous: native to a particular area or region

indigestion: lack or failure of digestion

indole alkaloids: a subgroup of the alkaloids; see also alkaloids

indumentum: a covering, as of hairs, scales, etc.

induplicate: with the margins bent inwards and the external face of these edges applied to each other without twisting; V-shaped in cross section, trough-shaped

indurated: becoming firmer or harder

inferior: beneath, lower, below; an inferior ovary is one which is situated below the sepals, petals and stamens

inflammation: a protective response of the body in response to injury, infection, irritation, etc., aimed at destroying or isolating the injurious agent and injured tissue, and characterized by redness, pain, heat, and swelling

inflexed: bent or curved inward toward the centre

inflorescence: the arrangement and mode of development of the flowers on the floral axis; the branch that bears the flowers, including all its bracts and branches

influenza: an acute highly contagious virus disease characterized by sudden onset, fever, prostration, severe aches and pains, and progressive inflammation of the respiratory mucous membrane

infraspecific: referring to any taxon below the species level

infructescence: a ripened inflorescence in the fruiting stage

infundibular: funnel-shaped

infusion: a liquid extract obtained by steeping or soaking something in a liquid for the purpose of extracting its medicinal principles without boiling; the therapeutic introduction of a fluid, other than blood, into a vein

inner bark: the secondary phloem; the living part of the tissue outside the cambium

inotropic: affecting the force or energy of muscular

contractions (positive: increasing the force; negative: weakening the force)

insecticidal: destroying or controlling insects

insecticide: an agent that destroys insects

insomnia: sleeplessness

insulin: a protein hormone produced by β-cells of the islets of Langerhans in the pancreas, which is secreted in response to elevated glucose and amino acid levels in the blood and promotes their storage and utilization. Insulin deficiency is often the cause of diabetes, and exogenous insulin is used to control that disease

insulinotropic: changing the action of insulin

intercropping: the growing of two or more crops in different but proximate rows

internode: the portion of the stem (culm) between two nodes

interpetiolar: of stipules placed between the petioles of opposite leaves

intramarginal: placed within the margin near the edge; of a vein, running near and parallel with the margin

intrapetiolar: of stipules, positioned within the petiole axil

intrastaminal: within the stamens

involucral: belonging to an involucre

involucre: a ring of bracts (involucral bracts) surrounding several flowers or their supports, as in the heads of *Compositae* or the umbels in *Umbelliferae*

involute: having the edges of the leaves rolled inwards

iridoids: monoterpenes (C_{10}) characterized by a cyclopentanotetrahydropyran ring system, also known as the iridane skeleton; seco-iridoids can be regarded as being formed from iridoids by opening of the cyclopentane ring between C_7 and C_8

isoflavonoids: a subgroup of the flavonoids, in which the basic structure is the 3-phenyl chromane skeleton; see also flavonoids

isomer: a compound, radical or ion containing the same numbers of atoms of the same elements in the molecule as one or more others, and hence having the same molecular formula, but differing in the structural arrangement of the atoms and consequently in one or more properties

isoquinoline alkaloids: a subgroup of the alkaloids; see also alkaloids

jamu: a traditional Indonesian medicinal draught, which is usually a mixture of several ingredients

jaundice: a syndrome marked by hyperbilirubinaemia and deposition of bile pigments in the skin, mucous membranes and eyeball, resulting in yellowish pigmentation of these body parts

joint; jointed: an articulation, like a node in plants and a place of union of two bones in the human body; articulated

jugate: connected or yoked together; e.g. in leaves 1–n-jugate: with 1–n pairs of leaflets

keel (carina): a ridge like the keel of a boat; the two anterior and united petals of a papilionaceous corolla; the principal vein of a sepal or glume

keeled (carinate): having a keel or carina

keloid: an overgrowth of scar tissue

kerangas: heath forest, a type of tropical forest generally consisting of comparatively small trees with thin trunks (pole forest), often overlying a podsolic soil

keratinophilic: having an affinity for keratin, i.e. any of a family of scleroproteins which form the primary constituents of epidermis, hair, nails and horny tissues

kernel: the nucellus of an ovule or of a seed, that is, the whole body within the coats

kino: gum of various trees, resembling catechu, and used in medicine and tanning

knee: an abrupt bend in a stem or tree-trunk

labellum: lip; the lowest petal of an orchid; petaloid anterior staminode in *Zingiberaceae*

lac insect: a scale insect (*Laccifer lacca*, synonym *Kerria lacca*) that produces lac, a resinous gold-coloured substance used for lacquerware

lacerate: torn; irregularly cleft or cut

laciniate: slashed, cut into narrow lobes

lamellate: made up of thin plates

lamina: see blade

lanate: with woolly hairs

lanceolate: lance-shaped; much longer than broad, being widest at the base and tapering to the apex

landrace: a locally developed kind of cultivar, without formal recognition, and usually much more variable than an official registered cultivar and from which usually several cultivars can be selected

larvicidal: destroying insect larvae

lateral: on or at the side

laterite: a red soil that shows intensive weathering and chemical change and leaching away of bases and silica, leaving aluminium and iron oxides

latex: a juice, usually white and sometimes sticky, exuding from broken surfaces of some plants

lax: loose, distant

laxative: aperient, mildly purgative; an agent that

promotes evacuation of the bowel

layer: a branch caused to root while still connected to the parent and used for propagation (layering)

LD_{50}: median lethal dose, i.e. the amount of an agent that kills fifty percent of the organisms in a test population

leaflet: one part of a compound leaf

lectins: proteins of glycoproteins, which are not antibodies or enzymes, but which have the ability to attach themselves to specific sugars; the binding is not covalent, and the sugar can either be free or constituent part of a larger molecule, which may be present, e.g. in a membrane

leishmania: a group of flagellate protozoa comprising parasites which are pathogenic for humans

lemma: the lower of the two glumes which surround each floret in the spikelet of grasses

lenticel: lenticular masses of loose cells protruding through fissures in the periderm on stems, fruits and roots, usually arising beneath individual stomata; their main function is gaseous exchange

lenticellate: having lenticels

lenticular: shaped like a double-convex lens

lepidote: covered with small scales

leprosy: a chronic, infectious, slowly progressive disease, caused by *Mycobacterium leprae*, characterized by lesions in the skin, mucous membranes, nerves, bones and viscera, and manifested by a broad range of clinical symptoms

leucoderma: a skin abnormality that is characterized by a usually congenital lack of pigment in spots or bands and produces a patchy whiteness

leucorrhoea: a whitish, viscid discharge from the female genitals

leukaemia: a malignant, progressive disease of the blood-forming organs, with distorted proliferation and development of the white corpuscles (leucocytes) and their precursors

liana: a woody climber

lignans: a group of natural products (dimers) derived from condensation of 2 phenylpropane units

lignified: converted into wood or woody tissue

ligulate: possessing an elongated flattened strap-shaped structure or ligule

ligule: an elongated flattened strap-shaped structure; a membranous outgrowth on the upper surface of a grass leaf at the junction of the sheath and the blade which may be presented by a ridge or by a line of hairs

limb (botany): the expanded part of a tubular corolla, as distinct from the tube or throat; the lamina of a leaf or of a petal; the branch of a tree

linear: long and narrow with parallel sides

liniment: an oily liquid preparation to be used on the skin

lipophilic: having an affinity to fat; dissolving in lipids

liquorice: black substance extracted from the root of *Glycyrrhiza glabra* L. used in medicine especially against coughs and colds

lithophyte: a plant that grows on rock

lobe: any division of an organ or specially rounded division

lobed: divided, but not to the base

lochia: the vaginal discharge taking place during the first week or two after giving birth

locular: divided by internal partitions into compartments as in anthers and ovaries

loculicidal: the cavity of a pericarp dehiscent by the back, the dorsal suture

longitudinal: lengthwise

lorate: strap-shaped

lotion: a liquid suspension or dispersion for external application to the body

lumbago: pain in the lumbar region of the back (loins); lumbar rheumatism

lupus: name originally given to localized destruction or degeneration of the skin caused by various cutaneous diseases; formerly the term was used to designate lupus vulgaris and lupus erythematosus, nowadays it is only used with modifier

lymphoma: any neoplastic disorder of the lymphoid tissue; the term is often used alone to denote malignant lymphoma

lyrate: of a leaf with small pinnate lobes below and a larger terminal lobe

maceration: a method of extract preparation in which the matter to be extracted is mixed with the prescribed extraction solvent, and allowed to stand in a closed container for an appropriate time; the residue is separated from the extraction solvent, and if necessary, pressed out; in the latter case, the two liquids obtained are combined; see also percolation

macronutrients: chemical elements of which relatively large quantities are essential for the growth of a plant (such as N, P, Ca, Mg)

macrophage: any of the many forms of mononuclear phagocytes (cells capable of ingesting particulate matter) found in tissues

Malesia: the biogeographical region including Malaysia, Indonesia, the Philippines, Singapore, Brunei and Papua New Guinea

malignant: tending to become progressively worse and to result in death

mangrove: a brackish-water coastal swamp of tropical and subtropical areas that is partly inundated by tidal flow

margin: the edge or boundary line of a body

marginate: furnished with a margin of distinct character

mast cell: a connective tissue cell whose specific physiological function remains unknown

mastitis: inflammation of the mammary gland or breast

median: belonging to the middle

melanoma: a tumour arising from the melanocytic system of the skin and other organs; when used alone, the term refers to malignant melanoma

membranous: thin and semi-transparent, like a fine membrane

menorrhagia: excessive uterine bleeding, occurring at regular intervals, with the period of flow being of usual duration; also called hypermenorrhoea

merous: 4-, 5- etc., with 4, 5 etc. parts or numbers of sepals, petals etc.

mesocarp: the middle layer of the pericarp or fruit wall which is often fleshy or succulent

metabolism: the sum of all the physical and chemical processes by which living organized substance is produced and maintained, and also the transformation by which energy is made available for the uses of the organism; biotransformation

metabolite: any substance produced by metabolism or by a particular metabolic process

midrib: the main vein of a leaf which is a continuation of the petiole

mitogen: a substance that induces blast transformation, the synthesis of DNA, RNA and proteins, and the proliferation of lymphocytes

mitogenic: causing or inducing mitosis or cell proliferation

mitosis: a method of indirect division of a cell, consisting of a complex of various processes, through which the two daughter nuclei normally receive identical complements of the chromosomes

molluscicidal: destroying molluscs such as snails

moniliform: necklace-shaped

monocarp: a plant that flowers and fruits only once during its lifetime; the single carpel of an apocarpous fruit

monocarpic: only flowering and fruiting once (said of an annual or other plant)

monocotyledon: angiosperm having a single cotyledon or seed-leaf

monoecious: with unisexual flowers, but male and female flowers borne on the same plant

monomer: the simple unpolymerized form of a chemical compound having relatively low molecular weight

monopodial: of a primary axis which continues its original line of growth from the same apical meristem to produce successive lateral branches

monoterpenes: terpenes of molecular formula $C_{10}H_{16}$, e.g. limonene, myrcene and phellandrene; most monoterpenes are readily oxidized to coarse-smelling products, so essential oils containing them must be carefully preserved to minimize this tendency

monotypic: consisting of a single element, e.g. of a genus consisting of only one species

monsoon forest: a deciduous tropical woodland experiencing periodic drought

mordant: a compound that serves to fix a dye in or on a substance, e.g. a textile fibre, often a salt or hydroxide of chromium, aluminium or tin

mucilage: a gelatinous substance that is similar to gum but that swells in water without dissolving and forms a slimy mass

mucilaginous: slimy

mucolytic: an agent that destroys or dissolves mucin

mucous: pertaining to, resembling, producing, containing or covered with mucus

mucro: a sharp terminal point

mucronate: ending abruptly in a short stiff point

mulch: plant or non-living materials used to cover the soil surface with the object of protecting it from the impact of rainfall, controlling weeds, temperature and evaporation

muricate: rough, with short and hard tubercular excrescences

muscarinic: denoting the effects of muscarine or acetylcholine

mutagen: an agent inducing or increasing genetic mutations by causing changes in DNA

mutagenic: capable of inducing genetic mutation

mycorrhiza: a symbiotic association of roots with a fungal mycelium which may form a layer outside the root (ectotrophic) or within the outer root tissue (endotrophic)

myocardial: pertaining to the muscular tissue of the heart

myocyte: a cell of the muscular tissue

myopia: nearsightedness

myosis: contraction of the pupil

narcotic: pertaining to or producing narcosis or stupor; an agent that in moderate doses dulls the senses, relieves pain and induces sleep, but

in excessive doses may cause stupor, coma, convulsions and death

nasopharynx: the upper part of the alimentary canal continuous with the nasal passages

naturalized: introduced into a new area and established there, giving the impression of wild growth

nausea (nauseous): an uncomfortable feeling in and about the stomach associated with aversion to food and a need to vomit

necrosis: in plants, death of a portion of tissue often characterized by a brown or black discoloration; in humans, the sum of morphological changes indicative of cell death and affecting groups of cells, parts of structures, or organs

nectar: a sweet fluid exuded from various parts of the plant (e.g. by the flower to attract pollinators)

nectary: a group of modified subepidermal cells in flowers or leaves (extrafloral) secreting nectar

nematicide: an agent that destroys nematodes

nematode: small elongated cylindrical worm-like micro-organism, free-living in soil or water, or parasitic in animals or plants

neolignans: condensation products of phenylpropanoid units with the bond involving a single β-carbon

nephritis: inflammation of the kidney

nephrotic syndrome: general name for a group of diseases involving defective kidney glomeruli

neuralgia: pain radiating along the course of one or more nerves

neurasthenia: a syndrome of chronic mental and physical weakness and fatigue, which was thought to be caused by exhaustion of the nervous system

neuritis: an inflammatory or degenerative lesion of a nerve marked especially by pain, sensory disturbances, and impaired or lost reflexes

neuroleptic: term referring to effects of antipsychotic drugs, such as producing a state of apathy, lack of initiative, limited range of emotion, and, in psychotic patients, normalization of psychomotor activity and reduced confusion and agitation

neuron: any of the conducting cells of the nervous system

neurotrophic: pertaining to neurotrophy, i.e. the nutrition and maintenance of nervous tissue

nocturnal: of flowers, flowering during the night

node: the point on the stem or branch at which a leaf or lateral shoot is borne

nodule: a small knot or rounded body, often in roots of leguminous plants, where bacteria of the genus *Rhizobium* are active in the fixation of nitrogen from the air

norlignans: condensation products of phenylpropanoid units with a C_{17} skeleton

nucleus (plural: nuclei): an organized proteid body of complex substance in the protoplasm of cells; the central point in a starch granule

nut: a one- to many-seeded indehiscent fruit with a hard dry pericarp or shell

nutlet: a little nut

oblanceolate: reverse of lanceolate

obligate: necessary, essential; the reverse of facultative

oblique: slanting; of unequal sides

oblong: longer than broad, with the sides parallel or almost so

obovate: reverse of ovate

obovoid: a solid object which is obovate in section

obpyriform: pear-shaped but attached at the broad end

obtuse: blunt or rounded at the end

oedema: the presence of abnormally large amounts of fluid in the intercellular tissue spaces of the body

oestrogen: a sex hormone produced especially in the ovaries

oil gland: a glandular cell which secretes oil

oligomer: a chemical compound formed by polymerization and consisting essentially of a limited number of repeating structural units

oligotrophic: providing inadequate or with a low supply of nutrition

oliguria: reduced urine excretion

operculum: a lid or cover which separates by a transverse line of division

ophthalmia: severe inflammation of the eye, or of the conjunctiva or deeper structures of the eye

opposite: of leaves and branches when two are borne at the same node on opposite sides of the stem

orbicular: flat with a more or less circular outline

orchitis: inflammation of a testis

orthotropic: having a more or less vertical direction of growth

ostalgia: pain in a bone or in the bones

osteoporosis: reduction in the amount of bone mass, leading to fractures after minimal trauma

outer bark: the periderm or rhytidome; the non-living layer of fibrous or corky tissue outside the cambium in woody plants which may be shed or retained

ovary: in plants, that part of the pistil, usually the enlarged base, which contains the ovules and eventually becomes the fruit; in humans, one of

the two sexual glands in which the female reproductive cells (ova) are formed

ovate: egg-shaped in outline or in section; a flat surface which is scarcely twice as long as broad with the widest portion below the middle

ovoid: a solid object which is egg-shaped (ovate in section)

ovule (botany): the immature seed (egg) in the ovary before fertilization

oxidation: the processes of combining a compound with oxygen, dehydrogenating, or increasing the proportion of the electro-negative part

palea: the upper of two membranous bracts enclosing the flower in grasses

palmate: of leaflets, leaf-lobes or veins, with the different elements arising from the same point

palmatilobed: lobed in a palmate matter

palmatisect: palmately cut

palsy: paralysis

panicle: an indeterminate branched racemose inflorescence

paniculate: resembling a panicle

pantropical: distributed throughout the tropics

papilionaceous corolla: a butterfly-like, pea-like corolla, with standard, wings and keel

papillate: having minute nipple-like protuberances

papillose: covered with minute nipple-like protuberances

pappus: the various tufts of hairs on achenes or fruits; the limb of the calyx of *Compositae* florets

parasitic: deriving nourishment from some other organism

parasympathomimetic: producing effects resembling those of stimulation of the parasympathetic nerve supply to a body part

parenchyma: in plants: ground tissue composed of thin-walled, relatively undifferentiated cells, e.g. the pith and mesophyll; in humans: the soft cellular substance of glandular and other organs, or the essential elements of an organ

parietal: placentation type, when the ovules are attached to the wall of a one-celled ovary

paripinnate: a pinnate leaf with all leaflets in pairs

parthenocarpy: the production of fruit without true fertilization

particle board: board made from bonded particles of wood and/or other ligno-cellulosic material

partite (parted): cleft, but not quite to the base

patelliform: shaped like a small dish, circular and rimmed

patent (botany): spreading out widely

pectinate: pinnately cleft with narrow segments set close like the teeth of a comb

pectoral: of, or pertaining to, the chest or thorax; relieving disorders of the respiratory tract; any medicine against ailments of the chest

pedicel: the stalk of an individual flower

pedicellate: furnished with a pedicel

peduncle: the stalk of an inflorescence or partial inflorescence

pedunculate: furnished with a peduncle

peel: the rind or skin of the fruit

pellucid: translucent

peltate: of a leaf, with the stalk attached to the lower surface, not at the edge

pendent, pendulous: drooping; hanging down from its support

perennial: a plant living for many years and usually flowering each year

perforation plate: the originally imperforate wall involved in the coalescence of two elements of a vessel

perfume: a harmonious composition prepared from natural and/or synthetic aromatic materials having aesthetic appeal alone, or after incorporation in an end-product

perianth: the floral leaves as a whole, including both sepals and petals if both are present

pericarp: the wall of the ripened ovary or fruit whose layers may be fused into one, or may be more or less divisible into exocarp, mesocarp and endocarp

peristalsis: the movement by which the digestive tract and other tubular organs with both longitudinal and circular muscle fibres propel their contents

persistent: remaining attached; not falling off, not deciduous; applies to organs that remain in place after they have fulfilled their natural functions

petal: a member of the inner series of perianth segments (corolla) which are often brightly coloured

petaloid: petal-like

petiolar: borne on, or pertaining to a petiole

petiolate: having a petiole

petiole: the stalk of a leaf

petiolulate: having a petiolule

petiolule: the stalk of a leaflet

phagocytosis: endocytosis (uptake by a cell of material by invagination of its plasma membrane) of particulate material, such as microorganisms and cell fragments

pharmacopoeia: an authorative treatise on drugs and their preparations; a book containing a list

of products used in medicine, with descriptions, chemical tests for determining identity and purity, formulas for certain mixtures of these substances, and generally also statements of average dosage

pharyngitis: inflammation of the pharynx

phenolics: phenols are compounds which have an aromatic ring with an alcoholic group attached to it

phlegm: a viscid, stringy mucous secretion, like that produced by the mucous membranes of the respiratory tract, as during a cold

phlobaphene: a reddish-brown complex substance found in oak bark, or a similar substance obtained from bark or from tannins

phloroglucinols: derivatives of 1,3,5-trihydroxybenzene

photoperiod: the relative duration of illumination in a cycle of light and darkness, whether occurring naturally (day and night) or imposed in an artificial way

phthisis: wasting away of (a part of) the body; tuberculosis, especially of the lungs

phylogenetic: based on natural evolutionary and genealogical relationships

phytosterols: a group name for the widespread plant sterols sitosterol, campesterol and stigmasterol

pilose: hairy with rather long soft hairs

pinna (plural: pinnae): a primary division or leaflet of a pinnate leaf

pinnate: arranged in pairs along each side of a common axis

pinnatifid: pinnately divided about halfway to the midrib

pinnatilobed: pinnately divided to about half-way to the midrib

pinnatisect: pinnately divided down to the midrib

pioneer species: a species able to establish itself on bare ground, starting primary succession, often showing rapid growth and producing large amounts of diaspores

piperidine alkaloids: a subgroup of the alkaloids; see also alkaloids

piscicidal: poisonous to or controlling fish

pistil: the female part of a flower (gynoecium) of one or more carpels, consisting, when complete, of one or more ovaries, styles and stigmas

pistillate: a unisexual flower with pistil, but no stamens

pistillode: a sterile, often reduced pistil

pith: the soft core occurring in the structural centre of a log; the tissue, sometimes soft, in the centre of the stem of a non-woody dicotyledon

pits: recesses in the secondary wall of a cell, often in walls connecting two elements of a vessel (intervessel pits), these can be arranged in ladder-like series (scalariform), in horizontal rows (opposite) or in diagonal rows (alternate)

placenta: in plants, the part of the ovary to which the ovules are attached; in higher mammals, the vascular, spongy organ of interlocking maternal and foetal tissue by which the foetus is nourished in the uterus

placentation (botany): the way in which the placentae are arranged in the ovary

plagiotropic: having an oblique or horizontal direction of growth

platelet activating factor: a substance released by basophils and mast cells in immediate hypersensitivity reactions and macrophages and neutrophils in other inflammatory reactions. It is an extremely potent mediator of bronchoconstriction and of the platelet aggregation and release reactions

pleurogram: a characteristic fissure in the epidermal pallisade layer in some leguminous seeds (*Caesalpinioideae*, *Mimosoideae*); it is a U-shaped or horseshoe-shaped single or double line found on both faces of the seed and sometimes continuous between them and an important constant character to identify genera

plicate: folded to and fro, like a fan

plumose: featherlike with fine hairs

plywood: a panel material consisting of wood veneers glued together with the grains of adjacent layers arranged at right angles or at a wide angle

pneumonia: inflammation of the lungs, with the lungs becoming firm following the filling of air spaces with exudate

pod: a dry fruit composed of a single carpel and dehiscing by sutures, as in legumes; a general term for a dry dehiscent fruit

pollen: spores or grains borne by the anthers containing the male element (gametophyte)

pollination: the transfer of pollen from the dehiscing anther to the receptive stigma

pollinia: regularly shaped masses of pollen formed by the cohesion of a large number of pollen grains, as in orchids

polyene: an organic chemical compound containing many double bonds

polygamous: with unisexual and bisexual flowers in the same plant

polymorphic: with several or various forms; variable as to habit

polyphyletic: of a group of species or taxa, a

non-natural group in which the most recent common ancestor for all species (or taxa) is assigned to another group, the characterization of the group being based on convergent similarity

polyploid: with more than two sets (genomes) of chromosomes in the somatic cells, e.g. triploid (3 sets), tetraploid (4), pentaploid (5), hexaploid (6), heptaploid (7), octoploid (8), etc.

pomade: the highly fragrant, essential-oil-soaked fat resulting from enfleurage and usually used for absolute production

pome: a fruit of which the apple is the type, resulting from a multi-locular inferior ovary imbedded in a fleshy receptacle

posterior: next to or towards the main axis

poultice: a soft, moist, usually heated and sometimes medicated mass spread on cloth and applied to sores or other lesions to create moist local heat or counterirritation

preservative: a chemical formulation (usually in liquid form) used for the treatment of timber to increase its durability

prickle: a sharp, relatively stout outgrowth from the outer layers

proanthocyanidins: a group of tannins, being oligomers of 3-flavanols (catechins) and 3,4-flavandiols (leucoanthocyanidins)

promastigote: any of the bodies representing the morphological (leptomonad) stage in the life cycle of certain trypanosomatid protozoa resembling the adult form of members of the genus *Leptomonas*, with the elongate or pear-shaped cell having a central nucleus, and at the anterior end a kinetoplast and a basal body from which arises a long, slender flagellum

prop roots: aerial roots

prophylactic: tending to ward off disease

prophyll: the first bract borne on the inflorescence; the bracteole at the base of an individual flower

prostaglandins: the prostaglandins, leucotriens and thromboxanes are a large group of modified C_{20} fatty acids; they are known to occur widely in animal tissues, but only in tiny amounts, and they have been found to exert a wide variety of pharmacological effects (e.g. mediators of inflammation, platelet aggregation) on humans and animals

prostrate: lying flat on the ground

protandrous: of flowers, shedding pollen before the stigma is receptive

proteolysis: the splitting of proteins by hydrolysis of the peptide bonds with formation of smaller polypeptides

proteolytic: pertaining to, characterized by, or promoting proteolysis

proximal: in botany: the part nearest the axis (as opposed to distal); in human anatomy: relatively nearer to the central part of the body or point of origin

pruning: cutting off the superfluous branches or shoots of a plant for better shape or more fruitful growth

pseudocarp: false fruit, a fruit not derived solely from the ovary, but also from adnate parts, e.g. a pome, an aggregate fruit

pseudopetiole: a structure resembling a petiole, but not being one

pseudoraceme: raceme-like inflorescence but not a true raceme

psoriasis: a common chronic, scaly dermatosis with polygenic inheritance and a fluctuating course

puberulent: covered with down or fine hairs

puberulous: minutely pubescent

pubescent: covered with soft short hairs

pulp: the soft fleshy part of the fruit; mechanically ground or chemically digested wood used in manufacturing paper and allied products

pulses: dry edible seeds of legumes

pulvinate: cushion-shaped

punctate: marked with dots or translucent glands

punctiform: in the form of a point or dot

pungent: bearing a sharp point; causing a sharp or irritating sensation

purgative: causing evacuation of the bowels; an agent causing evacuation of the bowels, especially through stimulating peristaltic action; also called cathartic

pustular, pustulate: with blister-like prominences

pustule: a pimple or blister

pyrene: a nutlet or kernel; the stone of a drupe or similar fruit

pyrexia: fever; an abnormal elevation of the body temperature

pyriform: resembling a pear in shape

pyrrolidine alkaloids: a subgroup of the alkaloids; see also alkaloids

pyrrolizidine alkaloids: a subgroup of the alkaloids; see also alkaloids

quadrangular: four-cornered or four-edged

quadrate: approximately square or cubical

quassinoids: a subgroup of the saponins; the aglycone is a modified triterpene which has lost 10 carbons, and thus could be misinterpreted as a diterpene; most quassinoid structures also include a lactone function in the molecule; see also saponins

quinoline alkaloids: a subgroup of the alkaloids; see also alkaloids

quinones: a group of oxygen-containing homologues of aromatic derivatives, characterized by a diketo pattern (dione-structure)

raceme: an unbranched elongated indeterminate inflorescence with stalked flowers opening from the base upwards

racemic: made up of two enantiomorphic isomers (stereoisomers which have molecules which are mirror images of each other) and therefore optically inactive

racemose: raceme-like

rachis (plural: rachides): the principal axis of an inflorescence or a compound leaf beyond the peduncle or petiole

radial: lengthwise, in a plane that passes through the pith; radiating, as from a centre (cf. tangential)

radical: arising from the root, or its crown

radicle: the first root of an embryo or germinating seed

rain forest: a tropical forest receiving an annual rainfall of at least 1800 mm, characterized by lofty evergreen trees forming a continuous canopy below which terrestrial herbs and shrubs are poorly developed

ramentum (plural: ramenta): thin, chaffy scale of the epidermis

ramified: branched

ramiflorous: bearing flowers on the branches

raphe: a ridge on a seed, formed by a portion of the funicle that is adnate to the ovule, as in an anatropous ovule

raphid (plural: raphides): a needle-shaped crystal occurring typically as one of a closely packed, sheaf-like bundle and consisting of calcium oxalate

rash: a temporary eruption on the skin, as in urticaria

ray: the radiating branch of an umbel; the outer floret of an inflorescence of the *Compositae* with straplike perianth which differs from those in the centre or disk

receptacle (botany): the flat, concave or convex part of the axis from which the parts of the flower arise

recurved: bent or curved downward or backward

reduced: subnormal in size; connotes also either a failure to fulfil a normal function, or a diminution the expected number of parts in a set (of stamens, for example)

reflexed: abruptly bent or turned downward or backward

reforestation: the planting of a formerly forested area with forest trees

refrigerant: in medicine: an agent that relieves fever and thirst

regular: of a radially symmetrical flower; actinomorphic

reniform: kidney-shaped

repand: with an undulating margin

resin: solid to soft semisolid amorphous fusible flammable substance obtained as exudate or as an extract of plants

resinous: exuding, made of, or similar to resin

resolvent: promoting resolution or the dissipation of a pathological growth

restorative: capable of restoring health, strength, consciousness; an agent having this capability

resupinate: upside down, or apparently so

reticulate: netted, as when the smallest veins of a leaf are connected together like the meshes of a net

retrorse: turned or directed backward or downward (opposed to antrorse)

retuse: with a shallow notch at a rounded apex

rheophyte: organism preferring or living in flowing water

rheumatism: any of various disorders, characterized by inflammation, degeneration, or metabolic derangement of the connective tissue structures of the body, especially the joints and related structures, and accompanied by pain, stiffness or limited mobility of these parts

rhizome: an underground stem which is distinguished from a root by the presence of nodes, buds, and leaves or scales

rhombic: shaped like a rhomb, an equilateral oblique-angled figure

rhomboid (botany): quadrangular, diamond-shaped with the lateral angles obtuse

rind: the tough outer layer of the fruit

ringworm: popular name for tinea, which is a term used to describe various fungal skin infections. The name refers to the ring-shaped lesions

riparian: growing on the banks of streams or rivers

riverine forest: = riparian forest

root sucker: a shoot originating from adventitious buds on the roots

rootstock: see rhizome; a stock for grafting consisting of a root and part of the main axis

rosette: a cluster of leaves or other organs in a circular form

rostellum: a small beak; in orchids a projection of the upper edge of the stigma in front of the anthers

rostrate: beaked
rosulate: collected in a rosette
rotate: wheel-shaped; circular and flat
rotund: rounded in outline, somewhat orbicular, but a little inclined towards oblong
rubefacient: reddening the skin by causing hyperaemia (an excess of blood); an agent that reddens the skin
rudimentary: of organs, imperfectly developed and non-functional
rufous: reddish
rugose: wrinkled
rugulose: somewhat wrinkled
ruminate: of endosperm, mottled in appearance, due to the infolding of a dark inner layer of the seed-coat into the paler coloured endosperm
saccate: pouched
sagittate: shaped like an arrowhead; of a leaf base with two acute straight lobes directed downwards
samara: an indehiscent winged fruit
sapling: a young tree of more than 1.5 m tall and with a bole of less than 10 cm in diameter
saponins: a group of glycosides which have the ability to lower the surface tension of aqueous solutions
saprophytic: living upon dead organic matter such as humus
sapwood: the outer layers of wood adjacent to the bark which in the living tree contain living cells and reserve materials
sarcoma: any of a group of tumours usually arising from connective tissue, most of which are malignant
sarcotesta: the fleshy outer seed-coat
scaberulous: somewhat rough
scabies: a contagious dermatitis caused by the itch mite (*Sarcoptes scabiei*) that burrows under the skin and deposit eggs, causing intense itching
scabrid, scabrous: rough to the touch
scalariform: ladder-like, having markings or perforations suggestive of a ladder
scale: a thin scarious body, often a degenerate leaf or a trichome of epidermal origin
scandent: climbing
scape: a leafless floral axis or peduncle arising from the ground
scarification: of seed, the cutting or softening of the wall of a hard seed to hasten germination
schistosomiasis: infection with flukes of the genus *Schistosoma*; sometimes called bilharzia
schizocarp: a dry fruit formed from a syncarpous ovary which splits into one-seeded portions, mericarps or 'split fruits'
schizocarpous: in the form of a schizocarp
sciatica: pain in the lower back, buttocks, hips or adjacent parts of the body
sclerotic: hardened, stony in texture
scorpioid: circinnate; coiled as to resemble a scorpion
scrofula: tuberculosis of the lymph nodes of the neck
scrub: vegetation whose growth is stunted because of lack of water coupled with strong transpiration
scurf: abnormal skin condition in which small flakes or scales become detached
scurfy: bearing small scales on the surface (lepidote; scaly)
secondary vegetation: a plant cover that has been disturbed by natural causes or by man
secondary venation: the collection of veins of a leaf blade branching off from midrib in pinnately veined leaves, or from the main veins in palmately veined ones
section (botany): a taxonomic rank between the genus and the species accommodating a single or several related species
secund: arranged on one side
sedative: allaying activity and excitement; an agent that allays excitement
seed: the reproductive unit formed from a fertilized ovule, consisting of embryo and seed-coat, and, in some cases, also endosperm
seedling: a plant produced from seed; a juvenile plant, grown from a seed
segment: one of the divisions into which a plant organ, as a leaf or a calyx, may be cleft; the division of a palmate or costapalmate leaf
semi-: prefix, meaning half or incompletely, e.g. semi-inferior
seminal vesicle: either of the paired, sacculated pouches attached to the posterior part of the urinary bladder
sensu lato (s.l.): in the broad sense
sensu stricto (s.s.): in the strict sense
sepal: a member of the outer series of perianth segments
septate: divided by one or more partitions
septicidal: dehiscing along the septa of the ovary
septum (plural: septa): a partition or cross-wall
seriate: serial, disposed in series of rows
sericeous: silky
serrate: toothed like a saw, with regular pointed teeth pointing forwards
serrulate: serrate with minute teeth
sesquiterpene: terpenes of molecular formula $C_{15}H_{24}$, e.g. caryophyllene and farnesene

sessile: without a stalk
setose: set with bristles or bristle-like elements
shaggy: villous
shale: sedimentary rock formed by the consolidation of unaltered clay or silt
sheath: a tubular structure surrounding an organ or part, as the lower part of the leaf clasping the stem in grasses
shell: the hard envelope of a nut
shellac: a purified lac resin prepared by heating and filtering lac from lac insects
shoot: the ascending axis, when segmented into dissimilar members it becomes a stem; a young growing branch or twig
shrub: a woody plant which branches from the base, all branches being equivalent (see also tree)
siliceous: containing silica
simple (botany): not compound, as in leaves with a single blade
sinuate: with a deep wavy margin
sinuous: wavy
softwood: the wood of a coniferous tree
sore: popular term for almost any lesion of the skin or mucous membranes
spadix: a flower spike with a fleshy or thickened axis, as in aroids and some palms
spasmodic: of the nature of a spasm, i.e. a sudden, violent, involuntary contraction of a muscle or of a group of muscles
spasmolytic: checking spasms; antispasmodic
spathaceous: resembling a spathe
spathe: a large bract enclosing a spadix, or two or more bracts enclosing a flower cluster
spatulate: spoon-shaped
specific gravity: ratio of the weight of a volume of material to the weight of an equal volume of water of 4°C
spermatorrhoea: involuntary, abnormally frequent, and excessive emission of semen without copulation
spherical: globular
spicate: spike-like
spiciform: with the form of a spike
spike: a simple indeterminate inflorescence with sessile flowers along a single axis
spikelet: a secondary spike, one of the units of which the inflorescence is made in grasses, consisting of one or more florets on a thin axis, subtended by a common pair of glumes
spine (botany): a short, stiff, straight, sharp-pointed, hard structure usually arising from the wood of a stem
spiral: as though wound round an axis
splenocyte: the monocyte (mononuclear phagocytic leucocyte) characteristic of the spleen
sporangium: a sac endogenously producing spores
sporophyll: a leaf or leaf-like structure bearing or subtending a sporangium
sprue: a chronic deficiency syndrome due to subnormal absorption of dietary constituents
spur (botany): a hollow and slender extension of some part of the flower, usually nectariferous
squamous cell carcinoma: carcinoma developed from squamous epithelium, having cuboid cells and characterized by keratinization and often be preservation of intercellular bridges
stamen: one of the male reproductive organs of a flower; a unit of the androecium
staminate: a flower bearing stamens but no pistil
staminode: an abortive or rudimentary stamen without or with an imperfect anther
standard (botany): the fifth, posterior or upper petal of a papilionaceous corolla
starch: polysaccharide made up of a long chain of glucose units joined by α-1,4 linkages, either unbranched (amylose) or branched (amylopectin) at a α-1,6 linkage, and which is the storage carbohydrate in plants, occurring as starch granules in amyloplasts, and which is hydrolysed by animals during digestion by amylases, maltase and dextrinases to glucose via dextrins and maltose
stellate: star-shaped, as of hairs with radiating branches, or of petals arranged in the form of a star
stem: the main ascending axis of a plant; in bamboos usually named culm, in other plant groups occasionally
sterile: unable to produce offspring; in plants: failing to complete fertilization and produce seed as a result of defective pollen or ovules; not producing seed capable of germination; lacking functional sexual organs (sterility)
steroids: a group of modified triterpenes which contain a ring system of three 6-membered and one 5-membered rings
stigma: the portion of the pistil which receives the pollen
stilt root: an oblique adventitious root as in mangrove trees and similar forms
stimulant: producing a temporary increase of the functional activity or efficiency of an organism or any of its parts; an agent acting so
stipe: the stalk supporting a carpel or gynoecium
stipitate: borne on a stipe or short stalk
stipulate: with or bearing stipules
stipule: a scale-like or leaf-like appendage at the base of a petiole

stolon: a trailing stem usually above the ground which is capable of producing roots and shoots at its nodes

stoloniferous: bearing a stolon or stolons

stoma (plural: stomata): a breathing pore or aperture in the epidermis

stomachic: pertaining to the stomach; a medicine stimulating the action of the stomach

stone: the hard endocarp of a drupe containing the seed or seeds

straggling: extremely divergent, spreading very far apart; irregular, bushy

strain: a group of individuals of a common origin, usually a more narrowly defined group than a cultivar

striate: marked with fine longitudinal parallel lines, as grooves or ridges

strigillose: covered with minute stiff hairs

strigose: with short stiff hairs lying close along the surface

stump: seedling with trimmed roots and shoot and used as planting stock; the part of anything that remains after the main part has been removed, e.g. the part of a tree remaining attached to the root after the trunk is cut

style: the part of the pistil connecting the ovary with the stigma

styptic: astringent, tending to check bleeding through astringent properties; a remedy which is astringent and arrests bleeding

sub-: prefix, meaning somewhat or slightly (e.g. subacute), or below (e.g. subterranean) or less than, imperfectly

subfamily: a taxonomic rank between the family and the tribe denoting a part of a family

subglobose: nearly globular

subshrub: a small shrub which may have partially herbaceous stems

subspecies: a subdivision of a species, in rank between a variety and a species

subulate: awl-shaped, sharply pointed

succulent: juicy, fleshy

sucker: a shoot, usually originating from adventitious buds on the roots or basal stem parts, which does not fit in the architectural model, but is capable of repeating the model

sudorific: causing or promoting the flow of sweat; an agent causing sweating

suffrutescent: obscurely shrubby

superior: of an ovary, with the perianth inserted below or around its base, the ovary being attached at its base only

suture: the line of junction of two carpels; the line or mark of splitting open

symbiosis: the intimate living together of two dissimilar organisms in a mutually beneficial relationship

sympathomimetic: mimicking the effects of impulses conveyed by adrenergic postganglionic fibres of the sympathetic nervous system

sympetalous: with united petals

sympodial: of a stem in which the growing point either terminates in an inflorescence or dies, growth being continued by a new lateral growing point

syncarp: a multiple or fleshy aggregate fruit, including fruit produced from a more or less entire inflorescence (as in *Artocarpus*, *Ananas*, *Morus*)

syncope: a temporary suspension of respiration and circulation due to cerebral ischemia

syphilis: a disease usually communicated by sexual contact, or via the blood or bite of an infected person, caused by a spirochete (*Treponema pallidum*) and characterized by a clinical course in 3 stages continued over many years

tachycardia: excessive rapidity of the heartbeat, usually applied to a pulse rate of more than 100 in an adult

tail (botany): any long and slender prolongation

tannins: a large group of plant-derived phenolic compounds

taproot: the primary descending root, forming a direct continuation of the radicle

taxon (plural: taxa): a term applied to any taxonomic unit irrespective of its classification level, e.g. variety, species, genus, etc.

taxonomy: the study of principles and practice of classifying living organisms (systematics)

tendril: a thread-like climbing organ formed from the whole or part of a stem, leaf or petiole

tepal: a segment of a perianth, applied when no distinction between sepals and petals can be made

terete: cylindrical; circular in transverse section

terminal: placed at the end or apex; a termination, end or extremity

termite: ant-like organism of the order *Isoptera* damaging wood by characteristic irregular honeycombing or wide channels with dry bore-dust or dust cemented together

ternate: in threes

terpenes: unsaturated hydrocarbons of molecular formula $(C_5H_8)n$. In monoterpenes n=2, in sesquiterpenes n=3. The term terpene is often used to refer to a terpenoid

terpenoids: chemical compounds derived from a terpene

terrestrial: on or in the ground

tertiary venation: generally the collection of the smallest veins of a leaf blade
testa: the outer coat of the seed
tetanus: an acute, often fatal, infectious disease characterized by muscular contractions and abnormal reflexes, and caused by a toxin produced by *Clostridium tetani*, a bacillus which is usually introduced through a wound
tetraploid: having four times ($4n$) the basic number of chromosomes or twice the diploid number ($2n$)
thallus: a vegetative body without differentiation into stem and leaf
theca (plural: thecae): a spore- or pollen-case
thorn: a woody sharp-pointed structure formed from a modified branch
throat (botany): of a corolla, the orifice of a gamopetalous corolla
thrush: infection of the mucous membrane of the mouth with a fungus of the genus *Candida*, especially *C. albicans*, and characterized by the formation of creamy, white, somewhat elevated lesions
thyrse (thyrsus): a compound inflorescence composed of a panicle (indeterminate axis) with the secondary and ultimate axes cymose (determinate)
thyrsiform: shaped like a thyrse
thyrsoid: like a thyrse
tincture: an alcoholic or hydroalcoholic solution of some principle used in medicine
tissue culture: a body of tissue growing in a culture medium outside the organism
tomentellous: minutely tomentose
tomentose: densely covered with short soft hairs
tomentulose: slightly tomentose
tomentum: pubescence
tonic: restoring or producing the normal tone (degree of vigour and tension) of tissue or organs; characterized by continuous tension (e.g. tonic spasm); medicinal preparation believed to have the power of restoring normal tone to tissue or organs
tonsillitis: inflammation of the tonsils
topical: pertaining to a particular surface area, as a topical anti-infective applied to a certain area of the skin and affecting only the area to which it is applied
torus: = receptacle
trailing: prostrate, but not rooting
transgenic: pertaining to the experimental splicing of a segment of DNA from one genome to DNA of a different genome
transverse: straight across; of tertiary veins, connecting the secondary veins, not necessarily in a perpendicular way
trapezoid: like a trapezium, a figure of four unequal sides
trauma: a wound or injury, whether physical or psychic
tree: a perennial woody plant with a single evident trunk (see also shrub)
tribe: a taxonomic rank between the family and the genus
trichome: any hair, bristle or scale-like outgrowth of the epidermis
trichotomous: three-forked, branching into three divisions
trifid: cleft in three parts
trifoliolate: with three leaflets
trigonous: three-angled, with plane faces
trilocular: having 3 chambers, each usually bearing an ovule or seed
tripartite: divided into 3 parts
tripliveined: with 3 main veins
triquetrous: three-edged, with three salient angles
triterpenes: a subgroup of the isoprenoids, formed by coupling of 6 C_5 units
truncate: cut off more or less squarely at the end
trunk: the main stem of a tree apart from its limbs and roots
tuber: the swollen portion of an underground stem or root which acts as a storage organ and propagule; it is usually of one year's duration, those of successive years not arising directly from the old ones nor bearing any constant relation to them
tubercle: a small tuber-like excrescence
tuberculate: covered with warty protuberances
tuberculosis: any of the diseases in man and animals caused by *Mycobacterium* spp., characterized by the formation of lesions (tubercles) and necrosis in the tissue of the lung or other organs and having a tendency to great chronicity
tuberous: producing tubers or resembling a tuber
tufted: growing in tufts (caespitose)
tumour necrosis factor: a substance (lymphokine) produced by macrophages, capable of causing in vivo haemorrhagic necrosis of certain tumour cells, but not affecting normal cells
turbinate: top-shaped
turgid: swollen, but not with air
turnery: articles made by the process of turning
twining: winding spirally
ulcer: an open sore on an external or internal body surface, usually accompanied by disintegration of tissue and formation of pus
ultrabasic: of soil, very low in silica and rich in fer-

romagnesian minerals as in e.g. serpentine soils
umbel: an indeterminate, often flat-topped inflorescence whose divergent peduncles (rays) and pedicels arise from a common point; in a compound umbel each ray itself bears an umbellule (small umbel)
umbelliform: umbrella-shaped
umbellule: diminutive of umbel
unarmed: devoid of thorns, spines or prickles
uncinate: hooked
undershrub: any low shrub; partially herbaceous shrub, the ends of the branches perishing during the winter
undulate: wavy, said for instance of a leaf margin if the waves run in a plane at right angles to the plane of the leaf blade
unguiculate: contracted at the base into a claw
unifoliolate: with one leaflet only, but in origin a compound leaf
unilateral: one-sided
unilocular: one-celled
unisexual: of one sex, having stamens or pistils only
urceolate: urn-shaped
urolithiasis: the formation of urinary stones or calculi
urticaria: a vascular reaction, acute or chronic, which can have various causes and is characterized by the development of weals on the skin
uterotonic: giving muscular tone to the uterus
utricle: a small bladdery pericarp
valvate: of perianth segments, with their edges in contact, but not overlapping in the bud
valve: one of the parts produced by a dehiscing capsule
variegated: irregularly coloured in patches, blotched
variety: a botanical variety which is a subdivision of a species; an agricultural or horticultural variety is referred to as a cultivar
vasoconstriction: diminution of the calibre of vessels, especially of arterioles
vasodilation: dilation of a vessel, especially dilation of arterioles leading to increased blood flow to a part
vein (botany): a strand of vascular tissue in a flat organ, such as a leaf
velutinous: see velvety
velvety: with a coating of fine soft hairs; the same as tomentose but denser so that the surface resembles (and feels like) velvet
venation (botany): the arrangement of the veins in a leaf
veneer: a thin sheet of wood
venereal: pertaining or related to or transmitted by sexual contact
venereal disease: any of a diverse group of contagious diseases (as gonorrhoea or syphilis) that are typically transmitted by sexual contact
ventral: in botany: facing the central axis (adaxial), opposed to dorsal (abaxial); in human anatomy: pertaining to the abdomen, or denoting a position more toward the belly surface than some reference object
ventricose: with a swelling or inflation on one side
ventricular: pertaining to a ventricle, i.e. a small cavity, such as one of the several cavities of the brain, or one of the lower chambers of the heart
vermifuge: an agent expelling worms or intestinal animal parasites; an anthelminthic
verrucose: warty
verruculose: very warty, much covered with warts
verticillaster: a false whorl, composed of a pair of opposed cymes, as in *Labiatae*
verticillate: in a whorl with several elements arising at the same node
vertigo: an illusory sense that the surroundings or one's own body are revolving
vesicant: causing blisters; an agent that induces blistering
vesicular: bladder-like
vesicular stomatitis: a vesicular eruption caused by a virus and affecting pigs, cattle and horses
vessel (anatomy): a continuous tube formed by superposition of numerous cells whose common walls are perforated or have broken down
vestigial: small and imperfectly developed
viability: ability to live, grow and develop
villous: with long weak hairs
vine: a plant having a stem that is not woody and too slender to hold itself erect and therefore supports itself by climbing over an object
viscid: sticky
viscous: glutinous, or very sticky
volatile: a volatile substance is one that evaporates at room temperature. It is an essential property of odorous materials
volatile oils: see essential oils
vulnerary: pertaining to wounds or the healing of wounds; an agent promoting the healing of wounds
wart (in medicine): a small, usually hard and non-malignant, excrescence on the skin
warty: covered with firm roundish excrescences
wax: waxes are mixtures of esters of higher alcohols and higher fatty acids. Waxes are used as stiffening agents in the manufacture of cosmetics. Natural plant waxes are removed from con-

cretes to produce absolutes

whorl: arrangement with more than two organs of the same kind arising at the same level

wilt: loss of turgidity, usually in leaves, typically caused by pathogens which colonize the vascular system

wing: any membraneous expansion attached to an organ; a lateral petal of a papilionaceous corolla

wood: the hard, compact, fibrous substance between pith and bark

woolly: clothed with long and tortuous or matted hairs

xylem: the main water-conducting tissue in vascular plants which extends throughout the body of the plant and is also involved in transport of minerals, food storage and support; primary xylem is derived from the procambium, secondary xylem (e.g. the wood of trees and shrubs) from the vascular cambium; xylem is composed of tracheary elements: tracheids and (in angiosperms) vessel elements; both are elongated hollow cells, with thickened, usually heavily lignified walls, and lacking protoplasts when mature; they are joined end to end to form a continuous conducting tube

yaws: an infectious, tropical disease caused by a spirochete (*Treponema pertenue*), usually affecting children under 15, and marked by skin elevations (papules) and papilloma, with later manifestations including deformation of skin, bone and joints (also called framboesia)

yellow fever: an acute destructive infectious disease caused by a virus transmitted by a mosquito

zygomorphic: irregular and divisible into equal halves in one plane only

Sources of illustrations

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Crassocephalum crepidioides: Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G. (Editors), 1987. Weeds of rice in Indonesia. Balai Pustaka, Jakarta, Indonesia. p. 73, fig. 4.22 (upper part of flowering and fruiting plant, flower, fruit with pappus, fruit without pappus). Redrawn and adapted by Iskak Syamsudin.

Cryptocoryne cordata: de Wit, H.C.D., 1983. Aquariumplanten [Aquarium plants]. 4th Edition. Uitgeverij Hollandia, Baarn, the Netherlands. p. 224, fig. 71(right, 1, 2) (plant habit, spatha), p. 188, fig. 55(right, 3) (opened basal part of spatha showing spadix). Redrawn and adapted by Iskak Syamsudin.

Cymbidium aloifolium: Bejing Botanical Research Institute, 1976. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 5. Bejing, China. p. 745, fig. 8319 (plant habit); Seidenfaden, G., 1983. Orchid genera in Thailand XI. Cymbidieae Pfitz. Opera Botanica 72: p. 80, fig. 43(a, b, c) (part of inflorescence, lip in side view, expanded lip). Redrawn and adapted by Iskak Syamsudin.

Cynoglossum lanceolatum: Bejing Botanical Research Institute, 1974. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 3. Bejing, China. p. 575, fig. 5103 (lower part of plant, upper part of plant); Martins, E.S., 1990. Boraginaceae. In: Launert, E. & Pope, G.V. (Editors): Flora Zambesiaca. Vol. 7, Part 4. Flora Zambesiaca Managing Committee, London, United Kingdom. p. 106, tab. 30(3, 4, 5, 6) (flower, opened corolla showing stamens, fruit, nutlet). Redrawn and adapted by Iskak Syamsudin.

Dalbergia pinnata: Wight, R., 1839. Icones plantarum Indiae orientalis. Vol. 1. Madras. pl. 242 (branch with inflorescences); Niyomdham, C., Pham Hoang Ho, Dy Phon, P. & Vidal, J.E., 1997. Legumineuses - Papilionoidées - Dalbergiées. In: Hul, S., Vidal, J.E. & Vidal, Y. (Editors): Flore du Cambodge, du Laos et du Vietnam. Vol. 29. Muséum National d'Histoire Naturelle, Paris, France. p. 47, pl. 7(1–4) (leaflets from below and above, flower, standard, fruit). Redrawn and adapted by Iskak Syamsudin.

Dalea cliffortiana: White, P.S., 1980. Dalea. In: Dwyer, J.D. et al. (Editors): Flora of Panama. Part 5, fasc. 5. Family 83. Leguminosae, subfamily Papilionoideae (conclusion). Annals of the Missouri Botanical Garden 67(3): p. 621, fig. 19 (flowering branch, flower). Redrawn and adapted by Achmad Satiri Nurhaman.

Dasymaschalon blumei: Boerlage, J.G., 1899. Anonaceae. Icones Bogorienses. Vol. 1, Fasc. 3. Jardin Botanique de Buitenzorg. E.J. Brill, Leiden, the Netherlands. pl. 73(4) (flower); Sinclair, J., 1955. A revision of the Malayan Annonaceae. Gardens' Bulletin Singapore 14(2): p. 270, fig. 16A (fruiting twig); Nguyen Tien Ban, 1975. Notes on the genus Dasymaschalon (Hook. f. et Thoms.) Dalla Torre et Harms (Annonaceae) (in Russian). Botaniceskij Zurnal 60(2): p. 226, fig. 2a (fruit). Redrawn and adapted by Achmad Satiri Nurhaman.

Dentella repens: Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G., (Editors) 1987. Weeds of rice in Indonesia. Balai Pustaka, Jakarta, Indonesia. p. 501, fig. 4.234 (plant

habit, flower, corolla opened, showing stamens, fruit, seeds). Redrawn and adapted by Iskak Syamsudin.

Desmos chinensis: Sinclair, J., 1955. A revision of the Malayan Annonaceae. Gardens' Bulletin Singapore 14(2): p. 267, fig. 15A (twig with flower); Bejing Botanical Research Institute, 1994. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 1. Bejing, China. p. 813, fig. 1625 (twig with fruit). Redrawn and adapted by Achmad Satiri Nurhaman.

Diospyros montana: Matthew, K.M., 1988. Further illustrations on the Flora of Tamilnadu Carnatic. The Rapinat Herbarium, St. Joseph's College, Tiruchirapalli, India. p. 345, pl. 345 (twig with male flowers, male flower, female flower); Phengklai, C., 1981. Ebenaceae. In: Smitinand, T., & Larsen, K. (Editors): Flora of Thailand. Vol. 2. The Forest Herbarium, Royal Forest Department, Bangkok, Thailand. p. 309, fig. 12 (twig with fruits). Redrawn and adapted by Achmad Satiri Nurhaman.

Dipteracanthus repens: Backer, C.A., 1973. Atlas of 220 weeds of sugar-cane fields in Java. Handbook for the cultivation of sugar-cane and manufacturing of cane-sugar in Java. Vol. 7, Atlas. Indonesian Sugar Experiment Station, Pasuruan, Indonesia. pl. 619 (plant habit); Hsieh, C.-F. & Huang, T.-C., 1978. Acanthaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 4. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 631, pl. 1134(10, 11) (dehisced fruit, seed). Redrawn and adapted by Achmad Satiri Nurhaman.

Dischidia major: Rintz, R.E., 1980. The Peninsular Malayan species of Dischidia (Asclepiadaceae). Blumea 26(1): p. 108, fig. 6(a, c, d) (habit of flowering plant, flower, flower with opened corolla). *Dischidia nummularia*: Rintz, R.E., 1980. The Peninsular Malayan species of Dischidia (Asclepiadaceae). Blumea 26(1): p. 120, fig. 18(a, b, c) (habit of flowering and fruiting plant, flower, flower with opened corolla). Redrawn and adapted by Iskak Syamsudin.

Dracaena angustifolia: Ochse, J.J. & Bakhuizen van den Brink, R.C., 1980. Vegetables of the Dutch East Indies. 3rd English edition (translation of 'Indische groenten', 1931). Asher & Co., Amsterdam, the Netherlands. p. 461, fig. 285 (flowering and fruiting branch). Redrawn and adapted by Achmad Satiri Nurhaman.

Dregea volubilis: Lu, F.-Y. & Kao, M.-T., 1978. Asclepiadaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 4. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 233, pl. 981(1, 2) (flowering branch, flower); Kuriachen, P.M., Thomas, V. & Dave, Y., 1992. Taxonomic and phylogenetic significance of fruit walls in Asclepiadaceae. Feddes Repertorium 103: p. 186, fig. 29 (fruit). Redrawn and adapted by Iskak Syamsudin.

Drosera burmannii: Lecompte, O., 1965. Droseraceae. In: Tardieu-Blot, M.-L. (Editor): Flore du Cambodge, du Laos et du Vietnam. Muséum National d'Histoire Naturelle, Paris, France. p. 69, pl. 1(12, 13) (plant habit, leaf with stipules). *Drosera indica*: van Steenis, C.G.G.J., 1953. Droseraceae. In: van Steenis, C.G.G.J. (Editor): Flora Malesiana. Ser. 1, Vol. 4. Noordhoff-Kolff N.V., Jakarta, Indonesia. p. 378, fig. 1 (plant habit); Lecompte, O., 1965. Droseraceae. In: Tardieu-Blot, M.-L. (Editor): Flore du Cambodge, du Laos et du Vietnam. Muséum National d'Histoire Naturelle, Paris, France. p. 69, pl. 1(8) (part of leaf). *Drosera peltata*: Lecompte, O., 1965. Droseraceae. In: Tardieu-Blot, M.-L. (Editor): Flore du Cambodge, du Laos et du Vietnam. Muséum National d'Histoire Naturelle, Paris, France. p. 69, pl. 1(1, 3) (plant habit, leaf). Redrawn and adapted by Iskak Syamsudin.

Drymaria cordata: Wild, H., 1961. Caryophyllaceae. In: Exell, A.W. & Wild, H. (Editors): Flora Zambesiaca. Vol. 1, Part 2. Crown Agents for Oversea Governments and Administrations, London, United Kingdom. p. 345, tab. 62(A1, A2, A3, A4, A6, A7, A8) (flowering stem, leaf and stipules, flower with sepals removed, sepal, petal, dehisced fruit enclosed by sepals, seed). Redrawn and adapted by Achmad Satiri Nurhaman.

Enicostema axillare: Backer, C.A., 1941. Onkruidflora der Javasche suikerrietgronden. Handboek ten dienste van de suikerriet-cultuur en de rietsuiker-fabricage op Java. Deel 7(15) (atlas) [Weed flora of Javanese sugar-cane fields. Handbook for the cultivation of sugar-cane and manufacturing of cane-sugar in Java. Vol. 7(15) (atlas)]. Vereniging het Proefstation voor de Java-Suikerindustrie, Pasuruan, Indonesia. pl. 463 (flowering stem); Raynal, A., 1969. Révision du genre Enicostema Blume (Gentianaceae) [Revision of the genus Enicostema Blume (Gentianaceae)]. Adansonia, ser. 2, 9(1): p. 69, pl. 4(5, 6, 7) (flower, stamens, front and side view). Redrawn and adapted by Iskak Syamsudin.

Epiphyllum oxypetalum: Schumann, K., 1890.

Cactaceae. In: von Martius, C.F.P. (Editor): Flora brasiliensis. Vol. 4(2). Leipzig, Germany. pl. 45 (branch with flower). Redrawn and adapted by Achmad Satiri Nurhaman.

Epipremnum pinnatum: Liu, T.-S. & Huang, T.-C., 1978. Araceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 5. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 808, pl. 1528(1, 4) (plant habit, inflorescence); Mayo, S.J., Bogner, J. & Boyce, P.C., 1997. The genera of Araceae. The Trustees, Royal Botanic Gardens, Kew, United Kingdom. p. 120, pl. 15(A, C, D) (leaf of juvenile shoot, stem part with infructescences, seed). Redrawn and adapted by Achmad Satiri Nurhaman.

Euodia hortensis: Hartley, T.G., 2001. On the taxonomy and biogeography of Euodia and Melicope (Rutaceae). Allertonia 8(1): p. 59, fig. 14 (flower, floral parts partially removed, fruit), p. 60, fig. 15 (flowering twig with 3-foliolate leaves, flowering twig with 1-foliolate leaves, leaf variability of putative cultigens). Redrawn and adapted by Achmad Satiri Nurhaman.

Fagerlindia fasciculata: Tirvengadum, D.D., 1983. New taxa and name changes in tropical Asiatic Rubiaceae. Nordic Journal of Botany 3(4): p. 463, fig. 4(7, 9, 11) (flowering branch, corolla opened, showing stamens, style and stigmas, fruiting branch). Redrawn and adapted by Iskak Syamsudin.

Fimbristylis miliacea: Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G. (Editors), 1987. Weeds of rice in Indonesia. Balai Pustaka, Jakarta, Indonesia. p. 243, fig. 4.106 (plant habit, spikelet, fruit). Redrawn and adapted by Iskak Syamsudin.

Fissistigma fulgens: Sinclair, J., 1955. A revision of the Malayan Annonaceae. Gardens' Bulletin Singapore 14(2): p. 354, fig. 25 (flowering branch, flower, flower with petals detached, stamens, front and back view, pistil). Redrawn and adapted by Achmad Satiri Nurhaman.

Floscopa scandens: Hsu, K.-S., 1978. Commelinaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 5. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 169, pl. 1309(1, 6, 15, 16, 17, 18) (plant habit, flower, fruit, seeds in different views); Cherfils, H., 1937. Commélinacées. In: Gagnepain, F. (Editor): Flore Générale de l'Indo-Chine. Vol. 6. Masson & Co., Paris, France. p. 912, fig. 87(3) (top of flowering stem). Redrawn and adapted by Achmad Satiri Nurhaman.

Galbulimima belgraveana: Croft, J.R., 1978. Himantandraceae. In: Womersley, J.S. (Editor): Handbooks of the flora of Papua New Guinea. Vol. 1. Melbourne University Press, Carlton, Australia. p. 128, fig. 64 (twig with flowerbuds, flowering twig, fruit). Redrawn and adapted by Achmad Satiri Nurhaman.

Gentiana quadrifaria: van Steenis, C.G.G.J., 1972. The mountain flora of Java. E.J. Brill, Leiden, the Netherlands. pl. 20(2a, 2b) (habit of plant from exposed locality, habit of plant from shaded locality). Redrawn and adapted by Iskak Syamsudin.

Geophila repens: Chao, J.-M., 1978. Rubiaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 4. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 268, pl. 995(1, 2, 6) (habit of flowering plant, flower, dried fruit); Bejing Botanical Research Institute, 1975. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 4. Beijing, China. p. 272, fig. 5957 (habit of fruiting plant). Redrawn and adapted by Iskak Syamsudin.

Geunsia pentandra: Meijer, W., 1968. A taxonomic treatment of orders and families of trees of Sabah with further revisions of families. Botanical Bulletin, Herbarium, Forest Department, Sandakan, Sabah, Malaysia No 10. Opposite p. 224 (flowering branch); Briquet, J., 1894. Verbenaceae. In: Engler, A. (Editor): die natürlichen Pflanzenfamilien IV, 3a. Wilhelm Engelmann, Leipzig, Germany. p. 165, fig. 62A (flower); Koorders, S.H. & Valeton, Th., 1914. Atlas der Baumarten von Java [Atlas of tree species of Java]. Vol. 2. P.W.M. Trap, Leiden, the Netherlands. fig. 279N (fruit). Redrawn and adapted by Iskak Syamsudin.

Globba pendula: Roxburgh, W., 1815. Plants of the Coast of Coromandel. East India Company, London, United Kingdom. Vol. 3, part 2. Pl. 228 (habit of flowering plant); Smith, R.M., 1988. A review of Bornean Zingiberaceae: IV (Globbeae). Notes from the Royal Botanic Garden Edinburgh 45(1): p. 7, fig. 2Be (flower). Redrawn and adapted by Iskak Syamsudin.

Glochidion rubrum: Hsieh, C.-F., 1977. Euphorbiaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 3. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 476, pl. 692(1, 3, 5, 9) (flowering twig, male flower, female flower, part of twig with fruits). Redrawn and adapted by Achmad Satiri Nurhaman.

Grammatophyllum speciosum: Seidenfaden, G.,

1983. Orchid genera in Thailand XI. Cymbidieae Pfitz. Opera Botanica 72: p. 97, fig. 54(a, b) (leafy stems and inflorescence, flower). Redrawn and adapted by Iskak Syamsudin.

Grangea maderaspatana: Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G. (Editors), 1987. Weeds of rice in Indonesia. Balai Pustaka, Jakarta, Indonesia. p. 91, fig. 4.31 (plant habit, flower head, marginal flower, disk flower, fruit). Redrawn and adapted by Achmad Satiri Nurhaman.

Gunnera macrophylla: van Steenis, C.G.G.J., 1972. The mountain flora of Java. E.J. Brill, Leiden, the Netherlands. pl. 23(1) (habit of flowering and fruiting plant). Redrawn and adapted by Achmad Satiri Nurhaman.

Gymnema inodorum: Beijing Botanical Research Institute, 1974. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 3. Beijing, China. p. 495, fig. 4943 (flowering branch, fruit, seed); Forster, P.I., 1995. New names and combinations in Marsdenia (Asclepiadaceae: Marsdenieae) from Asia and Malesia (excluding Papuasia). Australian Systematic Botany 8: p. 695, fig. 1(A, B) (flower in apical view, flower in side view). Redrawn and adapted by Iskak Syamsudin.

Gynura procumbens: Backer, C.A., 1973. Atlas of 220 weeds of sugar-cane fields in Java. Handbook for the cultivation of sugar-cane and manufacturing of cane-sugar in Java. Vol. 7, atlas. Indonesian Sugar Experiment Station, Pasuruan, Indonesia. Pl. 745 (flowering branch, flower head, flower without ovary and pappus). Redrawn and adapted by Achmad Satiri Nurhaman.

Harmsiopanax harmsii: Philipson, W.R., 1995. Araliaceae (excluding Schefflera). In: Conn, B.J. (Editor): Handbooks of the Flora of Papua New Guinea. Vol. III. Melbourne University Press, on behalf of the Government of Papua New Guinea. p. 13, fig. 3 (part of trunk, top of stem with leaves, inflorescence branch, umbellule of flowers). Redrawn and adapted by Achmad Satiri Nurhaman.

Homalanthus populneus: Lemmens, R.H.M.J. & Wulijarni-Soetjipto, N. (Editors), 1991. Plant Resources of South-East Asia No 3. Dye and tannin-producing plants. Pudoc, Wageningen, the Netherlands. p. 101 (flowering branch, detail of male part of inflorescence, male flower).

Homalomena sagittifolia: Mayo, S.J., Bogner, J. & Boyce, P.C., 1997. The genera of Araceae. The Trustees, Royal Botanic Gardens, Kew, United Kingdom. p. 178, pl. 47(i)A (plant habit); Engler, A. & Krause, K., 1912. Das Pflanzenreich IV.23Da. Verlag von Wilhelm Engelmann, Leipzig, Germany. p. 74, fig. 48(A, B, C) (part of flowering plant, inflorescence with spathe, spadix). Redrawn and adapted by Achmad Satiri Nurhaman.

Hoya australis: Forster, P.I. & Liddle, D.J., 1991. Variation in Hoya australis R.Br. ex Traill (Asclepiadaceae). Austrobaileya 3(3): p. 511, fig. 5(A, B, C) (habit of flowering plant, flower in apical view, flower in side view). Redrawn and adapted by Achmad Satiri Nurhaman.

Hunteria zeylanica: Omino, E., 1996. A contribution to the leaf anatomy and taxonomy of Apocynaceae in Africa. Wageningen Agricultural University Papers 96-1: p. 124, fig. 34(1, 3, 4, 6) (flowering branch, opened corolla, pistil, fruiting branch). Redrawn and adapted by Iskak Syamsudin.

Hydnophytum formicarum: Schumann, K., 1891. Rubiaceae. In: Engler, A. & Prantl, K. (Editors): die natürlichen Pflanzenfamilien. IV, 4. Verlag von Wilhelm Engelmann, Leipzig, Germany. p. 11, fig. 4A (plant habit); Burck, M.W., 1884. Sur l'organisation florale chez quelques Rubiacées [About floral organization in some Rubiaceae]. Annales du Jardin botanique de Buitenzorg 4: Pl. 4, fig. 5 (flower in longitudinal section). Redrawn and adapted by Achmad Satiri Nurhaman.

Hydrolea zeylanica: Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G. (Editors), 1987. Weeds of rice in Indonesia. Balai Pustaka, Jakarta, Indonesia. p. 311, fig. 4.140 (flowering branches, fruit with calyx removed, seed); Backer, C.A., 1951. Hydrophyllaceae. In: van Steenis, C.G.G.J. (Editor): Flora Malesiana. Ser. 1, Vol. 4. Noordhoff-Kolff N.V., Djakarta, Indonesia. p. 208, fig. 1b (flower). Redrawn and adapted by Iskak Syamsudin.

Hygrophila ringens: Backer, C.A., 1973. Atlas of 220 weeds of sugar-cane fields in Java. Handbook for the cultivation of sugar-cane and manufacturing of cane-sugar in Java. Vol. 7, atlas. Indonesian Sugar Experiment Station, Pasuruan, Indonesia. Pl. 612 (plant habit); Hsieh, C.-F. & Huang, T.-C., 1978. Acanthaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 4. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 641, pl. 1138(3, 7) (flower, fruit enclosed in calyx). Redrawn and adapted by Achmad Satiri Nurhaman.

Hypoxis aurea: Nasir, E., 1980. Amaryllidaceae.

In: Nasir, E. & Ali, S.I. (Editors): Flora of Pakistan. No 134. National Herbarium, Pakistan Agricultural Research Council, Islamabad. p. 4, fig. 1(F, G) (habit of flowering plant, flower). Redrawn and adapted by Achmad Satiri Nurhaman.

Hyptis brevipes: Soerjani, M., Kostermans, A.J.G.H. & Tjitrosoepomo, G. (Editors), 1987. Weeds of rice in Indonesia. Balai Pustaka, Jakarta, Indonesia. p. 319, fig. 4.144 (top of flowering and fruiting stem, flower in lateral view, flower in front view, fruiting calyx, fruit after removal of calyx). Redrawn and adapted by Iskak Syamsudin.

Illigera luzonensis: Yang, Y.-P. & Lu. S.-Y., 1996. Hernandiaceae. In: Huang, T.-C. (Editor): Flora of Taiwan. 2nd Edition. Vol. 2. Editorial Committee of the Flora of Taiwan, Taipei, Taiwan, Republic of China. p. 503, pl. 232 (fruiting branch). Redrawn and adapted by Iskak Syamsudin.

Indigofera linifolia: de Kort, I. & Thijsse, G., 1984. A revision of Indigofera in Southeast Asia. Blumea 30(1): p. 124, fig. 14 (flowering and fruiting twig, old inflorescence, flower bud); Matthew, K.M., 1988. Further illustrations on the Flora of Tamilnadu Carnatic. The Rapinat Herbarium, St. Joseph's College, Tiruchirapalli, India. p. 173, pl. 173 (corolla). Redrawn and adapted by Iskak Syamsudin.

Lepidagathis incurva: Bejing Botanical Research Institute, 1975. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 4. Bejing, China. p. 165, fig. 5743 (plant habit, flower); Malik, K.A. & Ghafoor, A., 1988. In: Nasir, E. & Ali, S.I. (Editors): Flora of Pakistan. No 188. Acanthaceae. Department of Botany, University of Karachi, Pakistan. p. 52, fig. 9C (fruit). Redrawn and adapted by Achmad Satiri Nurhaman.

Limacia scandens: Forman, L.L., 1986. Menispermaceae. In: van Steenis, C.G.G.J. & de Wilde, W.J.J.O. (Editors): Flora Malesiana. Ser. 1, Vol. 10. Kluwer Academic Publishers, Dordrecht/Boston/London. p. 220, fig. 12(j, k, m, p, q) (flowering branch of male plant, leaf, male flower, fruit, endocarp in lateral view, endocarp in median view). Redrawn and adapted by Iskak Syamsudin.

Lophatherum gracile: Gilliland, H.B., 1971. A revised flora of Malaya. An illustrated systematic account of the Malayan flora, including commonly cultivated plants. Vol. III. Grasses of Malaya. Botanic Gardens, Singapore. p. 56, fig. 5 (lower part of plant, basal part of leaf, inflorescence, part of inflorescence with 2 spikelets). Redrawn and adapted by Iskak Syamsudin.

Lophopyxis maingayi: Sleumer, H., 1971. Lophopyxidaceae. In: van Steenis, C.G.G.J. (Editor): Flora Malesiana. Ser. 1, Vol. 7. Noordhoff International Publishing, Leyden, the Netherlands. p. 90, fig. 1(a, b, f, h) (flowering branch, male flower, female flower, infructescence). Redrawn and adapted by Achmad Satiri Nurhaman.

Macaranga tanarius: Lemmens, R.H.M.J. & Wulijarni-Soetjipto, N. (Editors), 1991. Plant Resources of South-East Asia No 3. Dye and tannin-producing plants. Pudoc, Wageningen, the Netherlands. p. 88 (branch with male inflorescences, part of male inflorescence, fruiting branch).

Mallotus philippensis: Lemmens, R.H.M.J. & Wulijarni-Soetjipto, N. (Editors), 1991. Plant Resources of South-East Asia No 3. Dye and tannin-producing plants. Pudoc, Wageningen, the Netherlands. p. 92 (branch with female inflorescences, female flower, male flower, fruiting branch).

Mazus pumilus: Yamazaki, T., 1990. Scrophulariaceae. In: Smitinand, T. & Larsen, K. (Editors): Flora of Thailand. Vol. 5, Part 2. The Forest Herbarium, Royal Forest Department, Bangkok, Thailand. p. 158, fig. 45(3, 4, 6, 8) (plant habit, flower, corolla opened, showing stamens, seed). Redrawn and adapted by Achmad Satiri Nurhaman.

Melicope denhamii: Hartley, T.G., 2001. On the taxonomy and biogeography of Euodia and Melicope (Rutaceae). Allertonia 8(1): p. 186, fig. 21 (flowering twig, leaf variability of putative cultigens, bisexual flower, petals and stamens partially removed, functionally female flower, petals and stamens partially removed, detail of infructescence). Redrawn and adapted by Achmad Satiri Nurhaman.

Melissa axillaris: Beijing Botanical Research Institute, 1974. Iconographia Cormophytorum Sinicorum [Line drawings of Chinese vascular plants]. Vol. 3. Beijing, China. p. 676, fig. 5306 (base of plant); Keng, H., 1978. Labiatae. In: van Steenis, C.G.G.J. (Editor): Flora Malesiana. Ser. 1, Vol. 8. Sijthoff & Noordhoff International Publishers, Alphen aan den Rijn, the Netherlands. p. 342, fig. 15 (apical part of plant, flower, fruiting calyx). Redrawn and adapted by Iskak Syamsudin.

Morinda citrifolia: Lemmens, R.H.M.J. & Wulijarni-Soetjipto, N. (Editors), 1991. Plant Re-

sources of South-East Asia No 3. Dye and tannin-producing plants. Pudoc, Wageningen, the Netherlands. p. 95 (flowering branch, inflorescence-infructescence).

Mucuna biplicata: Wilmot-Dear, C.M., 1992. A revision of Mucuna (Leguminosae: Phaseoleae) in Thailand, Indochina and the Malay Peninsula. Kew Bulletin 47(2): p. 231, fig. 8 (A, B, H, J) (part of stem with leaf, part of stem with inflorescences, fruit, seed). Redrawn and adapted by Iskak Syamsudin.

Mukia maderaspatana: Liu, H.-Y., 1993. Cucurbitaceae. In: Huang, T.-C. (Editor): Flora of Taiwan. 2nd Edition. Vol. 3. Editorial Committee of the Flora of Taiwan, Taipei, Taiwan, Republic of China. p. 863, pl. 431(2, 4, 6) (part of stem with flowers and fruit, male flower, female flower). Redrawn and adapted by Achmad Satiri Nurhaman.

Mussaenda glabra: Backer, C.A. & van Slooten, D.F., 1924. Geïllustreerd handboek der Javaansche theeonkruiden en hunne beteekenis voor de cultuur [Illustrated handbook of Javanese weeds of tea and their significance for cultivation]. Algemeen Proefstation voor thee, Batavia. fig. 204 (flowering twig). Redrawn and adapted by Iskak Syamsudin.

Myrmecodia tuberosa: Huxley, C.R. & Jebb, M.H.P., 1991. The tuberous epiphytes of the Rubiaceae 1: a new subtribe - the Hydnophytinae. Blumea 36(1): p. 2, fig. 1d (plant habit), p. 8, fig. 4a (tuber in longitudinal section); Burck, M.W., 1884. Sur l'organisation florale chez quelques Rubiacées [About floral organization in some Rubiaceae]. Annales du Jardin botanique de Buitenzorg 4: Pl. 4, fig. 6 (flower in longitudinal section). Redrawn and adapted by Iskak Syamsudin.

Nervilia aragoana: Liu, T.-S. & Su, H.-J., 1978. Orchidaceae. In: Li, H.-L. et al. (Editors): Flora of Taiwan. Angiospermae. Vol. 5. Epoch Publishing Co., Taipei, Taiwan, Republic of China. p. 1068, pl. 1626 (1, 8) (habit of plant with leaf, habit of flowering plant); Seidenfaden, G., 1978. Orchid genera in Thailand VI. Dansk Botanisk Arkiv 32(2): p. 169, fig. 105a (flower). Redrawn and adapted by Achmad Satiri Nurhaman.

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Transcriptions of Vietnamese characters

[aa]	= â	[ar]	= ả	[ax]	= ã	[ej]	= ẹ	[oo]	= ô	[ow]	= ơ	[uj]	= ụ	[uwx]	= ữ
[aaf]	= ầ	[as]	= á	[ee]	= ê	[er]	= ẻ	[oof]	= ồ	[owf]	= ờ	[ur]	= ủ	[ux]	= ũ
[aaj]	= ậ	[aw]	= ă	[eef]	= ề	[es]	= é	[ooj]	= ộ	[owj]	= ợ	[us]	= ú		
[aar]	= ẩ	[awf]	= ằ	[eej]	= ệ	[ex]	= ẽ	[oor]	= ổ	[owr]	= ở	[uw]	= ư		
[aas]	= ấ	[awj]	= ặ	[eer]	= ể	[if]	= ì	[oos]	= ố	[ows]	= ớ	[uwf]	= ừ		
[aax]	= ẫ	[awr]	= ẳ	[ees]	= ế	[is]	= í	[oox]	= ỗ	[owx]	= ỡ	[uwj]	= ự		
[af]	= à	[aws]	= ắ	[eex]	= ễ	[of]	= ò	[or]	= ỏ	[ox]	= õ	[uwr]	= ử		
[aj]	= ạ	[awx]	= ẵ	[ef]	= è	[oj]	= ọ	[os]	= ó	[uf]	= ù	[uws]	= ứ		

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The Prosea Foundation
(Plant Resources of South-East Asia)

Name, location, legal status and structure

- Prosea is a Foundation under Indonesian law, with an international charter, domiciled in Bogor. It is an autonomous, non-profit, international agency, governed by a Board of Trustees. It seeks linkage with existing regional and international organizations;
- Prosea is an international programme focusing on the documentation of information on plant resources of South-East Asia;
- Prosea consists of a Network Office in Bogor (Indonesia) coordinating 6 Country Offices in South-East Asia, and a Publication Office in Wageningen (The Netherlands).

Participating institutions

- Forest Research Institute of Malaysia (FRIM), Karung Berkunci 201, Jalan FRIM, Kepong, 52109 Kuala Lumpur, Malaysia;
- Indonesian Institute of Sciences (LIPI), Sasana Widya Sarwono, Jalan Gatot Subroto 10, Jakarta 12710, Indonesia;
- Institute of Ecology and Biological Resources (IEBR), Nghia Do, Cau Giay, Hanoi, Vietnam;
- Papua New Guinea University of Technology (UNITECH), Private Mail Bag, Lae 411, Papua New Guinea;
- Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Los Baños, Laguna, the Philippines;
- Thailand Institute of Scientific and Technological Research (TISTR), 196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand;
- Wageningen University (WU), Costerweg 50, 6701 BH Wageningen, The Netherlands.

Objectives

- to document and make available the existing wealth of information on the plant resources of South-East Asia for education, extension work, research and industry;
- to make operational a computerized data bank on the plant resources of South-East Asia;
- to publish the results in the form of an illustrated, multi-volume handbook in English;
- to promote the dissemination of the information gathered.

Target groups

- those professionally concerned with plant resources in South-East Asia and working in education, extension work, research and commercial production (direct users);
- those in South-East Asia depending directly on plant resources, obtaining relevant information through extension (indirect users).

Activities

- the establishment and operation of data bases;
- the publication of books;
- the sponsorship, support and organization of training courses;
- research into topics relevant to Prosea's purpose;
- the publication and dissemination of reports and the research results.

Implementation

The programme period has been tentatively divided into 4 phases:
- preliminary phase (1985–1986): publication of 'Plant Resources of South-East Asia, Proposal for a Handbook' (1986);
- preparatory phase (1987–1990): establishing cooperation with South-East Asia through internationalization, documentation, consultation and publication; reaching agreement on the scientific, organizational and financial structure of Prosea;
- implementation phase (1991–2000): compiling, editing and publishing of the handbook; making operational the computerized data bank with the texts and additional information; promoting the dissemination of the information obtained.
- Prosea beyond 2000 (Phase 2001–2005): handbook finalization; emphasis on lesser-known useful plants, and making the information services demand-driven.

Documentation

A documentation system has been developed for information storage and retrieval called Prosea Data Bank. It consists of 7 data bases:
- BASELIST: primarily a checklist of more than 6200 plant species;
- CATALOG: references to secondary literature;
- PREPHASE: references to literature from South-East Asia;
- ORGANYM: references to institutions and their research activities;
- PERSONYM: references to specialists;
- TEXTFILE: all Prosea publications and additional information;
- PHOTFILE: photographs of useful plants of South-East Asia.

Publication

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In brief, Prosea is

- an international programme, focused on plant resources of South-East Asia;
- interdisciplinary, covering the fields of agriculture, forestry, horticulture and botany;
- a research programme, making knowledge available for education and extension;
- ecologically focused on promoting plant resources for sustainable tropical land-use systems;
- committed to conservation of biodiversity;
- committed to rural development through diversification of resources and application of farmers' knowledge.

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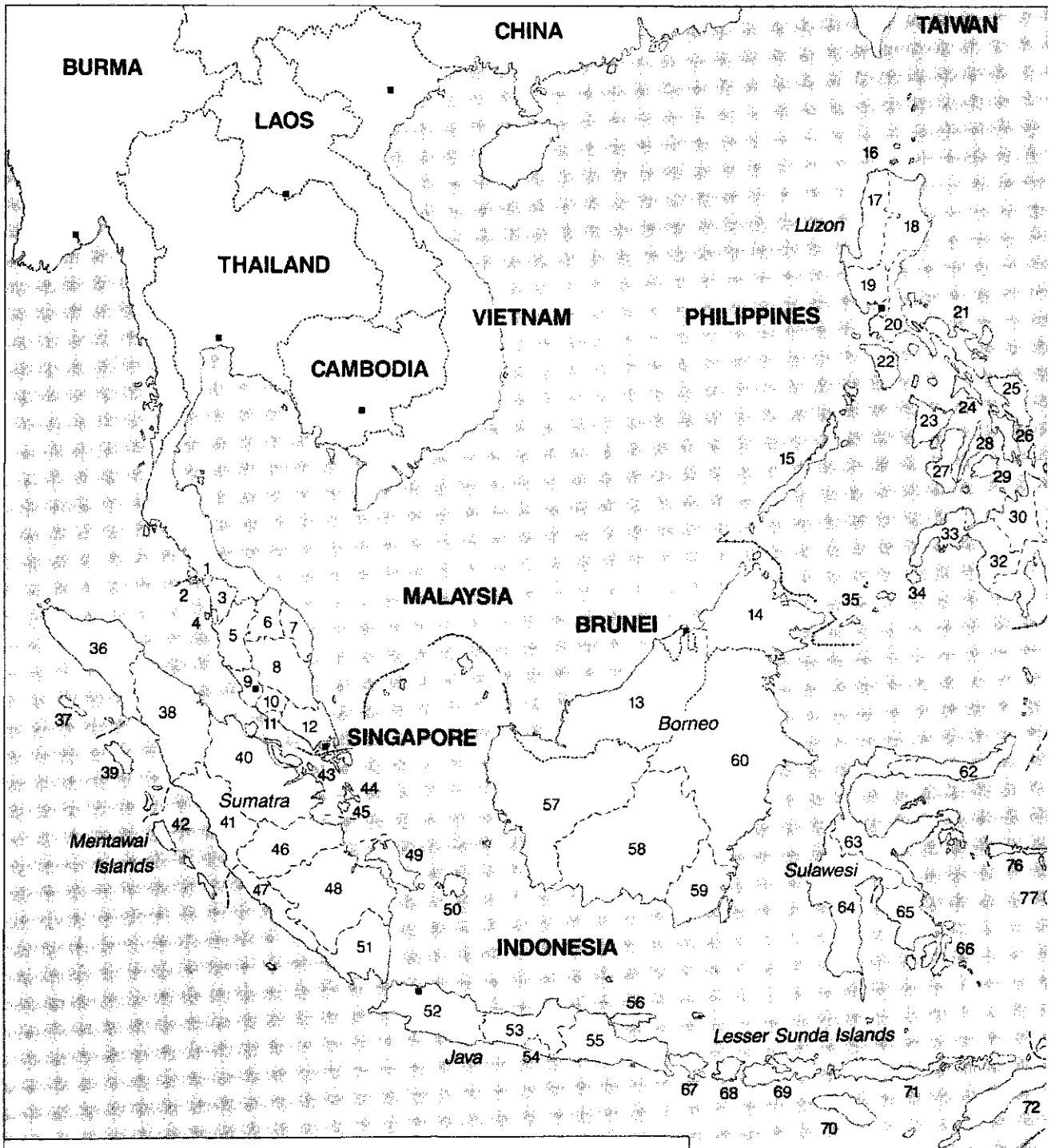
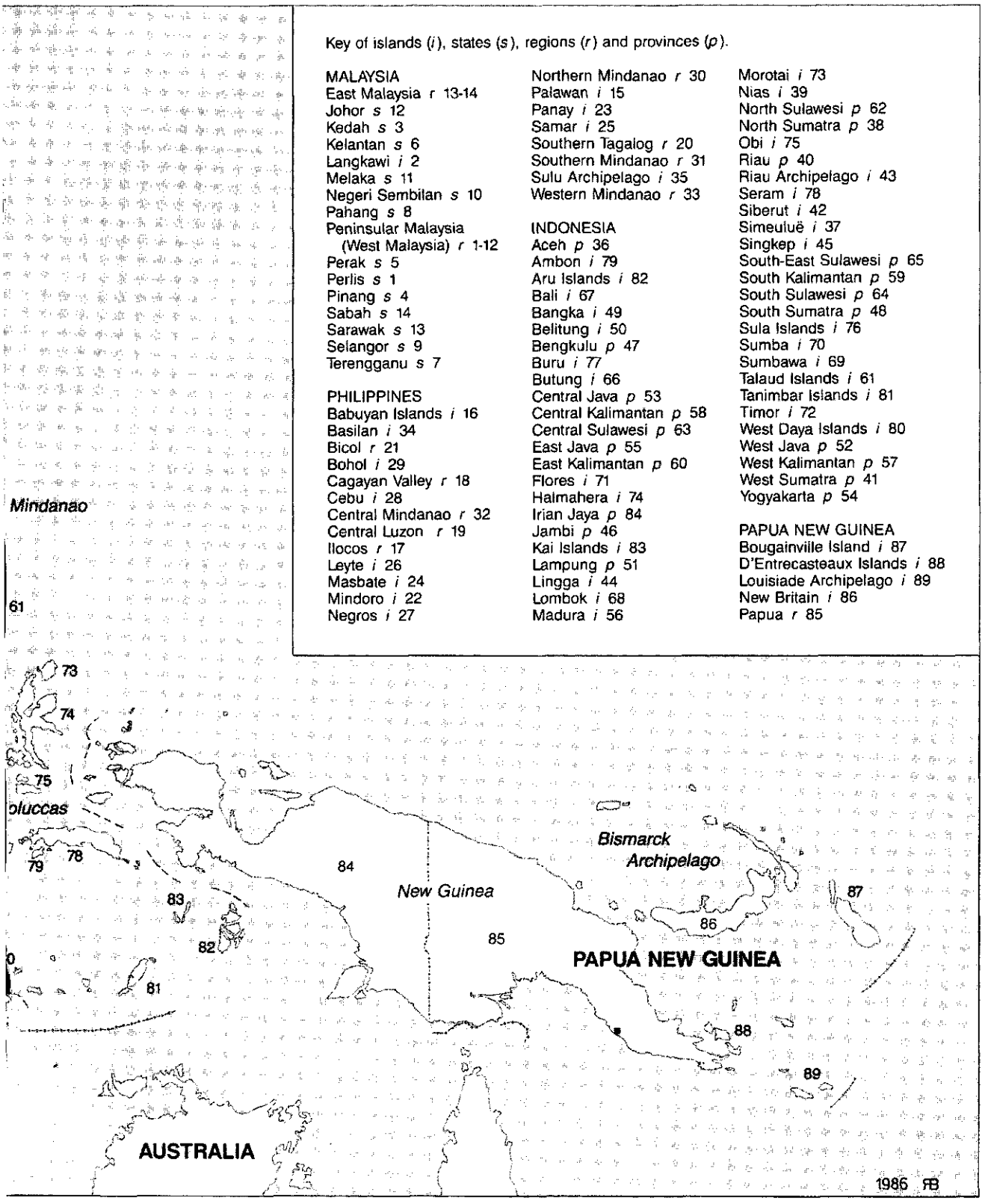


MAP OF SOUTH-EAST ASIA FOR PROSEA

Names of countries in capital letters and islands in lower case; numbers refer to the key.


Key of islands (i), states (s), regions (r) and provinces (p).
MALAYSIA
East Malaysia r 13-14
Johor s 12
Kedah s 3
Kelantan s 6
Langkawi i 2
Melaka s 11
Negeri Sembilan s 10
Pahang s 8
Peninsular Malaysia (West Malaysia) r 1-12
Perak s 5
Perlis s 1
Pinang s 4
Sabah s 14
Sarawak s 13
Selangor s 9
Terengganu s 7
PHILIPPINES
Babuyan Islands i 16
Basilan i 34
Bicol r 21
Bohol i 29
Cagayan Valley r 18
Cebu i 28
Central Mindanao r 32
Central Luzon r 19
Ilocos r 17
Leyte i 26
Masbate i 24
Mindoro i 22
Negros i 27
Northern Mindanao r 30
Palawan i 15
Panay i 23
Samar i 25
Southern Tagalog r 20
Southern Mindanao r 31
Sulu Archipelago i 35
Western Mindanao r 33
INDONESIA
Aceh p 36
Ambon i 79
Aru Islands i 82
Bali i 67
Bangka i 49
Belitung i 50
Bengkulu p 47
Buru i 77
Butung i 66
Central Java p 53
Central Kalimantan p 58
Central Sulawesi p 63
East Java p 55
East Kalimantan p 60
Flores i 71
Halmahera i 74
Irian Jaya p 84
Jambi p 46
Kai Islands i 83
Lampung p 51
Lingga i 44
Lombok i 68
Madura i 56
Morotai i 73
Nias i 39
North Sulawesi p 62
North Sumatra p 38
Obi i 75
Riau p 40
Riau Archipelago i 43
Seram i 78
Siberut i 42
Simeuluë i 37
Singkep i 45
South-East Sulawesi p 65
South Kalimantan p 59
South Sulawesi p 64
South Sumatra p 48
Sula Islands i 76
Sumba i 70
Sumbawa i 69
Talaud Islands i 61
Tanimbar Islands i 81
Timor i 72
West Daya Islands i 80
West Java p 52
West Kalimantan p 57
West Sumatra p 41
Yogyakarta p 54
PAPUA NEW GUINEA
Bougainville Island i 87
D'Entrecasteaux Islands i 88
Louisiade Archipelago i 89
New Britain i 86
Papua r 85
Mindanao
61
73
74
75
Moluccas
78
79
84
New Guinea
83
82
85
81
Bismarck Archipelago
87
86
PAPUA NEW GUINEA
88
89
AUSTRALIA
1986 RB