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A REVISION OF THE GENUS « CASSIA » (CAESALP.) AS OCCURRING IN MALAYSIA **

> Comment donc, au milieu de tant d'anomalies, pourrons nous saisir le lieu qui unit des espèces si diverses ? Les anciens botanistes qui ne connaissaient qu'un petit nombre de casses, les avaient divisées en genres très-bien caracterisés, en particulier Breynius, dans son Prodromus ; les modernes ont d'abord rejeté ces genres et semblent aujourd'hui tendre à les adopter de nouveau.
>
> COLLADON, *Hist. Casses*, 1816.

INTRODUCTION

This revision of the genus *Cassia* L. is precursory to the treatment of the family of Caesalpiniaceae as occurring in Malaysia. I wish to express my deep appreciation to the Directors or Keepers of the following Herbaria : Bogor, Brisbane, British Museum (Nat. Hist.), Brussels, Florence, Geneva, Kew, Leyden, Linnean Society, Manila, Melbourne, Paris, Sandakan, Singapore, and Utrecht, who gave me, in various ways, all assistance they were able to.

It will be noticed that in the present revision of Malaysian *Cassia* I came to different results than when treating Malaysian *Bauhinia*. Both, *Bauhinia* s. ampl. and *Cassia* are, when accepted in the wide sense as became customary in the second half of the former and the first half of the present century, circumtropical genera. For reasons explained in a paper on Malaysian Bauhinieae (Reinwardtia, now in the press) I felt that the current concept of

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Bauhinia L. was no longer tenable and accordingly I resuscitated a number of genera and reduced *Bauhinia* L. to its original, much narrower, limits. The tribe of Bauhinieae — and the genus *Bauhinia* s. ampl. — are well represented in the indigenous vegetation of Malaysia and there are centres of development of some important taxa within that area.

As regards *Cassia* s. ampl., the position is essentially different. From a morphological point of view, something can be said in favour of splitting this heterogeneous genus, though I am decidedly not prepared to support the extreme views held by BRITTON & ROSE on this matter. On the other hand, the Linnean concept of *Cassia* was in accordance with the present, currently accepted delimitation. Malaysia holds about ten per cent of the number of species at present referred to *Cassia*, and the majority of species occurring in Malaysia are undoubtedly introductions. Whatever taxa are distinguished in *Cassia* s. ampl., there is not a single one showing a centre of development in Malaysia. Under the circumstances I have preferred to follow the systematy adopted in BENTHAM's monograph of 1871.

CASSIA

Cassia [Breyne, Prodr. Fasc. Rar. Pl 2 : 26-29. 1689] ; Linnaeus, Gen. Pl. ed. 5 : 178. 1754 ; ed. 6 : 206. 1764 ; Gaertner, Fruct. Sem. Pl. 2 : 310, 313. 1791 ; Persoon, Syn. Pl. 1 : 456. 1805 ; Willdenow, Enum. Hort. Berol. 439. 1809 ; Colladon, Hist. Cass. 1816 ; De Candolle, Prodr. 2 : 489. 1825 ; Meyen, Nov. Act. Phys. Med. Bonn 12 : 805. 1825 ; Don, Gard. Dict. 2 : 438. 1832 ; Vogel, Syn. Gen. Cass. 1837 ; endt, Linnaea 11(2) : 651. 1837 ; Bischoff, Bot. Zeit. 8 : 833, 881, 897. 1850. t. 9, 10 ; Batka, Bot. Zeit. 12 : 105. 1854 ; De Candolle A., Géogr. Bot. 2 : 772, 795. 1855 ; Miquel, Fl. Ind. Bat. 1(1) : 87. 1855 ; Bentham & Hooker, Gen. Pl. 1 : 571. 1865 ; Baillon, Dict. Bot. 1 : 646. 1876 ; Hist. Pl. 2 : 187. 1870 ; Bentham, Trans. Linn. Soc. 27 : 503. 1871 ; Baker in Hook. Fl. Br. Ind. 2 : 261. 1878 ; Müller, Kosmos 7 : 245-247. 1883 ; Burck, Ann. Jard. Bot. Btzg 6 : 254. 1887 ; Trimen, Fl. Ceylon 2 : 102. 1894 ; Koorders & Valeton, Bijdr. Kennis Booms. Java 2 : 6. 1895 ; Prain, Journ. As. Soc. Bengal 66(2) : 153. 1897 ; Backer, Schoolfl. Java 404. 1911 ; Gagnepain in Lecomte, Fl. Gén. Indo-Ch. 2 : 156. 1913 ; Fawcett & Rendle, Fl. Jamaica 4 : 99. 1920 ; Ridley, Fl. Mal. Pen. 1 : 616. 1922 ; Corner, M. A. H. A. Mag. 5(2) : 37. 1935 ; Amshoff, Fl. Surinam 2(2) : 54. 1939 ; Backer, Bekn. Fl. Java em. ed. 5, fam. 118 : 25. 1941 ; Steyaert, Bull. Jard. Bot. État Brux. 20 : 233. 1950 ; Bull. Soc. Roy. Bot. Belg. 84 : 32. 1951 ; Schwabe, Darwiniana 9 : 173-187. 1950.

(Synonymous generic names are treated in the note below, and under the subgenera *Cassia* and *Senna*).

Trees, shrubs or herbs. Leaves paripinnate, at least one pair of free leaflets present. Intrastipular trichomes absent. Flowers in simple or, rarely, compound racemes. Receptacle flat or saucer-shaped. Sepals 5, free. Petals 5, subequal, the uppermost smallest. Stamens as a rule 10, the 3 lower (outer) often much longer than the others. Anthers basifixed or nearly so, opening by terminal pores, or by slits. Stigma small. Pods variously shaped, usually indehiscent or subdehiscent, rarely dehiscent. Seeds albuminous.

Type species. – *Cassia fistula* L. Sp. Pl. 377. 1753 (cf. Prop. Br. Bot. Intern. Bot. Congr. Cambridge 152. 1929).

Distribution. – Circumtropical.

Ecology. – Mostly at low or medium altitudes.

Note. – I am of opinion that the subgenus *Cassia* originated in SE. Asia, probably on the continent. Of the subgenus *Senna* a few species are to be considered indigenous in Malaysia, the subgenus *Lasiorhegma* has been introduced, possibly with the exception of *C. mindanaensis*.

Terms. – If the leaflets, arranged in pairs along the rachis increase in size (the terminal pair being largest) the term increasing is used, if the leaflets decrease in size (the terminal pair being smallest) the term decreasing is used, and if they increase towards the middle and decrease in the upper half of the leaf (the pairs about the middle of the rachis being largest) the term recrescent is used.

WILLDENOW (Mag. Ges. Naturf. Fr. Berlin 2 : 174, 175. 1808) coined for the fruit of some Leguminosae including *Cassia fistula* and allied species the term « lomentum » ; it is distinguished from the leguminous pod by the presence of transverse septs and by its not being longitudinally dehiscent. Another and chief character of a lomentum is, however, that the fruit falls apart between the seeds in one-seeded joints, and this is not found in *Cassia*. I have, therefore, defined the fruit in *Cassia* as a pod.

Taxonomy. – Since DIOSCORIDES (1st Cent.) applied the Greek name « kassia » or « kasia » to a lauraceous species, there has been some diversity and confusion concerning its application. This might form the subject of a historico-botanical study but falls beyond the scope of this paper. DODOENS (1553) and MATHIOLUS (1554) interpreted *Cassia* in the Linnean sense.

The relationship of taxa in *Cassia* was first outlined by BREYNE (1689) who described, and drew attention to, the characteristics of the pods and position of the seeds (the only material at his disposal) in the taxa *Fistula*, *Chamaecrista*, and *Chamaecassia*. Since then further subdivisions of the genus were proposed but BREYNE'S taxa are maintained among them to the present day.

On the other hand, a number of authors proposed a narrower delimitation of *Cassia* and adopted new genera consisting of, or based on, species previously described in *Cassia*.

PERSOON (1805) arranged *C. fistula* and allied species in *Cathartocarpus* (l. c., p. 459). He was followed e. g. by F. VON MUELLER. Whether their view is accepted or not, the present Code of Nomenclature prescribes the use of the name *Cassia* for a taxon comprising *C. fistula*.

Later on, WILLDENOW proposed the name *Bactyrilobium* for a genus conform with PERSOON'S *Cathartocarpus*.

MILLER (Gard. Dict. abr. ed. 4 : 1754) adopted the name *Senna* (in use since MATHIOLUS, 1570, DODONAEUS, 1583, BREYNE, and TOURNEFORT, cf. BATKA, l. c. 1854) for a genus, comprising in particular the species of *Cassia* producing the well-known purgative leaflets. He was followed e. g. by GAERTNER (1791) and ROXBURGH (ed. Carey, 1832).

Other authors who proposed new genera which are now usually maintained as infrageneric taxa in *Cassia* are e. g. MOENCH (*Chamaecrista*), G. DON (*Chamaefistula*), and some others.

RAFINESQUE described a considerable number of new genera which are generally reduced to *Cassia*, viz *Adipera*, *Cassiana*, *Chamaesenna*, *Dialanthera*, *Diallobus*, *Diplotax*, *Ditremexa*, *Emelista*, *Herpetica*, *Isandrina*, *Nictitella*, *Octelisia*, *Ophiocaulon*, *Panisia*, *Peiranisia*, *Rostella*, *Scolodia*, *Tagera*, and *Xamacrista* (cf. MERRILL, Index Rafin. 142-149. 1949). BRITTON (N. Am. Flora **23** : 228-301. 1930), however, accepted all RAFINESQUE'S genera and added, within the currently accepted limits of *Cassia* : *Pseudocassia*, *Pterocassia*, *Desmodiocassia*, *Phragmocassia*, *Sericeocassia*, *Xerocassia*, *Tharpia*, *Earleocassia*, *Echinocassia*, *Cowellocassia*, *Sciacassia*, *Gaumerocassia*, *Palmerocassia*, *Psilorhegma* (Bth.), *Vogelocassia*, *Leonocassia*. So far the splitting of *Cassia* into a large number of smaller genera has met with little support and I have

found in the morphology of Malaysian *Cassia* no arguments inducing me to follow these authors.

DE CANDOLLE composed a monograph of *Cassia*, which was incorporated in COLLADON's treatise (1816) and further established wide generic limitations for *Cassia*, since then followed by the majority of botanists (e. g. VOGEL, 1837 ; MIQUEL, 1855 ; BENTHAM, 1871 ; BAKER, 1878 ; PRAIN, 1897 ; GAGNEPAIN, 1913 ; RIDLEY, 1922 ; CORNER, 1935 ; AMSHOFF, 1939 ; BACKER, 1941 ; and others).

BENTHAM having made an outstanding revision of the whole of the genus *Cassia* (1871), stated :

« So natural, indeed, is the genus that, notwithstanding the great contrast in habit between the splendid arborescent Fistulas and some of the weedy herbaceous Prosospermas, or Chamaecristas, and although its principal characters are derived from the pod and the anthers, which both present more diversity than in any other Leguminous genus, yet there is hardly a species which has ever, by any tolerably fair botanist, been falsely or carelessly included in or rejected from the genus . . . » (l. c. p. 503).

I have thought it best to follow the majority of authors who studied *Cassia* in Malaysia and to maintain in this revision *Cassia* L. sensu latissimo. Only the subgenus *Cassia* is indigenous in Malaysia — though it extends considerably beyond its boundaries — and this contains less than a dozen of species. Of the remainder of the genus, comprising at least 400 species, about thirty occur as introductions in Malaysia. In the circumstances it seemed preferable to adhere to the customary delimitation of *Cassia* although I wish to say that E. MEIJER's proposal to accept 3 genera, delimited as *Cathartocarpus* Pers., *Cassia* L. (*Chamaefistula*, *Chamaesenna*, and *Senna*), and *Chamaecrista* Moench deserves to be considered (cf. Nov. Act. Phys. – Med. Ac. Caes. Leop. – Carol. Nat. Cur. Bonn 12 (2) : 805. 1825) insofar as it is a taxonomical arrangement, not as regards the nomenclature. In the present paper I have followed BENTHAM'S subdivision of *Cassia* into 3 subgenera (l. c. p. 505).

The striking fact that in *Cassia*, in widely different parts of its area of distribution, species occur which show an unusual high amount of convergential characters and resemble each other

in a sometimes deceptive manner, may be adopted as an argument for its natural homogeneity. Its generic morphological pattern acts as a stratum on which, actually, many species-groups represent, parallelous segregations or homologous series. As long as this taxonomical hierarchy is recognized it is a matter of appreciation whether one prefers to have e. g. three genera from a common stock (tribe or subtribe) or a single genus subdivided in three infrageneric taxa.

KEY TO THE SUBGENERA

1. Foliar gland(s) absent.
   2. Three stamens at least twice as long as the others, with deeply (twice) curved filaments, which are many times as long as the anthers. Anthers finally longitudinally split, not distinctly basifix. Transverse septs of the pods entire . . . . . subg. **Cassia**, p. 202
   2. All stamens nearly equally short, often two or three slightly longer, filaments shorter than or equally long as their anthers. Anthers opening by single or double terminal pores, basifix. Transverse septs of the pods entire or not . . . . . subg. **Senna**, p. 228
1. Glands present on the leaf-rachis.
   3. Sepals blunt or rounded. Leaflets in few or many pairs, very rarely narrow. Pods indehiscent or subdehiscent, seeds transversal or longitudinal. Bracteoles present or absent. Funicle capillary subg. **Senna**, p. 228
   3. Sepals very acute. Leaflets in many pairs, very narrow, rarely few pairs and broader. Pods flat, dehiscent, seeds longitudinal. Bracteoles present. Funicle short, broad, ± triangular. subg. **Lasiorhegma**, p. 278

Subgenus 1. Cassia.

Cathartocarpus Persoon, Syn. Pl. 1 : 459. 1805 ; Buchanan-Hamilton, in Pharm. Journ. 5 : 118. 1846.

Bactyrilobium Willdenow, Enum. Hort. Berol. 440. 1809.

Cassia sect. *fistula* De Candolle in Coll. Hist. Cass. 83. 1816, t. 1 ; Prodr. 2 ; 489. 1825 ; Vogel, Linnaea 11(2) : 651. 1837 ; Miquel, Fl. Ind. Bat. 1(1) : 89. 1855 ; Bentham in Benth. & Hook., Gen. Pl. 572. 1865.

Brewsteria (non Roemer) F. von Mueller, Hook. Journ. Bot. 9 : 229, 230. 1857 ; Proc. Linn. Soc. N. S. Wales 2 : 155. 1858 ; Fragm. Phytogr. Austr. 1 : 111. 1858/9.

Cassia subgen. *fistula* (DC.) Baker in Hook. f., Fl. Br. Ind. 2 : 261. 1878 ; Benth. Trans. Linn. Soc. London 27 : 513. 1871 (« subgenus vel sectio ») ; Taubert in Engl. & Pr. Nat. Pflz. fam. 3(3) : 158. 1891.

Trees. Leaves glandless. Sepals blunt or rounded. Bracts and pseudo-bracteoles present, very rarely bracteoles occur on the pedicel. Filaments of the 3 lower stamens long, curving ; anthers finally splitting lengthwise (in *C. roxburghii* opening by basal

pores). Filaments of the 7 upper stamens short; anthers opening by basal pores, the uppermost sometimes abortive. Pod long, terete or slightly flattened, woody, indehiscent. Seeds transverse, separated by septs which reach the wall of the pod on both sides, often imbedded in pulp. Funicle capillary.

Type species. – *Cassia fistula* L.

Distribution. – Tropical Asia. In my opinion introduced into tropical America, probably wild in Africa.

Uses. – The medicinal properties were described by BUCHANAN-HAMILTON (1846). Further references under the species.

Morphological note. – STEYAERT (l. c. 1951), commenting on the heterogeneous character of the tribe Cassieae, stated that the type section (« *Cathartocarpus* ») of the genus *Cassia*, and its type species *C. fistula*, had dorsifix anthers, dehiscing laterally. He thought this to be at variance with the generally accepted circumscription of *Cassia*, which demands basifix anthers opening by pores.

In the subgenus *Cassia*, the long stamens carry anthers in which the lower part of the connective is spurious. The loculi are, in the basal part, closely appressed to each other but not or hardly adnate. This is easily observed in the ripe anther because the loculi become separate in their basal part at full maturity. The result is that only in the upper part the loculi are connected by a permanent connective but in the lower part a pyramid-shaped cavity or hollow separates the loculi at full maturity. At the top of this pyramid-shaped cavity the anther is inserted i. e. at the base of the permanent or true connective. The anthers can, therefore, be described as basifix though, at first, they seem to be nearly versatile.

A longitudinal rim of dehiscence is evident in each loculus of the anther of the longer stamens in the subgenus *Cassia*. This rim opens at first by a basal pore and then apically by an only tardily lengthening pore. The anther is therefore not really biporous, nor is it really longitudinally dehiscent.

A hypanthium is a characteristic of the subgenus *Cassia* and also found in a number of other species in the other subgenera. Its presence and shape reminds one of the tubular receptacle (« calyx-tube ») occurring in several genera of Bauhinieae but it

is solid and its base is never dilated. It is easily observed on the stalks of young growing pods and of old flowers, its base is sometimes marked by a transverse rim of pubescence.

A *joint occurs in the pedicels at the base of the hypanthium.* The unpollinated flowers are usually shed and leave the slender, straight pedicels from below the hypanthium attached to the axis of the inflorescence. Later on, the pedicel itself drops, often preceded by the bract. Two « pseudo-bracteoles » are found to be very closely inserted to the bract, laterally or half axillary. They are not shed with the pedicel and appear to be inserted on the axis of the inflorescence, like the bract. Strictly speaking, nearly all species in the subgenus *Cassia* are without bracteoles, the « pseudo-bracteoles » being homologous with stipules.

KEY TO THE TAXA IN THE SUBGENUS CASSIA.

1. Inflorescence 20-40 cm long, drooping or pendent, bractless when in full bloom (« Ebracteatae » Vogel). Stipules soon shed.
   2. Leaflets 3–8 pairs, top acute to blunt, on the lower surface soon glabrous but when very young silvery tomentose. Petals 2 cm long or longer, yellow . . . . . 3. **C. fistula**
   2. Leaflets 10–20 pairs, top rounded, on the lower surface dull, woolly pubescent. Petals c. 1½ cm long, pink . . . . . 4. **C. grandis**
1. Inflorescence short, 6-15 cm long (corymbose), stiff, not (or very rarely) drooping or pendent, bracts remaining attached as long as the flowers (« Bracteatae » Vogel). Stipules tardily shed, laterally attached.
   3. Ovary glabrous. Leaflets oblong or narrowly elliptic, velutinous or tomentose on the lower surface. Petals pubescent outside.
      4. Flowers pink or yellow. Pods 2½ cm through, up to 60 cm long. Petals distinctly clawed, 15–35 mm long. Stipules c. 2 cm across 7. **C. renigera**
      4. Flowers yellow. Pods 10–13 mm through, up to 35 cm long. Petals narrowed towards the base, 15–18 mm long. Stipules c. 1 cm across 2. **C. bartonii**
   3. Ovary (appressed) pubescent. Leaflets broad, ovate to elliptic, glabrous, puberulous or pubescent on the lower surface. Petals outside glabrous or nearly so.
      5. Filaments of the long stamens slightly increased at the middle (in dry specimens scarcely evident), their anthers without evident longitudinal rim and opening by a basal pore. Petals up to 1½ cm long . . . . . 8. **C. roxburghii**
      5. Filaments of the long stamens distinctly increased at the middle, their anthers with an evident longitudinal rim and opening by a basal and an apical pore. Petals at least 2 cm long.
         6. Mature pods grey or pale brown velvety. Leaflets 5 pairs. Calyx c. 1 cm long . . . . . 1. **C. bakeriana**
         6. Mature pods glabrous. Leaflets 5–20 pairs. Calyx c. ½ cm long.
            7. Stipules c. 5 mm across. Axis of inflorescence as a rule slender. Top of leaflets as a rule acute. Petals 2 (–3) cm long, oblong . . . . . 6. **C. nodosa**

7. Stipules 12–25 mm across, leafy. Axis of inflorescence stout. Top of leaflets as a rule rounded. Petals up to 3½ cm long, ovate.
   8. Leaflets on the lower surface glabrescent, (5)12–20 pairs. Flowers pink to white, 4–6 cm across **5. C. javanica var. javanica**
   8. Leaflets on the lower surface persistently, densely, short pubescent, 10–20 pairs. Flowers pink to white, 4–6 cm across . . . **5b. C. javanica var. pubifolia**
   8. Leaflets on the lower surface glabrescent, 6–7 pairs. Flowers carmine, 3–3½ cm across **5a. C. javanica var. agnes**

1. Cassia bakeriana Craib

C. bakeriana Craib in Kew Bull. 45. 1911 ; Gagnepain in Lec. Fl. Gén. Indo-Ch. 2 : 170. 1913 ; Craib, Fl. Siam. Enum. 1 : 508. 1928.
? *C. javanica* var. *indo-chinensis* Gagnepain in Lec. Fl. Gén. Indo-Ch. 2 : 158. 1913.

A tree. Leaflets 5 pairs, more or less chartaceous, oblong to oblanceolate, 6 ½–8 ½ cm long, 1 ½–3 cm wide, on both surfaces rather densely hairy, very densely on the midrib and nerves, top acute or rounded, base oblique, cuneate to rounded ; petiole 4 cm long, fulvous, velvety puberulous, terete, like the 30–40 cm long rhachis ; petiolules 2 mm long. Stipules not seen. Racemes 4 ½–7 ½ cm long. Bracts lanceolate (base broad), acute, on both surfaces thinly woolly hairy, up to 12 mm long, 3 mm wide, pseudo-bracteoles similar, smaller, adjacent, 4 mm long. Flowers large, on 6 cm long, sulcate, thinly hairy pedicels. Sepals lanceolate or ovate-lanceolate, obtusish, 9–12 mm long, 2–3 mm wide, woolly hairy on both surfaces. Petals lanceolate to ovate-lanceolate, 3 ½–4 ½ cm long, 12–25 mm wide, on both surfaces thinly hairy, blade contracted into a c. 5 mm long, narrow claw. Stamens : 3 more than 3 cm long, much longer than the others, filaments in the middle increased, glabrous ; anthers opening by a basal pore and a terminal slit, length-rim distinct. Ovary on a indistinct, long slender stipe, recurved, white pubescent, stigma subapical, punctiform. Pods terete, softly grey to pale brown velvety, c. 30 cm long, c. 17 mm through, at first somewhat annulate, later smooth, sutures conspicuous.

Type specimen. – *Hosseus* 478 (Doi Sutep, M. Siam ; holotype in K.).

Distribution. – Probably occurring in Malaysia (Mal. Pen.) but so far only collected in Annam, Laos, Cambodia, throughout East and Central Siam, and Burma.

Ecology. – Occurring from 500–1500 m alt., sometimes at altitudes below 200 m; once reported on a rocky, limestone hill.

Note. – GAGNEPAIN was uncertain about the true status of *C. bakeriana* (cf. l. c. pp. 158, 170). The subsequent discovery of the very distinctive pods removed all doubt if *C. bakeriana* were a good species (cf. CRAIB, l. c. p. 509). I think that CRAIB'S suggestion that *C. javanica* var. *indochinensis* Gagnep. is synonymous with *C. bakeriana* should be followed.

2. Cassia bartonii Bailey

C. bartonii Bailey, Queensl. Agric. Journ. 9 : 410. 1901, t. 16.

A tree, c. 15 m tall, with spreading branches and ± zig-zag twigs; young growth and foliage velvety pubescent; branchlets dark, angular by decurrent lines. Leaflets 12–18 pairs, chartaceous, oblong-elliptic, slightly unequal-sided, 2½–5½ cm long, (8) 12–18 mm wide; upper surface thinly pubescent, glossy, lower surface (densely) woolly pubescent, spreadingly so on the midrib which is slightly excurrent and with a caducous glandlet on the top, margins slightly recurved, top and base rounded; petiole pubescent, c. 2 cm long, rhachis 20–25 cm long, woolly pubescent, ribbed, produced in a short, blunt mucro between the upper petiolules, glandless; petiolules thick, 2–3 mm long, spreadingly pubescent. Stipules somewhat reniform, attached near the middle, nearly 1¼ cm long and 6 mm wide, pubescent. Racemes lateral, oblong, finally subcorymbose, 10–12 ½ cm long, possibly not drooping. Bracts c. 8 mm long, ovate, acuminate, slightly dilated at the base, pubescent, ± persistent. Flowers on c. 3 cm long pedicels. Sepals ovate-oblong, 6 mm long, pubescent on both sides, the outer side probably dark-coloured. Petals ovate-obtuse, tapering much towards the base, pubescent, prominently veined, c. 18 mm long. Filaments of the three long lower stamens much longer than the petals, swollen into a globular or ellipsoid appendage near the middle. Ovary glabrous, recurved. Pods on a c. 3

cm long slender stalk, 25–32 cm long, 10–13 mm through, terete (suture not thickened) but irregularly, gradually constricted, vaguely annulate between the seeds, not straight, smooth, glabrous, septs transverse, complete, seeds 40–70, entirely enclosed in suberous, 3–4 mm thick, discs.

Type specimen. – *F. R. Barton s. n.* (holotype) ; *W. S. Sayers s. n.*, a. 1887 (neotype in MEL).

Distribution. – East New Guinea (Mikanagoro ; Mount Obree).

Ecology. – Sayers, who collected the neotype on Mt Obree at c. 1000 m alt. stated that it occurred also at 350 m alt.

BAILEY (l. c.) described the seeds as only 6 mm long and said that they were « enclosed in a spongy, grey testa, 2 lines thick ».

Note. – BAILEY's holotype (*F. R. Barton s. n.*) seems to be lost ; I found nothing among the Melbourne or Brisbane specimens, nor at Kew or in the British Museum. I appoint for that reason SAYERS' fruiting specimen as the neotype. When better material becomes available, *C. bartonii* might prove to be identical with *C. renigera*.

3. Cassia fistula Linnaeus

C. fistula [Rumphius, Herb. Amb. 2 : 83, t. 21. 1741] Linnaeus, Sp. Pl. 377. 1753 ; Burman, N. L., Fl. Indica 96. 1768 ; Gaertner, Fruct. Sem. Pl. 2 : 313. 1791, t. 147, p. p. syn. ; Lour. Fl. Cochinchin. ed. Willd. 323. 1793 ; Colladon, Hist. Cass. 85. 1816 (vide ib. pro ref. ad lit. obsol.) ; Ham. Trans. Linn. Soc. 13 : 484. 1822 ; Hayne, Arznei-Gew. 9 : 39. 1825, cum tab. ; DC. Prodr. 2 : 490. 1825 ; Vogel, Syn. Cass. no 3 : 11. 1837 ; Blanco, Fl. Filip. 339. 1837 ; ed. 2 : 237. 1845 ; ed. 3, 2 : 76. 1878, p. p. t. 120 ; Wight, Ic. 1 : t. 269. 1840 ; Hasskarl, Flora, Beibl. 2 : 89. 1842 ; Pl. jav. rar. 402. 1848 ; Miq., Fl. Ind. Bat. 1(1) : 89. 1855 ; Baillon,Hist. Pl. 2 : 127, 128. 1870 ; Dict. Bot. 1 : 647. 1878 ; Bentham, Trans. Linn. Soc. 27 : 514. 1871 (vide ib. pro syn. extra-Mal.) ; Bentley & Trimen, Med. Pl. 2 : t. 87. 1877 ; Kurz, For. Fl. Br. Burma 1 : 391. 1877 ; Baker in Hook. f. Fl. Br. Ind. 2 : 261. 1878 ; F.-Vill. Nov. App. 70. 1880 ; Vidal, Sin. Atlas 24 : t. 42, f. E. 1883 ; Phan. Cuming. 110. 1885 ; Rev. Pl. Vasc. Filip. 116. 1886 ; Bail. Econ. Pl. Queensl. 21. 1888 ; Taubert in Engl. Pr. Nat. Pflz. Fam. 3(3) : 157. 1891 ; Trimen, Handb. Fl. Ceylon 2 : 103-104. 1894 ; Koorders & Valeton, Bijdr. Booms. Java 2 : 11. 1895 ; Atlas Baumart. Java 1(1) : t. 39. 1913 ; Prain, Journ. As. Soc. Bengal 66(2) : 156. 1897 ; Knuth, Handb. Blütenbiol. 3 : 375, 377. 1904 ; Brandis, Indian Trees 253. 1907 ; Tischler, Jahrb. Wiss. Bot. 47 : 220. 1910 ; Merrill, Philip. Journ. Sci. Bot. 5 : 47, 1910 ; Backer, Schoolfl. Java 404. 1911 ; Tischler, Nat. Tijdschr. Ned. Ind. 72 : 249. 1913 ; Gagnepain in Lec. Fl. Gén. Indo-Ch. 2 : 159. 1913 ; Bradley Bibliogr. 3 : 471. 1915 (lit. ref. on medic. prop.) ; Merr. Interpr. Rumph. Herb. Amb. 259. 1917 ; Sp. Blancoanae 174. 1918 ; Fawcett & Rendle, Fl. Jamaica 4(2) : 102. 1920 ; Rock, Ornam. Trees Hawaii t. 28. 1920 ; Legum. Pl. Hawaii 75, 77, t. 28, 1920 ; Domin,

Beitr. Fl. Pflz. geogr. Austr. 790. 1921-'29; Ridley, Fl. Mal. Pen. 1: 620. 1922; Merr. Enum. Philip. Fl. Pl. 2: 262. 1923; Heyne, Nutt. Pl. Ned. Ind. 741. 1927; Craib, Fl. Siam. Enum. 1(3): 509. 1928; Pittier, Trab. Mus. Com. Venez. 3: 147. 1928; Merr. Comm. Lour. Fl. Cochinch. 189. 1935; Kloppenburgh-Versteegh, Wenken Raadg. Ind. Pl. ed. 4: 143. 1935, atl. f. 22; Corner, M. A. H. A. Mag. 5(2): 47. 1935; Wayside Trees Mal. 386. 1940, t. 83; Burkill, Dict. Econ. Prod. Mal. Pen. 1: 475. 1935; Backer, Bekn. Fl. Java em. ed. 5, fam. 118: 28. 1941; Neal, Pacific Sci. 5: 82. 1951; Meijer Drees in Comm. For. Res. Inst. Bogor 33: 69. 1951.

Canna fistula Paludanus in Linschoten, Itinerario 100. 1595/6.

Conna Rheede, Hort. Mal. 1: 37. 1678, t. 21.

Cassia fistula vulgaris flore luteo Breyne, Prodr. 2: 26. 1689.

Cassia fistula alexandrina Commelin, Hort. Med. Amst. 1: 215. 1697, t. 110.

Cassia foliolis quinque L. Hort. Cliff. 158. 1737; Fl. Zeyl. no 149: 63. 1748.

Cathartocarpus fistula Persoon, Syn. Pl. 1: 459. 1805.

Bactyrilobium fistula Willdenow, Enum. Hort. Berol. 440. 1809.

Cassia fistula var. β *obovata* DC. Prodr. 2: 490. 1825.

Cassia rhombifolia Roxburgh, Fl. Ind. 2: 334, 335. 1832; DC. Prodr. 2: 490. 1825; Miquel, Fl. Ind. Bat. 1(1): 89. 1855 Prain, Journ. As. Soc. Bengal 66(2): 155, 473. 1897.

Cathartocarpus rhombifolius Don, Gen. Syst. Gard. 2: 453. 1832.

A deciduous tree, 10–20 m tall, with spreading branches and small, shallow buttresses; branchlets glabrous. Leaflets 3–8 pairs, subcoriaceous, ovate to ovate-oblong, nearly equal-sided, 6–10(–20) cm long and 3 ½–9 cm wide, when young sparsely puberulous, later glabrous and shining above, on lower surface when young silvery tomentose, soon glabrous, acute (rarely blunt and ± emarginate; midrib produced in a caducous, subulate mucro, side-nerves numerous, slender, marginal nerve slender), base broadly cuneate; petiole terete, sturdy, 7–10 cm long, glabrous, rhachis 12–25 cm long, terete, glabrous, glandless, when young produced in a truncate mucro beyond the upper petiolules; petiolules glabrous, 4–6 mm long. Stipules deltoid, acute, 1–2 mm long, tardily caducous, ± glabrous. Racemes pendent, axillary, 1–3 together, many-flowered, lax, open, 10–40 cm long; peduncle 2–10 cm long, terete, glabrous. Bracts 8–10 mm long, ovate, long-acute, puberulous. Pseudo-bracteoles adjacent, linear, twisting, acute, c. 7 mm long, puberulous. Flowers large, on 3 ½ cm long slender, glabrous pedicels. Calyx finely puberulous. Sepals ± equal, narrowly ovate, blunt, c. 9 mm long, finally reflexed. Petals (broadly) obovate, nearly symmetrical, 2–3 ½ cm long, ± sessile or blade narrowing into a (very short, 1–3 mm long) claw, glabrous. Stamens 3 lower twice curved, filaments increasing towards the middle, c. 3 cm long, anthers 5 mm long, opening

at the top, at the base, and often by a longitudinal rim, the filaments inserted in the top of the cleft of the basally deeply split anther, centrally puberulous behind, 4 stamens shorter, 8–10 mm long, anthers smaller, opening by a basal pore, 3 stamens still shorter, 5 mm long, anthers poorly developed. Ovary slender, thinly appressed puberulous, style sturdy, stigma punctiform. Pods terete, glabrous, scarcely rimmed, finally strong-valved, indehiscent, 20–60 cm long, 1 ½–2 cm through, black, 40–100-seeded. Seeds glossy brown, smooth, flattened, transverse, ovate ; albumen copious, entirely enveloping the warped embryo, 13 mm long, a central line running from the hilum to the top of the seed ; funiculus straight, capillary, 3–4 mm long.

Type specimen. – In Herb. Hermann (in BM; cf. FAWCETT & RENDLE, Fl. Jamaica 4(2) : 102. 1920).

Distribution. – Tropics generally.

Ecology. – Sometimes on the sea-beach but mostly in the interior ; specimens, always scattered, in jungles or old forests on clayey soils at low or medium altitudes (not near water). It is commonly found (Beumée, de Boer) in teak forests (cf. CORDES, Djati-bosschen op Java 73. 1881) but also in « Bambu duri » and « Ploso » forests. Through occurring on red, volcanic soils (Beumée, at Djabung near Surabaja), it favours calcareous soils (Elbert on Sumbawa, Walsh in S. Central Timor, Becking, Noltée, de Boer, Vincent at Prupuk near Pekalongan) ; MEIJER DREES (l. c.) thinks it is a « characteristic species of the *Schleicheretea* and the *Pterocarpion* ».

Vernacular names. – Sumatra : *Bak birakhta* (Atchin) ; Mal. Pen. : *bereksa, tenggali, raya kaya, dulang* (mal.) Java : *bobondélan, bubúndelan, bumbungdélan, bondel tanggoli, trangguli* (sund.) ; *bongkok alas, kéjok, klohur, klohor, kluwur, péjok, pijok, tangguli, tengguli, trengguli* (jav.); Madura : *kalobur, klobor* ; Bali : *tangguli, kaju radja, kaju dulang* ; Sumba : *kundjur* ; Timor : *babuni daun besar, biraksa, kaju radja, nikis, nain nain* ; Flores : *klowang, kandapistu* ; Roti : *bubuni radja* ; Wetar : *lunbateh* ; Sumbawa : *kenahi* ; Alor : *kikili, ladau* ; Borneo : *kilai, ngadju* (Dyak) ; Philip. : *bitsula* (C. Bis.), *cana fistula* (Sp.), *kana péstula* (Ibn.), *kana pistola* (Tag.), *fistula* (C. Bis.), *ibabau* (Bis.), *lombayong* (Bis.), *lapad lapad* (Tagb.) ; Celebes : *kaju radja* (mal.) ; Ambon : *poope pauma* ; Buru : *gula* ; Muna : *kapoeé poeé* ; Sangi : *limbalo* ; Key Isl. : *ait nil, pong radja* (Bug.), *papa papuno* (Alf.) ; Dutch : *Indische Gouden regen* ; Engl. : *Indian Laburnum, Cassia stick tree, Golden Shower, Pudding Pipe tree, Purging Cassia* ; French : *Caneficier* ; German : *Röhrenkassie.*

Uses. – *Cassia fistula* is often planted as an ornamental in gardens or as a wayside tree.

MEIJER DREES (l. c.) suggests that *C. fistula* might be used in mixed plantations for soil protecting purposes in dry and moderately dry regions of the lowland ; planting on open sites in dry areas might meet with difficulties.

The bark is valuable for tanning (cf. HEYNE, l. c. p. 742). RUMPHIUS said that it serves as a substitute for *Areca* and that it was chewn with sirih and lime. There was, he said, also some « stickiness » in the bark which the Javanese added to their « bobori » ointment. Fresh bark was found useful to purify wounds.

The wood is used, in Java, for charcoal and house building. The heart wood is hard and blackish-brown and serves for making knife sheaths, also, in India, for bows, axles of carts, plough-shares and rice-pounders. KURZ warned that the wood was soon attached by xylophages, if not properly seasoned.

KLOPPENBURG-VERSTEEGH (l. c. p. 143, 144) recorded the medicinal use of a decoction of the roots, which were boiled to a thick broth by continued heating. It was used to purify wounds. The roots, according to RUMPHIUS, when chewn with « siri-pinang », or mushed in water, were deemed effective as an antidote, especially if excavated on dry days and scalded under hot ashes.

RUMPHIUS also noted that cattle browse on the leaves but do not take the pods. Young leaves are externally applied to buffalo as a medicine (at Semarang, Java, according to KOORDERS).

At Klumpit (Central Java) it was part of a « sacred grove ». This agrees with TRIMEN's record of the use of the flowers in temple ceremonies on Ceylon. Sugared flowers are, according to RUMPHIUS, suitable as a purgative but the fruits are much preferred for that purpose.

Most widely known is the time-honoured use of the ripe pods as a purgative. Formerly they were an important article for export but at present their only market is the native medicine trade. KLOPPENBURG-VERSTEEGH prescribes that to obtain a purgative jelly, the pods are peeled and their contents boiled, just immersed in water. When the jelly becomes detached from the seeds, the mess is put through a close sieve. The juice is again boiled with an addition of sugar and when thick, cooled and put 3–4 days in the sun. This keeps well. A good spoonful is considered a suitable dose.

The pulp, fresh from the pod may also be taken. HASSKARL stated that one seed, ground and mixed with sugar and water was applied in Java as a laxative.

Full accounts of the varied use of *C. fistula* are given by BURKILL (l. c.) as regards the Mal. Peninsula, HEYNE (l. c.) as regards Indonesia ; QUISUMBING recorded extensive pharmaceutical data (Medic. Pl. Philip., Dpt Agricult. Nat. Res. Techn. Bull. 16 : 379, 1032, 1951).

Biological note. – MEIJER DRESS stated that it was a small tree in Timor, deciduous and fairly resistant against fire. KURZ, however, found it « frequent all over Burma. . . in the leaf-shedding forests, especially in the savannah and lower mixed forests ».

In transverse section the bark is light pink or orange. Flowering occurs throughout the year.

CORNER noted that at Singapore the leaves are shed at intervals of 9–10 months. The inflorescences develop with the new foliage, from the old branches behind the leaves.

The flowers are scented. The calyx is yellowish-green, more

or less reflexed. The filaments of the stamens are pallid-yellow, the anthers dark brown-yellow. The pulp of the ripe pods decomposes to a black, syrupy, homey-scented (also judged to be « stinking ») mess.

The pollen grains in the smaller stamens contain starch or dextrin. KNUTH studied at Buitenzorg the pollination of the flowers by wood bees. The insects « milk » the starchbearing anthers for food and effect pollination by transmitting the pollen of the large stamens.

MARIE C. NEAL (l. c.) found on certain individual trees in Honolulu several kinds of aberrant flowers. They differed in having a duller yellow colour, and e. g. four petals, four sepals, and eight stamens. Forms with 3 sepals, 7 or 8 stamens or with 6 petals, 6 sepals and 12 stamens were observed. There were also variations in shape of the petals, sepals and stamens.

NEAL and METZGER described a highly ornamental hybrid between *C. fistula* and *C. nodosa*, the former providing the pollen. The pods from the pollinated flowers contain seeds of different shapes (Bernice P. Bishop Mus. spec. Publ. **13** : 145. 1929).

Note on the distribution of Cassia fistula and allied species. – Is *Cassia fistula* indigenous in Malaysia? MERRILL (1923) stated that it was introduced in the Philippines. PRAIN (1897) was of the opinion that *C. fistula* was not indigenous in the Malay Peninsula. The same view is held by RIDLEY (1922) and CORNER (1940); the latter said it was native to India and Ceylon. The position may be outlined as follows.

It is a striking fact that numerous species of Caesalpiniaceae occur both in eastern Malaysia (Moluccas, some Lesser Sunda Islands, parts of Celebes, in general dry areas with a pronounced eastern [dry] monsoon), and in NE. Siam and adjacent India. Either the same species occur or closely allied taxa.

The interlying area, subject to a pronounced western (wet) monsoon, consisting of Sumatra, the Malay Peninsula, Borneo and Java (the latter island in some cases only as regards the larger, western part) is without those species. The Philippines in general, are also without them.

Some examples of those disjunct areas in Caesalpiniaceae are *Piliostigma malabarica* (Roxb.) Benth., *Bauhinia viridescens* Desv.,

B. pottsii Don, *B. acuminata* L., *B. hirsuta* Weinmann, *Lasiobema scandens* (L.) De Wit, *Cassia bartonii* Bailey and *C. renigera* Wall. ex Benth., *C. javanica* L. and *C. nodosa* Ham.-Buch., and *C. fistula* L.

The so-called « teak forest flora » contains numerous other examples in other families and the teak tree itself can probably be added to the list.

It has been said that this peculiarity in the distribution of many species and other taxa was due to their being spread by human agency. Though it seems that definite proof towards a solution of this problem will be hard to obtain I am of opinion that the present distribution of the abovementioned, and also of other similarly distributed taxa is to be regarded as a relict distribution. The areas they now occupy in eastern Malaysia are remnants, I think, of uninterrupted areas of distribution existing in a former geological period in which the climatical conditions prevailing in large parts of western Malaysia were identical with those now found in the drier parts of the SE. Asiatic Continent and in parts of eastern Malaysia.

A change of climate in large parts of Malaysia, which made the present extension of the rainforest possible, may have caused that numerous taxa disappeared in large areas. Many became entirely extinct in the area now under rainforest, some succeeded in maintaining themselves in a few, isolated stations [e. g. *Bauhinia pottsii* Don, *Lasiobema scandens* (L.) De Wit].

As regards *Cassia fistula*, it will never be possible to decide, in many places in eastern Malaysia, whether it is indigenous there or was introduced by man. It seems to me that *C. fistula* is indigenous in eastern Malaysia, occupies a relict area of distribution, and occurs also extensively cultivated and introduced in the same area.

4. Cassia grandis Linnaeus f.

C. grandis Linnaeus f. Suppl. 230. 1781 ; Bentham, Trans. Linn. Soc. 27 : 515. 1871 ; Flora Bras. 15(2) : 93. 1872 ; Backer, Schoolfl. Java 405. 1911 ; Fawcett & Rendle, Fl. Jam. 4(2) : 229. 1920 ; Britton & Rose, N. Am. Fl. 23 : 229. 1930 ; Blatter & Millard, Journ. Bombay Nat. Hist. Soc. 35 : 292. 1932 ; Corner, M. A. H. A. Mag. 5(2) : 47. 1935 ; Ways. Trees Mal. 388. 1940 ; Backer, Bekn. Fl. Java, em. ed., 5, fam. 118 : 28. 1941.

Cassia brasiliana Lamarck, Dict. **1**: 649. 1783; Miq. Linnaea **18**: 578. 1844; (non « *brasiliensis* »).
Cassia mollis Vahl, Symb. **3**: 57. 1794.
Cathartocarpus grandis Persoon, Syn. **1**: 459. 1805.
Cathartocarpus brasiliana Jacquin, Fragm. **59**: t. 85, f. 3. 1809.
Bactyrilobium molle Schrader, Gött. Gelehrt. Anz. 713. 1821.

A tree, up to 10–25 m high; trunk buttressed, branches ribbed; twigs, petioles and inflorescences with a rusty or white pubescence. Leaflets 10–20 pairs, subcoriaceous, elliptic-oblong, equal-sided, 2 ½–6 cm long, 14–22 mm wide, upper surface glossy, sparingly pubescent, lower dull, woolly pubescent, top and base rounded (midrib excurrent in a minute, broad mucro); petiole 2–3 cm long, woolly tomentose, slightly ribbed; rhachis, 10–25 cm long, produced beyond the upper petiolules into a 3 mm long, tomentose mucro, glandless; petiolules stout, woolly tomentose, 2–3 mm long, often not quite opposite; stipules minute, falcate and somewhat laterally attached, 1 ½ mm long. Racemes lateral, 10–25 cm long, c. 20-flowered. Bracts ovate, long-acute, outside woolly tomentose, c. 5 mm long. Pseudo-bracteoles similar, slightly smaller, inserted on the base of the pedicel, both very early caducous. Flowers medium, on 1–2 cm long, woolly pubescent pedicels. Calyx mealy pubescent, red. Sepals pubescent on both sides, obovate, rounded, 6–9 mm long, finally reflexed. Petals orbicular to obovate, c. 1 ½ cm long, blade narrowing into a 1–2 mm long claw, glabrous, at first bright red, later pallid-pink, finally orange, upper petal spotted yellow and with a swollen basal furrow. Stamens 3 longest, filaments increasing but much thinner at the top, c. 2 cm long, recurved; anthers broadly ovate, pubescent, 2 ½ mm long, opening by an apical, large, rim-shaped and a basal pore, 5 shorter, filaments 7–9 mm long, straight, glabrous; anthers ± deltoid, pubescent, opening by an apical and a basal slit-shaped pore; 2 shortest c. 2 mm, incurved, anthers small. Ovary silky tomentose, recurved, on a 1 cm long, slender, patently silky stipe, style not evident, stigma punctiform. Pods woody, slightly or not compressed, transversely veined or rugose, rough, coarse, 45–65 cm long, 3–4 cm through, 70–80-seeded.

Type specimen. – *C. G. Dahlberg s. n.* Surinam (holotype n. v.).

Distribution. – Central & tropical America to N. Brazil. Everywhere cultivated in the tropics. Introduced in Malaysia.

Malay Peninsula (Perlis, Kedah, Singapore), Java (Bogor, Semarang, Bagelen).

Ecology and Biology. – CORNER stated that it was deciduous in the north of the Malay Peninsula. The inflorescences were borne on the twigs before the new leaves.

In Java it flowers from August to November.

Vernacular names. – Mal. Pen.: *Kotek, kotak manak*; English: *Horse Cassia, Pink Shower.*

Uses: FAWCETT & RENDLE say (l. c.): « the pulp is used like that of C. fistula, but is coarser and more powerful. The wood is strong and handsome, and useful for many purposes ».

Valuable as an ornamental.

5. Cassia javanica Linnaeus

C. javanica Linnaeus, Sp. Pl. 379. 1753; N. L. Burman, Fl. Indica 97. 1768; Lamarck, Dict. 1: 649. 1785; Vogel, Syn. Cass. 13. 1837; Bentham in Miq. Pl. Jungh. 1: 259. 1852; Miquel, Fl. Ind. Bat. 1(1): 90. 1855; Bentham, Trans. Linn. Soc. 27: 517. 1871; F.-Villars, Nov. App. 70. 1880; Vidal, Sinopsis Atlas 24, t. 42, f. D. 1883; Rev. Pl. Vasc. Filip. 116. 1886; Koorders & Valeton, Bijdr. Kenn. Booms. Java 2: 8. 1895; Prain, Journ. As. Soc. Bengal 66 (2): 156, 474. 1897; Perkins, Fragm. Fl. Philip. 14. 1904; Merrill, Philip. Journ. Sci. Bot. 5: 48. 1910; Backer, Schoolfl. Java 405. 1911; Gagnepain in Lec. Fl. Gén. Indo-Ch. 2: 158. 1913; Merrill, Sp. Blancoanae 174. 1918; Koorders, Bull. Jard. Bot. Buitenz. III, 1: 168. 1919; Fawcett & Rendle, Fl. Jamaica 4(2): 101. 1920; Ridley, Fl. Mal. Pen. 1: 619. 1922; Merrill, Enum. Philip. Fl. Pl. 2: 263. 1923; Heyne, Nutt. Pl. Ned. Ind. 743. 1927; Craib, Fl. Siam. Enum. 1: 508, 509, 511. 1928; Blatter & Millard, Journ. Bombay Nat. Hist. Soc. 35: 289. 1932, t. 13, XIII, XIV; Corner, M.A.H.A. Mag. 5: 48. 1935; Ways. Trees Mal. 389. 1940; Burkill, Dict. Econ. Prod. Mal. Pen. 1: 476. 1935; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 29. 1941; — non Aubl. Hist. Pl. Guiane Fr. 1: 382. 1775, nec Vellozo, Fl. Flum. 4, t. 73. 1827, nec Sieber ex Benth. Trans. Linn. Soc. 27: 516. 1871.

Cassia fistula indica Breyne, Prodr. 2: 26, 1689.

Cassia fistula javanica Commelin, Hort. Med. Amst. 1: 217. 1697, t. 111.

Cassia fistula sylvestris Rumphius, Herb. Amb. 2: 88. 1711, t. 22.

Cassia bacillus Gaertner, Fruct. Sem. Pl. 2: 313. 1791; Wight, Ic. I, t. 254. 1840 (haud « *basillus* » sec. Auctt.).

Cathartocarpus javanicus Persoon, Syn. Pl. 1: 459. 1805; G. Don, Gen. Syst. 2: 453. 1832.

Cassia megalantha Decaisne in Herb. Tim. descr. 136. 1835 (Nouv. Ann. Mus. Hist. Paris 3. 1834).

A small, deciduous tree, 3–20(–30) m tall, trunk armed by pointed branch-remnants, twigs glossy, sparsely puberulous to glabrous, tips downy. Leaflets 10–16(–20) pairs, chartaceous to subcoriaceous, broadly elliptic to ovate-oblong, more or less equal-sided, 2½–5½(–7) cm long, 1½–2½(–3½) cm wide, upper sur-

face (semi-) glossy, glabrescent, lower dull, finely appressed puberulous, top rounded to blunt or ± acute, emarginate (midrib minutely excurrent), base broadly rounded to cuneate; petiole 1½–4½ cm long, terete, sparsely puberulous; rhachis 20–30(–40) cm long, ribbed, terete, glandless, produced in a very early caducous, blunt mucro; petiolules slender 1–3 mm long, delicately puberulous. Stipules membranous to foliaceous and falcate to broadly elliptic, pubescent, 12–25 mm long, in the middle attached, pointed or rounded at both ends, yellow-green, caducous. Racemes ± corymbose, 5–16 cm long, 8–10 cm wide, stiff, sometimes branching, peduncle stout, terete, puberulous. Bracts ovate, acute, sometimes auriculate at the base, puberulous, 10–12(–18) mm long and almost as wide, brown-red. Pseudo-bracteoles axillary, linear-oblong, acute, 4–5 mm long. Flowers large, on 3–5 cm long, patent, straight, thinly pubescent pedicels. Sepals chartaceous, narrowly ovate, ± acute, 6 mm long, puberulous. Petals (broadly) spathulate-obtuse to obovate, 2½–3½ cm long, minutely thinly puberulous, blade contracted into a narrow, c. 3 mm long claw. Stamens 3 longest recurved, filaments in the middle suddenly thickened, glabrous, c. 3 cm long; anthers with some sparse pubescence on the back, broadly ovate, basally deeply split, 4 mm long, opening by two slit-shaped pores, the apical much the larger; 4 shorter, filaments glabrous, 8–11 mm long; anthers slightly longer, opening by 2 widely separate, oval pores; 3 equally long as the latter, anthers greatly reduced. Ovary slender, on an indistinct, glabrescent stipe, appressed pubescent, recurved, stigma subapical, punctiform. Pods terete, glabrous, glossy, black, thin-valved, not dehiscent, 20–60 cm long, 1–1½ cm through, 50–75-seeded. Seeds glossy pale brown, smooth, flat, broadly ovate or nearly spherical; embedded in a suberous, flat, orbicular disc, 1–1½ cm across; albumen very copious, embryo warped, transversely placed; dissepiments thin.

Type specimen. – COMMELIN, Hort. Med. Amst. 1; 217. 1697, t. 111 (see also sub Typification).

Distribution. – Throughout the Old World tropics, indigenous in SE. Asia and Malaysia though not in the Malay Peninsula, where it is occasionally cultivated. In Malaysia: Sumatra; Java; Bali; Sumbawa; Timor; Southwestern Isl.; Tanimber Isl.; Key

Isl.; Borneo (SE. Div. Martapura; Pleihari); Brit. N. Borneo (Sabah); Philippines: Luzon; Polillo; Mindoro; Palawan; Balabac; Burias; Leyte; Mindanao. Celebes; Saleyer; Sula Besi; Ambon; New Guinea.

Ecology. – *C. javanica* was found in Atchin (Langsa) on dry clay in old forest (Andutu). Grashoff judged it to be common at Lematangulu (Palembang).

In W. Java it was found on fertile volcanic loams (Bantam, KOORDERS) or, in the same region, near the sea on marshy soils interspersed with coral rocks (Tjilingtang), also on lime soils. It may occur in teak forests (Madiun). On Madura it grew on leached sea sands (BACKER). KOORDERS & VALETON record it from the whole of Java, particularly E. and C. Java and state that it is rather common. They consider it to belong both to the open homogenous, and to the shady, evergreen, heterogeneous, primary forests, though it is more often seen in young, secondary forests and open savannah. It is never gregarious.

On Sumbawa it occurred on a sandy, temporarily inundated riverbank, on Wetar on never inundated peaty soils, on Timor on limey (WALSH) but also on clayey soils.

MEIJER DREES (l. c.) stated that it was « deciduous in very dry regions; not fire-resistant ». It was a « characteristic species of the *Schleicheretea* » in Timor, where it grew best in moist monsoon forest.

Vernacular names. – Sumatra: *Ilieuh* (Atchin), *boking boking, si busuk* (E. Coast); Java: *meurubuh, trosian, bubundelan* (Sunda), *kaju dulang* (W. Java, « *dulang* » also used for cultivated specimens in the Malay Peninsula, and also in India and in the Philippines), *trengguli*; Bali: *dulang dulang*; Timor: *buni*; Sumbawa: *ganulang*; Wetar: *laik*; Tenimber Isl.: *asumi balabal*; Borneo: *tilai* (SE. Division); Philippines: mostly *cana fistula* (erroneous use), also many other names (see MERRILL, Enum. Philip. Flow. Pl. 263. 1923); on Mindanao: *girong*; English: *Java Cassia*.

Uses. – Often cultivated in gardens or as a wayside tree.

MEIJER DREES (l. c.) thought it might be tried in mixed reafforestations for soil protecting purposes, though less suitable for dry open sites in the lowlands, possibly in the hills.

The heartwood is very hard and is often used for the teeth of a harrow (KOORDERS, at Priangan, Palabuan ratu). The boiled seeds and pulp of the pods are used as a laxative in particular but also applied by natives as a poultice on the abdomen.

HEYNE (l. c.) may be consulted for other possible uses. His statement that the seeds are not embedded in pulp is erroneous, although the pulp is dried than in *C. fistula*. DON (l. c.) refers to a use of the pulp as a cathartic for horses (« Horse Cassia ») in the East Indies.

Biological and morphological note. – On Sumatra *C. javanica* was described as having a generally curved trunk which was terete, at the base usually angled and with small buttresses.

KOORDERS (1919) described, at Bogor, Java, the thornlike remains of fallen branches which arm the trunk, especially in young specimens ; these remnants may be forked and leafbearing. The smooth, black and grey mottled, very thin bark is yellow or orange in the layer touching the wood, the outer wood itself being also often yellow. Some collectors noticed a strong smell emanating from the bruised bark.

The slightly scented flowers appear simultaneously with the leaves. The flowering period is short and falls mainly between November and July. I observed that when fertilisation of the flowers is not effected, the axis of the inflorescence may lengthen to 30 cm. Decaisne found the flowers in specimens from Timor sometimes to be bicarpellate.

BACKER made some close observations in Java. He found that *C. nodosa* had pale pink flowers, thinner and shorter pedicels, a slenderer axis of the inflorescence, and that its flowers faded in age to light, yellow-pink. The filaments of the larger stamens were very gradually enlarged in the middle to spindle-shaped, and flat on the inner side. The calyx was green and the flowers were smaller than in *C. javanica*. The latter had deep pink flowers which changed to white. The filaments were suddenly enlarged in the middle to nearly globular ; the calyx and pedicels were dark red or purple.

In the mature pod, the pulp was found to be of unpleasant taste, and bitter.

Distributional note. – In the distributional note concerning *C. fistula* (see there), I have included *C. javanica* among the examples of species occupying a disjunct area (NE. Siam/India – eastern Malaysia). I referred to species which maintain themselves in isolated stations in the rainforest area. *Cassia javanica* is one of these. In a wild state it is rarely found in Sumatra and Borneo, it is absent in the Malay Peninsula, not very common in West Java and truly at home in the dry parts of Central Java and further east. It is seen from the note on its ecology that it thrives in a dry climate (pronounced eastern monsoon) but, on the other

hand, requires a somewhat moist habitat. This ecological habit may be correlated with its general distribution.

See further note under *C. nodosa*.

Taxonomical note. – *C. javanica* us a polymorphic species. The leaflets vary indifferently from large to small, round tops to acute, glabrous to woolly pubescent, nearly dull to brightly glossy. Bornean specimens have rather narrow leaflets. A form in Timor (*C. megalantha* Decne) has somewhat larger flowers and larger bracts than is usual. VAN STEENIS distinguished in herb. a variety « *acutifolia* », which was published by BACKER (Bekn. Fl. Java, em. ed 5, fam. 118 : 29. 1941), an illegitimate name, not intended for publication here. The specimen on which this herbarium note was made, is *P. Mulder s. n.*, 8 Dec. 1938, Krawang, Java, in BO. It has more acute and perhaps somewhat larger leaflets than are usually seen.

GAGNEPAIN (Fl. gén. Indo-Ch. 2 : 158. 1913) reduced *C. nodosa* Ham. to *C. javanica*. He described at the same time a new variety, *C. javanica* var. *indochinensis*, and suggested that this variety might be identical with *C, bakeriana* Craib (Kew Bull. 45. 1911). GAGNEPAIN later, in the same work, accepted *C. bakeriana* as a good species (Fl. Gen. Indo-Ch. 2 : 170. 1913). On examining the specimens of *C. bakeriana* at Kew, I found that this species is quite distinct in having very much larger flowers, larger and hairier leaves, and densely silky-velutinous pods (cf. Note sub *C. bakeriana*).

CORNER may be believed to be in support of GAGNEPAIN's reduction of *C. nodosa* to *C. javanica* because he wrote : « As C. javanica and C. nodosa may hybridise under garden conditions . . . therefore be regarded as extremes of one species ». Though CORNER's observation of the possibility of crossing the two species deserves notice, I am not prepared to support his conclusions on this evidence. Moreover, CORNER treats *C. javanica* and *C. nodosa* as separate species himself (ll. cc.).

There has been some uncertainty regarding *Cassia fistula silvestris* (Rumph., Herb. Amb. 2 : 88. 1741). BAILEY based on it *C. brewsterii* F. Muell. var. *sylvestris* Bail. (Bot. Bull. 3, date unknown, and Queensl. Fl. 2 : 455, 1900). MERRILL suggests that *C. fistula silvestris* « may include two different species » (Int.

Rumph. Herb. Amb. 259. 1917). RUMPHIUS's drawing (t. 22, l. c.) accompanying the description is poor, but may be interpreted as *C. javanica*. This was also, tentatively, suggested by MERRILL (l. c.). *C. brewsterii* var. *sylvestris* Bailey is further discussed under Species excludenda etc.

Typification. – In the Linnean Herb. the specimen named *C. javanica* in LINNAEUS's handwriting, was later named *C. grandis* by J. E. SMITH, which is correct. LINNAEUS's description of *C. javanica* is clearly based on COMMELIN's description and from the latter publication the species is to be interpreted. No type specimen is extant.

Art. 18 of the Stockholm Code demands that the application of the names of taxa be determined by means of nomenclatural types. A nomenclatural type is the « constituent element of a taxon ».

In Art. 18 of the Amsterdam Rules it is stated, by means of an example, that a nomenclatural type can be a figure or a description. At Stockholm, Art. 18 was completely replaced and changed and no example of that nature was given. It seems to me that the whole tenor of Art. 18, as it stands now in the Stockholm Code — and it is an essential of the type method as a whole — is that a specific name is to be typified by a plant individual, *viz* a specimen.

If we follow custom, Note 2 to Art. 21 refers to Art. 21 only and in that case there is no contradiction because it admits the possibility that of « small herbaceous plants or most non-vascular plants » it may be impossible to indicate (or preserve) a single individual as a type specimen and then we are forced to use a description or figure. If we take Note 2 to Art. 21 in a general meaning we must realize that it is contradictory to Art. 18, Note 3, and also contradictory to the type method in general.

Directly connected with Note 2 to Art. 21 is the general custom, though no stipulation is made in the Code, that post-Linnean specific names can be based on pre-Linnean publications. I cannot see a reason why the type method should be applied in a different manner regarding post-Linnean publications (when no type is extant) and pre-Linnean publications (when no type is extant). Art. 18 of the Stockholm Code, as it stands now, implies the

appointment of neotypes for pre-Linnean species descriptions when they are the base of post-Linnean names and if no type specimen is extant.

Evidently, some clarification on this point is desirable and it seems that a proposal of that nature will be submitted to the next Congress. In accordance with the present Code, and because I think that a strict application of the type method is advisable, I have designated neotypes for pre-Linnean descriptions when type material (Art. 18) proved to be absent.

The neo-type of *Cassia javanica* L. is I. L. 2b, cult. in the Buitenzorg Botanic Garden (Hort. Bogoriensis), in BO.

5a. var. agnes De Wit.

var. *agnes* De Wit var. nov. — Fig. 1.

Cassia javanica var. *agnes* varietas nova foliolis 6–7-jugis apice acutis mucronulatis. Stipulae foliaceae, reniformes, c. 1 cm longis. Racemi aggregati ad apicem ramorum foliis interspersis. Antherae staminum longorum glabrae.

A tree, c. 10 m tall; bark greyish and smooth; twigs delicately thinly puberulous. Leaflets 6–7 pairs, recrescent, subcoriaceous, broadly elliptic, ± equal-sided, 3½–5½ cm long, 2½-3 cm wide, both surfaces sparsely puberulous, upper shining, lower dull, top broadly rounded, tip acute and mucronulate, veins evident on both surfaces, side-nerves slender, marginal nerve evident, puberulous, base broadly rounded, petiole c. 1½ cm long, terete, puberulous, rhachis 10–15 cm long, terete, thinly pubescent, produced in a short, truncate mucro, between the petiolules with sunken glandlike oval depressions; petiolules slender, puberulous, c. 3 mm. long. Stipules leafy, attached latero-median, reniform, mucronate, c. 1 cm long, tardily caducous, puberulous on the lower surface. Racemes 6–10, closely aggregate on top of leafy branches, slender, stiff, dense, 6–9 cm long, peduncle 2–3 cm long. Bracts c. 8 mm long, ovate, long-acute, puberulous. Bracteoles 1½–2½ mm long, similar in appearance, adjacent to the bracts. Flowers medium sized, on 3–3½ cm long, puberulous pedicels. Calyx finely puberulous. Sepals narrowly ovate, ± blunt, 4–5 mm long, ± reflexed. Petals ovate-spathulate, 15–18 mm

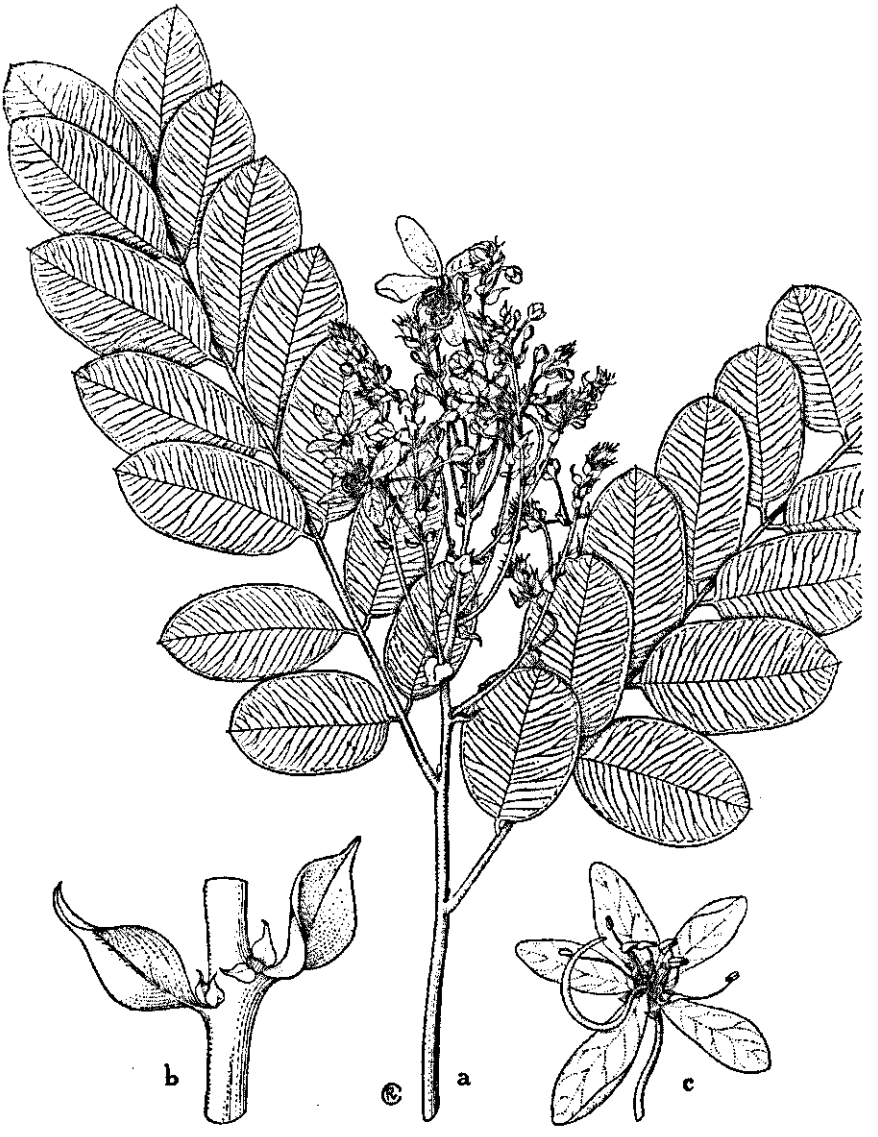

Fig. 1. – *Cassia javanica* L. var. *agnes* De Wit. – a. Flowering branch, × ½ – b. bracts and pseudo-bracteoles, × 3 – c. flower, nat. size. (All drawings of the type).

long, including a very short, broad claw, externally puberulous, inside nearly glabrous. Stamens : 3 lower twice recurved, filaments strongly increased to ± globular in the middle, c. 22–25 mm long, glabrous, anthers c. 4 mm long, opening by longitudinal rims and 2 basal pores, the filament inserted in the cleft of the basally deeply split connective ; 4 remaining stamens less than ½ as long, bearing larger anthers than the long stamens ; 3 stamens less than ⅓ ; anthers c. 2 mm long. Ovary slender, thinly puberulous, style stout, stigma punctiform. Pods unknown.

Type specimen. – *A. Cuadra* 3049 (holotype in L).

Distribution. – Only known cultivated. Possibly wild in the North or Northeast of the Deccan Peninsula.

Ecology. – CUADRA described the trunk as « usually straight and well-shaped ». The flowers are « carmine ».

Vernacular names. – Br. N. Borneo : *Manatapat.*

Note. – I name this variety in honour of Mrs AGNES KEITH, wife of Mr H. G. KEITH, the former Conservator of Forests, Sandakan.

The differences with *C. javanica* var. *javanica* are smaller flowers, which are probably deeper in colour, and fewer leaflets to the leaf. The type was collected at Sandakan (Br. N. Borneo), « along the rail-road, near the Government Hospital ». The variety is sometimes cultivated in the Malay Peninsula and in India.

5b. var. **pubifolia** Merrill.

var. *pubifolia* Merrill, Philip. Journ. Sci. Bot. 5 : 48. 1910 ; Enum. Philip. Fl. Pl. 2 : 263. 1923.

A tree, resembling *C. javanica* var. *javanica.* Leaflets 12–15 pairs, recrescent, subcoriaceous, elliptic-oblong, unequal-sided, 4½–5½ cm long, c. 2½ cm wide, upper surface shining, lower densely velvety puberulous, top narrowed (not acute), tip mucronulate or not, base broad, cuneate ; petiole like the rhachis velvety puberulous ; petiolules slender, densely velvety. Inflorescence densely velvety puberulous. Flowers as in variety *javanica.* Pods terete, smoothly annulate, glabrous, dull, 35–40 cm long, less than 1½ cm through. Seeds nearly black, with delicate striations, nearly spherical, 6 mm through, embedded in a suberous disc, grooved at the hilum.

Type. – No type indicated ; to be designated.

Distribution. – Malaysia. Philippines : Luzon (Ilocos Sur, Bulacan, Rizal). Cultivated in the Solomon Islands.

Note. – This variety is apparently endemic in Luzon. It is easily distinguished by its persistent softly velvety pubescence but intermediate specimens occur.

6. **Cassia nodosa** Buch.-Ham. ex Roxb.

C. nodosa Buch.-Ham. ex Roxb., Fl. Ind. ed. Carey 2 : 336. 1832, ed. Clarke 349. 1874 ; Benth. Trans. Linn. Soc. 27 : 517. 1871 ; Kurz, For. Fl. Br. Burma 1 : 392. 1877 ; Baker in Hook. f. Fl. Br. Ind. 2 : 261. 1878 ; Gagnep. in Lec., Fl. Gén. Indo-Ch. 2 : 158. 1913 ; Rock, Legum. Pl. Hawaii 79. 1920, t. 29 ; Ridley, Fl. Mal. Pen. 1 : 616. 1922 ; Craib, Fl. Siam. Enum. 1 : 508, 512. 1928 : Blatter, Journ. Bombay Nat. Hist. Soc. 35 : 290. 1931 ; Corner, M. A. H. A. Mag. 5 : 49. 1935 ; Backer in Bekn. Fl. Java, em. ed. 5, fam. 118 : 29. 1941 ; Corner, Ways. Trees Mal. 2nd ed. 389. 1952, t. 87.

A sometimes deciduous tree, 10–20(–40) m tall, trunk unarmed. Leaflets 5–12 pairs, chartaceous to subcoriaceous, elliptic-ovate to oblong, equal-sided, 4–10 cm long, 1½-3½ cm wide, upper surface glossy, finely puberulous to glabrous, lower surface dull, softly pubescent, finally glabrous, top blunt to acute, the top often slightly emarginate (midrib slightly excurrent, mucro very early caducous), base rounded to acute ; petiole 1½-2½ cm long, terete, sparsely puberulous ; rhachis 9–13 cm long, angulate, glandless, produced in a very early caducous blunt mucro ; petiolules slender, 2–4 mm long, delicately puberulous. Stipules falcate, pubescent, c. 5 mm long, pointed at both ends and attached in the middle. Racemes corymbose, 4–10 cm long, stiff ; peduncle terete, puberulous. Bracts lanceolate-acute, gradually broadening towards the base, accompanied by two small, ovate, acute, pseudo-bracteoles. Flowers medium to large, on 2–3½ cm long, patent, straight, thinly pubescent pedicels. Sepals chartaceous, narrowly ovate, ± acute, 6 mm long, puberulous. Petals spathulate-obtuse to obovate or oblong, 1½–2 cm long, thinly puberulous, blade contracted into a slender or thick, long or short claw. Stamens 3 longest, recurved, filaments in the middle thickened, glabrous, c. 1½–2 cm long, anthers glabrescent, broadly elliptic-ovate, basally deeply split, 4 mm long, opening by two slit-shaped pores, the apical the larger ; 4 shorter, filaments

glabrous, 10–12 mm long; 3 remaining equally long, anthers greatly reduced, empty. Ovary slender, recurved, on an indistinct, ± glabrous stipe, appressed thinly pubescent, stigma punctiform, Pods terete, glabrous, glossy black, thin valved, not dehiscent, 30–70 cm long, 1½–2 cm through, transversely septate, 50–80-seeded. Seeds pale brown, smooth, orbicular, flattened, embedded in a suberous disc, grooved at the hilum, trasverse, 8–10 mm across, funiculus capillary, short, 2 mm long; albumen copious; embryo warped.

Type specimen. – In Roxburgh Herbarium (K).

Distribution. – Eastern Himalayas. Malaysia: Sumatra (Atchin; E. Coast, Karo Lands; W. Coast, Padang; Lampongs). Malay Peninsula. Billiton. Java. Borneo: Br. N. Borneo (Sandakan, For. Res. Elopura); Sarawak (Kapit, Upper Rejang River); W. Borneo (Kapuas); SE. Borneo (Batu Besar, W. Kutai; Puruk tjahu; Liang gagang).

Ecology. – A tree of the mixed forests. KURZ found it in evergreen forests, from Martaban to Upper Tenasserim. He said it was an « evergreen » and « rather rare ». In the Malay Peninsula it was collected at 150–250 m altitude in dense bamboo forests in Perak by KUNSTLER. CORNER judged it to be « one of our most beautiful forest trees ». It was collected in mixed forest in W. Java and seems to be absent in the rest of the island. In Borneo it was observed to grow on temporarily submerged, flat, sandy river banks (PARADJUDIN). LOT OBI noted that it grew on brown clay (andesitic mother rock) in old forest.

Biological note. – CORNER, who is in doubt whether *C. nodosa* and *C. javanica* are separate species stated that *C. nodosa* flowered « on the branches behind the leaves » whereas *C. javanica* flowered « at the end of leafy twigs » (l. c., 1935). I doubt whether this character holds true in specimens from Java.

The bark was repeatedly found to contain a clear juice (Borneo), which smelt like « laundry soap » (BALAJADIA, Br. N. Borneo) or « foetid, like crushed bean-pods » (CORNER, Mal. Pen.).

The rosy pink to white flowers are scentless and appear at various times. Endert observed in the Lampongs, that *C. nodosa* flowered in « full leaf » from April to July and that the leaves are shed « very gradually » from November till March.

Vernacular names. – Sumatra : *Meurenba iku buë, si kieng kieng* (Atchin), *petarum* (Batak), *sibusuk* (Palembang), *pantjung dilan, kaju bujuk* (Lampongs) ; Mal. Peninsula : *busok busok, sebusok, beksa, terutup bumi, kayu belachan* ; Billiton : *liering* ; Java : *kasingat* ; Brit. N. Borneo : *langgong, lapak lapak, mapadsapad, piding* ; Indonesian Borneo : *monding* (Kutai) ; English : *Pink and White Shower.*

Uses. – ENDERT reported the vernacular name « kaju bujuh » (Lampongs) and that the wood is reputed to be even better than « merbau » (Intsia-wood). *C. nodosa* is valuable as an ornamental in large gardens and as a wayside tree.

Note. – Like other authors (MERRILL, CORNER), I am not entirely convinced of the right of standing of *C. nodosa* as a species separate from *C. javanica.* On the other hand, BACKER, who made a careful comparison of the living trees noted a number of differences (cf. biological and taxonomical notes under *C. javanica*).

Valuable differences when distinguishing the two species may be tabulated as follows :

C. javanica	*C. nodosa*
Young trees with armed trunk.	Young trees with smooth trunk.
Calyx dark red or red-brown.	Calyx green.
Petals at first pallid-red, changing to dark red, finally pallid.	Petals at first pallid to white, changing to pink, finally yellow-pink.
Petals 2½–3½ cm long.	Petals 1½–2 cm long.
Leaflets usually blunt or rounded.	Leaflets usually acute.
Rhachis of inflorescence stout.	Rhachis of inflorescence slender.

7. Cassia renigera Wall. ex Benth.

C. renigera Wall. ex Benth. Trans. Linn. Soc. **27** : 518. 1871 ; in Journ. As. Soc. Bengal **42** : 71. 1873 ; For. Fl. Burma 392. 1877 ; Baker in Hook. f. Fl. Br. Ind. **2** : 262. 1878 ; Prain, Journ. As. Soc. Bengal **66**(2) : 474. 1897 ; Blatter, Journ. Bombay Nat. Hist. Soc. **35** : 64, 293. 1931, tab. ; Corner, M. A. H. A. Mag. **5** : 49. 1935 ; Ways. Trees Mal. 390. 1940.

A deciduous tree, c. 6–8 m tall ; branchlets softly pubescent, numerous, slender, drooping. Leaflets 10–20 recrescent pairs, subcoriaceous, oblong-elliptic, ± equal-sided, 3½–7 cm long, 1–2½ cm wide ; both surfaces softly velutinous, lower surface much lighter in colour, top suddenly broadly rounded, retuse and mucronulate, marginal nerve stout, base suddenly broadly rounded, ± retuse or truncate, unequal-sided ; petiole stout, c. 3½ cm long, terete, velutinous, rhachis 18–25(–35) cm long, ribbed (2 parallelous close ribs above), velutinous, produced in a long, caducous, velutinous mucro, gland-like tissue between petiolules not evident.

Petiolule c. 2 mm long, velutinous, stout. Stipules leafy, laterodorsifixed, reniform, mucronate, c. 1½-2½ cm across, tardily caducous, thinly pubescent on both surfaces. Racemes solitary or paired, lateral along branches, stout, stiff, flowers on spreading pedicels on a 10–14 cm long, velvety axis. Bracts 8–12 mm long, ovate, mucronate, pubescent. Pseudo-bracteoles less than half as long, similar in appearance, adjacent. Flowers medium-sized, on 3–5 cm long, pubescent pedicels. Calyx pubescent. Sepals ovate, acutish, 4–5 mm long, finally ± reflexed. Petals ovate-spathulate, short-clawed, 15–35 mm long, externally pubescent, oblong, acute. Stamens twice curved, filaments suddenly increased and ± globular in the middle, glabrous; anthers not seen; 4 stamens less than half, 3 stamens less than ⅓ as long. Ovary slender, glabrous, style stout, stigma punctiform, laterodorsifixed, introrse. Pods 20–60 cm long, 2½ cm wide, smooth, cylindrical, many-seeded.

Type specimen. – *Wallich* 5307 (holotype in K).

Distribution. – Dry zone of Upper Burma, now introduced into India and the Malay Peninsula.

Ecology. – KURZ (1877) found it « not unfrequent in the dry forests of Prome and Ava ».

Biology. – Young leaves appear shortly after the tree is in full flower. PRAIN drew attention to the fact that all Pegu specimens are reported to be pink-flowered whereas all Shan Hill specimens are yellow-flowered; otherwise they seem not different.

BLATTER (1931) says that the flowers « fade from rose-pink to white » and adds that the calyx is dull red externally and tender green within. The style is deep red in colour. The anthers are described as large and green.

Uses. – A rapid growing ornamental, cultivated in the Malay Peninsula.

Note. – See under *C. bartonii*.

8. Cassia roxburghii DC.

C. roxburghii DC. Prodr. 2: 489. 1825; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 29. 1941.

Cathartocarpus roxburghii Loud. Hort. Brit. 167. 1830.

Cassia marginata (non Willd.) Roxburgh (Hort. Beng. 31. 1814) Fl. Ind. ed. Carey 2: 338. 1832; ed. Clarke 350. 1874; Wight & Arn. Prodr. Fl. Pen.

Ind. Or. 286, 292. 1834 ; Vogel, Syn. Cass. 13. 1837 ; Hasskarl, Pl. jav. rar. 402. 1848 ; Miq. Fl. Ind. Bat. 1(1) : 91. 1855 ; Baker in Hooker f., Fl. Br. Ind. 2 : 262. 1878 ; Trimen, Fl. Ceyl. 2 : 104. 1894 ; Blatter in Journ. Bomb. Nat. Hist. Soc. 35 : 292. 1931.

Cathartocarpus marginatus (Roxb.) G. Don, Gen. Syst. 2 : 453. 1832.

A tree, 5–10 m tall ; bark deeply cracked, dull, light brown-coloured, twigs ribbed, velutinous. Leaflets 8–12 pairs, recrescent, subcoriaceous, oblong, ovate-elliptical, unequal-sided, 1½-4½ cm long, 1–2 cm wide, lower surface lighter coloured, thinly pubescent, upper surface very thinly pubescent, top suddenly broadly rounded, often ± retuse, mucronulate, marginal nerve evident, stout, base very oblique, cuneate ; petiole 1–2 cm long, grooved, mealy pubescent, rhachis 12–17 cm long, grooved above, the groove widening towards the insertion of each pair of petiolules, mealy pubescent, produced in a long truncate mucro, glandular tissue not evident ; petiolules stout, 1–2 mm long, mealy pubescent. Stipules falcate-reniform, base broadened, long-acute, c. 8 mm long, caducous, pubescent. Racemes solitary, lateral from the axils of leaves, peduncle 1–2 cm long, axis 5–9 cm long, both mealy pubescent. Bracts ovate, acute, pubescent, c. 8 mm long. Bracteoles 3–4 mm long, narrowly ovate, placed on the base of the pedicel. Flowers medium-sized or small, on 10–13 mm long, straight, mealy pubescent pedicels, subcorymbosely arranged. Calyx mealy pubescent. Sepals narrowly ovate, 4–5 mm long, rounded or blunt, ± reflexed. Petals obovate, 10–14 mm long, sessile or very shortly clawed, rather fleshy, externally finely puberulous. Stamens 3 lower twice curved, filaments gradually somewhat incrassate about the middle, 2½–3 cm long, glabrous, anthers glossy, glabrous, broad, 2½–3 mm long, 2 mm wide, opening by short basal pores (later also by apical slits but a longitudinal rim of dehiscence is absent), 4 half as long bearing larger anthers (4 mm long) which open by basal pores and have vestigial terminal slits and 3 stamens c. 6 mm long bearing small anthers (1½ mm long) which have evident longitudinal rims. Ovary pubescent, on a stout stipe, style ± glabrous, stigma punctiform, latero-terminal, introrse. Pods 20–30 cm long, 2 cm through, cylindrical, glabrous, septs transverse.

Type specimen. – *Wallich 5308* (holotype in K).

Distribution. – S. India and Ceylon. Introduced into Malaysia.

Ecology. – Low and medium altitudes. Flowering in Java Febr.-April. The reflexed calyx turns red. The flowers are dark red. BLATTER (1931) described these : « terra cotta red with fine green veins, deeper in tone on the under surface. The older blooms are very bright pink ». The anthers of the longer stamens are « dark red », of the middle stamens « bright red », of the short stamens « yellow ». The bracts are pale green.

Uses. – Cultivated as an ornamental tree.
Vernacular name. – *Red Cassia* (Engl.).

Notes. – The bracteoles are manifestly inserted on the base of the pedicel in contradistinction with the other species in the subgenus in which pseudo-bracteoles emerge from the flowering axis at the insertion of the pedicel.

Three kinds of anthers occur, the large having no apparent longitudinal rim (of dehiscence), the middle only vestigial terminal slits and basal pores, and the smallest longitudinal rims.

Subgenus 2. S e n n a (Gaertner) Bentham

Cassia subgen. *Senna* (Gaertner) Bentham, Trans. Linn. Soc. **27** : 518 1871 ; Baker in Hook. f. Fl. Br. Ind. **2** : 262. 1878 ; Taubert in Engl. & Pr. Nat. Pfl. fam. **3**(3) : 159. 1894.

Senna [Bauhin, Pinax 397. 1623 ; Breyne, Prodr. **2** : 95. 1689 ; Tournefort, Inst. 618. 1700, t. 390] Gaertner, Fruct. Sem. Pl. **2** : 312. 1791, t. 146 ; Roxb. Fl. Ind. ed. Carey **2** : 339. 1832, ed. Clarke 351. 1874 ; Batka, Bot. Zeit. **12** : 112. 1854.

Cassia sect. *Senna* Colladon, Hist. Cass. 82, 92. 1816, t. 15A (vide ibid. pro ref. lit. prae-Linn.) ; De Candolle, Prodr. **2** : 492. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 287. 1834 ; Vogel, Syn. Cass. 8, 9. 1837 ; Bentham in B. & H. Gen. Pl. **1** : 572. 1865 ; Koorders & Valeton, Bijdr. Booms. Jave **2** : 7. 1895 ; Prain, Journ. As. Soc. Beng. **66**(2) : 158. 1897.

Cassia sect. *Herpetica* De Candolle in Colladon, Hist. Cass. 91. 1816 ; Prodr. **2** : 492. 1825.

Cassia subsect. *Herpetica* Vogel, Syn. Cass. 10, 21. 1837.

Herpetica Rafinesque, Sylva Tell. 123. 1838.

Shrubs, trees or herbs. Leaves bearing glands or glandless. Bracteoles, if present, placed at the middle of, or higher, on the pedicels, very rarely reduced to squamulae at the base of the pedicel. Sepals 5, blunt or rounded. Stamens 10–7 perfect, two or three with slightly longer filaments but never exceeding the petals, all filaments shorter than the anthers. Anthers opening by apical pores or short, porelike slits. Pods flat or terete, rarely

winged, dehiscent or not, often separated into two longitudinal halves by a sept, if so, the left half empty, the right transversely septate, seed-bearing. Seeds numerous, very rarely imbedded in pulp. Funicle capillary.

Type species. – *Senna officinalis* Gaertn. Fruct. Sem. Pl. 2 : 312. 1791 (= *C. sophera* L. teste Benth. et al.).

Distribution. – Pantropical.

KEY TO THE SPECIES

1. Leaves without glands. Bracteoles as a rule absent, if present, reduced to minute squamulae at the base of the pedicel.
   2. Pedicels shorter than the sepals. Inflorescence narrow, erect. Bracts 2½–3 cm long, up to c. 2 cm. wide.
      3. Pods with 2 longitudinal, perpendicular wings. Leaflets 2½–9 cm wide, lowest pair at the insertion of the leaf, amplexicaulous **9. C. alata**
      3. Pods flat. Leaflets ½–2 cm wide, lowest pair c. 5 cm removed from the insertion of the leaf . . . . . **14. C. didymobotrya**
   2. Pedicels much longer than the sepals. Inflorescence erect or pendent. Bracts 3–6 mm long, up to 4 mm wide.
      4. Pods terete or quadrangular.
         5. Leaflets narrow, acute, membranous. Pods slender, glossy, annulate . . . . . **28. C. spectabilis**
         5. Leaflets elliptic-oblong, broadly rounded, subcoriaceous. Pods very thick, coarsely veined . . . . . **24. C. pachycarpa**
      4. Pods flat, smooth or alternately bulging.
         6. Top of leaflets acute. Pods 2½–4 cm wide. Seeds 4 × as long as broad . . . . . **18. C. garrettiana**
         6. Top of leaflets rounded, often emarginate. Pods 1–1½ cm wide.
            7. Suture of the pod thickened. Stipules minute, subulate. Ovary and style ± as long as the longest stamens. Seeds up to 1½ × as long as broad . . . . **26. C. siamea**
            7. Suture of the pod not increased. Stipules falcate, curved, often toothed or lobed. Ovary and style decidedly longer than the longest stamens. Seeds ± 2 × as long as broad **31. C. timoriensis**

1. Leaves with one or more glands.
   8. A gland on or near the base of the petiole (*Oncolobium* Vogel sensu Bentham).
      9. Pods hirsute to strigose. Upper surface of the leaflets villose, hirsute or softly and thinly hairy.
         10. Whole plant hirsute. Pods not over 15 cm long, usually shorter, 4–6 mm thick . . . . . **19. C. hirsuta**
         10. Whole plant thinly and softly short-hairy. Pods usually longer than 20 cm, 2–3 mm thick . . . **20. C. leptocarpa**
      9. Pods and upper surface of the leaflets glabrous or nearly so.
         11. Bracts acute, 9–20 mm long. Peduncle less than 5 mm long, carrying 2–4 flowers. Leaflets ± green on lower surface. Foliar grand ovoid, short, squat **23. C. occidentalis**
         11. Bracts blunt, 4–5 mm long. Peduncle more than 5 mm

long, carrying 4–10 flowers. Leaflets glaucous on lower surface. Foliar gland narrow, subulate-clavate
27. **C. sophera**

8. Lowermost gland between the first pair of leaflets or some reduced glands irregularly scattered on the leaf-rhachis.
12. Reduced glands only present, irregularly placed
14. **C. didymobotrya**

12. Foliar gland(s) well developed ; the lower between the first pair of persistent leaflets.
13. Three upper stamens staminodial (with reduced, sterile anthers), or absent.
14. Flowers 4 to many in peduncled racemes. Filaments of long stamens more than 5 mm long. Shrubs.
15. Leaflets woolly hairy or pubescent on the lower surface.
16. Pods terete. Stipules linear, caducous. Foliar glands short, conical . . . 32. **C. tomentosa**
16. Pods flat. Stipules broadly reniform, persistent. Foliar glands slender, ± bristle-shaped
10. **C. auriculata**

15. Leaflets entirely glabrous or minutely puberulous on lower surface or there with a basal, limited patch of pubescence.
17. Leaflets 18–40 pairs . . . . 21. **C. multijuga**
17. Leaflets 2–5 pairs.
18. Leaflets acute or subacuminate and tapering to an acute tip.
19. Foliar glands (2)–4. Leaflets 3–5 pairs, lower surface glabrous
16. **C. floribunda**

19. Foliar gland 1. Leaflets 2 pairs, lower surface puberulous 17. **C. fruticosa**

18. Leaflets rounded or retuse, rarely acuminate but then the tip notched.
20. Leaflets 3–5 pairs, sometimes unequal-sided.
21. Leaflets entirely glabrous, margins pallid or green. Pedicels 2–8 mm long
11. **C. bicapsularis**

21. Leaflets on lower surface near petiolule with a patch of pubescence, margins orange. Pedicels (12–)15–40 mm long . . . . . 13. **C. coluteoides**

20. Leaflets 2 pairs.
22. Leaflets rounded to blunt, very nearly symmetrical
29. **C. splendida**

22. Leaflets acuminate, manifestly asymmetrical
17. **C. fruticosa**

14. Flowers in pairs on an at most 5 mm long peduncle. Filaments of long stamens less than 5 mm long. Herbs or shrubs.
23. Leaflets 3 pairs.
24. A gland between the leaflets of the two lower pairs. Pedicels 6–10 mm, stalk of pod 1–1½ cm. Foetid . . . . . 33. **C. tora**

24. A gland between the leaflets of the first pair only. Pedicels 13–23 mm, stalk of pod 2–3 cm. Smell weak . . . . . 22. **C. obtusifolia**
23. Leaflets 6–10 pairs . . . . . 12. **C. biflora**

13. Ten perfect stamens, all anthers containing pollen and well-developed.
25. Pods terete, subtetragonous. Leaflets obovate, 3 increasing pairs. Cotyledons wrinkled or involute. Plant foetid . . . . . 33. **C. tora**
25. Pods flat. Leaves ovate to elliptic to obovate, 6–11 pairs. Cotyledons flat. Plant not foetid.
26. Inflorescence 2–3 flowered. A gland between the uppermost petiolules . . . . . 15. **C. divaricata**
26. Inflorescence a raceme, with numerous flowers. No gland between the uppermost petiolules.
27. Whole plant more or less (golden) hairy. Top of up to 5 cm long leaflets rounded. Seeds slightly longer than broad . . 25. **C. retusa**
27. Plants partly glabrous, partly sparsely pubescent. Top of up to 10 cm long leaflets tapering. Seeds twice as long as broad. 30. **C. surattensis**

9. Cassia alata Linnaeus

C. alata Linnaeus [Hort. Cliff. 158. 1737] Sp. Pl. 378. 1753; Amoen. Acad. 4: 136. 1759; Burman, Fl. Ind. 96. 1768; Lamarck, Dict. 1: 648. 1785; Roxburgh, Hort. Beng. 31. 1814; Colladon, Hist. Cass. 91. 1816 (vide ibid. pro ref. prae-Linn.); De Candolle, Prodr. 2; 492. 1825; Wight & Arnott, Prodr. 287. 1834; Vogel, Syn. Cass. 21. 1837; Blanco, Fl. Filip. 339. 1837; ed. 2: 237. 1845; ed. 3, 2: 77. 1878, t. 124 bis; Hasskarl, Pl. Jav. rar. 404. 1848; Miquel, Fl. Ind. Bat. 1: 93. 1855; Bentham, Trans. Linn. Soc. 27: 550. 1871; Baker in Hook. f. Fl. Br. Ind. 2; 264. 1878; Miller, Gard. Dict. 3: 438. 1882; Prain, Journ. As. Soc. Beng. 66(2): 161. 1897; Merrill, Interpr. Rumph. Herb. Amb. 257. 1917; Sp. Blanc. 174. 1918; Rock, Legum. Pl. Hawaii 83. 1920, t. 32; Heyne, Nutt. Pl. Ned. Ind. 740. 1927; Craib, Fl. Siam. Enum. 1: 508. 1928; Corner, M. A. H. A. Mag. 5: 45. 1935; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 473. 1935; Corner, Ways. Trees Mal. 388. 1940; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 36. 1941; Steyart, Fl. Congo Belge 3: 507. 1951.

Herpetica, sive Daun Curap Rumphius, Herb. Amb. 5, VII: 35. 1747, t. 18.

Cassia herpetica Jacquin, Obs. 2: 24. 1778, t. 45, f. 2.

Cassia bracteata Linnaeus f. Suppl. 232. 1781; De Candolle Prodr. 2: 492. 1825.

Cassia alata var. *rumphiana* De Candolle, Prodr. 2: 492. 1825; Hasskarl, Flora 25: 1842, Beibl. 2: 91.

Senna alata Roxb. Fl. Ind. ed. Carey 2: 349. 1832; ed. Clarke 354. 1874.

Herpetica alata Rafinesque, Sylva Tell. 123. 1838.

A shrub, 1–5 m tall, branches thick, finely pubescent; stem marked by leaf scars and persistent, stiff stipules. Leaflets 8–24 accrescent pairs (lowest pair usually at first recurved, amplexi-

caulous, spurious), chartaceous, oblong(-elliptic) or oblong-obovate, slightly unequal-sided, 5–15 cm long and 3–7 cm wide, glabrous or glabrescent to ± retuse (often tipped by the excurrent midrib), top rounded, base obliquely truncate or semi-cordate (midrib on lower surface carinate, excurrent); petiole 1½–2½ cm long, thick, puberulous or pubescent, rhachis 30–60 cm long, like the petiole terete but with two paralelous rims on the upper side, which are connected by transverse rims between the puberulous, c. 4 mm long petiolules. Stipules auriculate, ± deltoid, 6–9 mm long, persistent, long-pointed, glabrous. Racemes very narrow, 50–70 cm long (peduncle 10–20 cm); bracts strobilate, at first enveloping the flowers, broadly ovate, acutish or blunt, 2–3 cm long, 1–2 cm wide; brachteoles absent. Sepals free, glabrous (except the minutely ciliolate margin), obovate, membranous, 1½–2 cm long, 4–6 mm wide. Petals (ob)ovate-orbicular to spathulate, 1½–2 cm long, 1 cm wide, blade suddenly contracted into a 2–3 mm claw, glabrous. Stamens : 2 (lower, lateral) largest, with thick, glabrous, 4 mm long filaments and a curved, swollen, 12 mm long anther opening apically by a widened pore, and a lateral rim from top to base. Filament of lowermost stamen twice as long, somewhat slenderer, anther similar but ¼–⅓ the size of the former. Two lateral pairs similar to the lowermost anther, but filaments only 4 mm long. Two (or 3) upper stamens reduced. Staminodes absent. Ovary revolute, glabrous, pruinose, style short; stigma pointed, narrow, involute. Pods straight, divaricately spreading with a ± crenulate, perpendicular, chartaceous wing on each valve from end to end, glabrous or minutely puberulous, dehiscent, septate, 50–60-seeded. Seeds flattened, ± quadrangular, two sides lengthened in a long, triangular point towards the hilum, c. 1 cm long, 8 mm wide, albumen copious; funicle capillary, straight, c. 8 mm long, the upper half suddenly enlarged.

Type specimen. – In *Linnaeus Herb.* 528.26 (in LINN).

Distribution. – Pantropical weed of S. American origin, throughout Malaysia, also purposely planted.

Ecology. – *C. alata* occurs from sealevel to 1400 m alt., in the Arfak Mts (New Guinea) even to 1900–2100 m.

It is everywhere naturalized, growing scattered or in groups along water courses, on dikes or edges of lakes, waste places,

grassy areas, in open forests favouring somewhat moist stations, sometimes not far from the sea. On Sumbawa (Bima) ELBERT found it from 200–400 m alt., in dry areas on limestone soils, in small groves in the low savanna forest.

Biological and morphological note. – The twigs hold abundant pith but are not hollow. The persistent stipules are brown-red, leathery. Colleters occur between the petiolules, in their axils, and on the lower half of the midrib.

Flowers appear mostly from March to December. GUSDORF noted in the Lampongs that the flowers had a pleasant scent. BÜNNEMEIJER (Celebes) compared the scent to that of peaches, but KOORDERS, on the same island, said that the flowers smelled disagreeably.

The sepals are light-orange to brown-yellow, the petals yellow, orange-veined ; the bracts are orange.

The seeds are placed transversely on the long axis of the pod, the embryo is transversely placed to the width of the seed, i.e. parallel to the long axis of the pod. The cotyledons are curved. The albumen occupies the larger part of the seed and, in water, acquires the same gummy, semi-fluid appearance as in *C. absus*.

Vernacular names. – Sumatra : *galinga djawa, galingang, galingang berak bulong, bulingang balah* (Simalur), *daun teping* (Palembang). Java : *katepeng-badak, ketepeng, ketepengtjina, ki manila*(n), *kimanilla-bener, daun kurap*. Borneo : *gelinggang*. Kangean Arch. & Madura : *atjan-atjanan*. Sumba : *landukaka*. Sula Arch. : *sajakun*. Celebes, Ceram, Ternate : *kupang-kupang*. Celebes : *pili-pili* (SW. Celebes), *manuru* (Kaelic), *kaju matatikil, sumé selep mamalapa* (Minahassa). Philippines : *akapulko, palo-china*, and many other names (see MERRILL l. c. 1923). English : *ringworm shrub, seven golden candlesticks, winged-podded Cassia*.

Uses : *C. alata* very probably owes its wide distribution to its being a time-honoured and effective remedy against ring-worm, scabies, and various « skin-spots ». It is known as a remedy for this purpose throughout the tropics.

ROXBURGH (l. c.) found, in India, the fresh leaves often applied to cure ring-worm. Leaflets were well rubbed into the affected parts, once or twice a day, and « generally with great success ».

MIQUEL referred to the same use by the Javanese who employed crushed leaves and flowers.

Often cultivated in Malaysia.

BÜNNEMEIJER found it similarly applied in Sumatra (leaves with lime against « skin-spots » and scabies), and so did e. g. VAN STRAELEN on Nusa Kambangan, and BLOEMBERGEN in the Sula Archipelago. ROCK (l. c.) finds the « juice of the leaves mixed with lemon juice a very good remedy for diseases of the skin ».

The active principle is chrysophanic acid.

Roasted leaves are also taken as a laxative. A full account of the various uses of *C. alata* in Indonesia is given by HEYNE (l. c.).

Note. – There is no reason to distinguish variety *rumphiana*. The type of that variety is in the De Candolle Herbarium at Geneva (see Merrill, l. c. 1917).

Miquel referred *C. atroviridis* Spanoghe (Linnaea 15 : 201. 1841) with doubt to *C. alata* but it is certainly better referred to 27. *C. sophera* (see there).

10. Cassia auriculata Linnaeus

C. auriculata Linnaeus, Sp. Pl. 379. 1753 ; Bentham, Trans. Linn. Soc. 27 : 542. 1871 ; Baker in Hook. f. Fl. Br. Ind. 2 : 263. 1878 ; Trimen, Fl. Ceyl. 2 : 106. 1894 ; Corner, M. A. H. A. Mag. 5 : 41, 45. 1935 ; Burkill, Dict. Econ. Prod. Mal. Penins. 1 ; 474. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 37. 1941.

A shrub, erect, up to 2 ½ m tall, softly hairy. Leaflets 6–12 pairs, slightly accrescent, firmly chartaceous, oblong-obovate, nearly equal-sided, 1–2 ½ (–3 ½) cm long, 7–12 mm wide, both surfaces loosely pubescent (the upper thinner, glabrescent), top broadly rounded, mucronate, base broad ; petiole 1–1 ½ cm long, terete but on top ribbed, pubescent along ribs, glandless ; rhachis 3 ½–5 cm, ribbed, pubescent, produced into a short, early caducous mucro carrying an erect, subulate, spindle-shaped gland between each pair of leaflets except the terminal pair ; petiolules slender, 1 ½ mm long, puberulous ; stipules tardily caducous, broadly reniform, membranaceous or foliaceous, 7–12 mm wide, with a c. 5 mm long point, puberulous and locally glabrescent. Racemes aggregate near the top of leafy branches, ± corymbose, 4–7 cm long, 3–6-flowered ; peduncle terete, puberulous, 2–2 ½ cm long ; bracts changing from leafletlike (lower) to leafy, ovate, puberulous, c. 6 mm long, mucronulate (upper) ; bracteoles absent. Flowers mediumsized, on puberulous, c. 2 cm long pedicels. Sepals broadly ovate, rounded, 9–12 mm long, the outer puberulous. Disc with numerous glandlike spindle-shaped bodies. Petals broadly elliptic to obliquely rhomboid or orbicular, distinctly clawed, 1 ½-2 ½ cm long including the 3–4 (–7) mm long claw. Stamens : 7 with large anthers and thick, 3–7 mm long filaments. Anthers curved, slightly rostrate and with longitudinal rims over the whole length, three 10–12 mm long, four 7–8 mm long. Three uppermost stamens

reduced, filaments slender, 2½ mm long, anthers empty, flat, ovate, opening by longitudinal rims, 2 mm long. Ovary slender, on a glabrous stipe, appressed pubescent, upper part of margins and style glabrous, reflexed in bud, stigma terminal, linear. Pods flat, 10–20-seeded, thinly hairy, ? indehiscent, 8–18 cm long, 1½ cm wide, undulate between seeds, valves papery. Seeds 8–9 mm long, 4 mm wide, oblong-ovoid, compressed, pointed at the radicle, longitudinal, distincly spaced, not seen fully grown.

Type specimen. – *Hort. Bog. I. B. 104a* (neotype in BO).

Distribution. – India, Ceylon. In Malaysia only cultivated.

Ecology. – Flowers deep yellow. Pods dull, dark brown.

Morphological note. – The cotyledons are deeply wrinkled. At the insertion of the radicle two lateral, short, stipulelike filaments occur. The pleurograms are linear-oblong, central, half as long as the seed. The funicle is capillary, near the seed suddenly curved. The albumen is copious, partly soluble in water.

Vernacular name. – English : *Tanner's Cassia*.

Uses. – Cultivated in the Malay Peninsula. Bark used in local tanning industry (see also TRIMEN and BURKILL, ll. cc.).

CORNER thinks that *C. auriculata* « would make a good border plant, if trimmed, or a centre for a low bed ». However, it does not seed readily and is difficult to propagate.

Note. – In the absence of a specimen in the Linnean Herbarium I designated a neotype.

11. Cassia bicapsularis Linnaeus

C. bicapsularis Linnaeus, [Hort Cliff. 159. 1737] Sp. Pl. 376. 1753 ; Colladon, Hist. Cass. 100. 1816 ; De Candolle, Prodr. **2** : 494. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. **1** : 286, 388. 1834 ; Vogel, Syn. Cass. 18. 1837 ; Hasskarl, Pl. Jav. rar. 403. 1848 ; Bentham, Fl. Bras. **15(2)** : 106. 1870, Trans. Linn. Soc. **27** : 525. 1871 ; Baker in Hook. f. Fl. Br. Ind. **2** : 263. 1878 ; Fawcett & Rendle, Fl. Jam. 4(2) : 103. 1920 ; Rock, Legum. Pl. Hawaii 85. 1920, t. 35 ; Corner, M.A.H.A. Mag. **5** : 46. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 34. 1941 ; Steyaert, Fl. Congo Belge **3** : 511. 1952.

Cassia laevigata (non Willd.) Prain, J. As. Soc. Bengal **66(2)** : 476. 1897 ; Heyne, Nutt. Pl. Ned. Ind. 744. 1927 ; Burkill, Dict. Econ. Prod. Mal. Penins. **1** : 477. 1935.

A shrub, 1½-3 m tall, branches spreading, ± pendent ; entirely glabrous. Leaflets 3 accrescent pairs, membranous to chartaceous, obovate to rounded, more or less unequalsided, 1½–3 cm

long and 12–17 mm wide, entirely glabrous, top rounded, often the very tip apiculate (midrib slightly excurrent, marginal nerve evident), base somewhat narrowed, obliquely cuneate, petiole slender, 1½–2½ cm long, glabrous, rhachis 1–2 cm long, furrowed like the petiole, bearing between the lowest petiolules a stalked, clavate gland, and gland-like hairs at the insertion of both the upper pairs (these hairs are sometimes absent); tip produced in a caducous, 1 mm long mucro; petiolules short, glabrous. Stipules linear-acute, c. 3 mm long, early caducous, flabby, membranous, glabrous. Racemes slender, 7–17 cm long, lateral near the top of the branches in the axils of leaves, peduncle 2–3 cm long, terete, glabrous. Bracts like the stipules, slightly smaller, early caducous. Bracteoles very minute scales, caducous before the bud attains half its size. Flowers medium, on 2–8 mm long, glabrous pedicels, at their insertion with a rim of gland-like hairs. Hypanthium conical, 2 mm long. Calyx glabrous. Sepals glabrous though usually on edge minutely ciliolate, thinly chartaceous, ovate, broadly rounded, 8–10 mm long. Petals obovate, 12–15 mm long, glabrous, sessile, delicately veined, membranous, rounded on top. Two longer stamens with 6–10 mm long filaments, anthers c. 7 mm long, curved, with longitudinal rims and 2 apical pores, 1 shorter stamen with a 2 mm long filament and a similar anther, 4 shorter stamens with 1 mm long filaments and 4–5 mm long anthers, 3 reduced stamens with small anthers. Ovary glabrous, slender, stipe and style glabrous, stigma inconspicuous. Pods cylindrical, on the suture slightly grooved, brown, smooth, glabrous, indehiscent, 15–20 cm long, 1–1½ cm through, septate, c. 60-seeded. Seed olive-green, flattened, ovate, transverse, 8 mm long; albumen copious, appressed to the testa, embryo large.

Type specimen. – *Linnaeus Herb. 528.10* (holotype in LINN).

Distribution. – Western South America (Bermuda, Br. Guyana, Costa Rica, Panama, Columbia, Venezuela, Ecuador, Peru); cultivated in Egypt, the Atlantic Islands and India (N. Y. SANDWITH, in litt.). In the Belgian Congo, the S. Pacific, and in Malaysia cultivated or, locally, as an escape.

Ecology. – Occasionally found from sealevel to 600 m alt.

Morphological note. – The cultivated specimens in the Malay Peninsula are described as « climbing or trailing ». BACKER de-

scribed the Javan specimens as « erect but drooping ». LÖRZING, examining specimens at Sibolangit, found the nerves and margin lighter green, the lower surface of the leaflets subglaucous, the larger anthers purplish green, the 4 (shorter) dirty yellow, the 3 smallest purple, green and yellow. The 3 longest stamens had yellow, the 7 shorter bright green filaments. Stigma bright green.

The longitudinal rim of the anthers is latrorse and runs from the base to disappear at a distance of c. 1 mm from the top (apical pore).

The basal part of the pod is empty and contracted.

On boiling, the olive-green outer layer of the seed swells and becomes detached as a ± silky, pellucid tunic; on its removal a shining-black testa, which shows no pleurogram, remains.

Vernacular name. – English : *Rambling Cassia.*
Use. – *C. bicapsularis* is reported to be poisonous for birds and bees (cf. HURST, Pois. Pl. N. S. Wales 150. 1942).

Notes. – BENTHAM referred *C. glanduliflora* (sphalm. « *glandulifera* » sec. STEUDEL) Reinw. ex Blume, nomen nudum, to the synonymy of *C. bicapsularis*, but examination of the specimens in the REINWARDT Herbarium proved it to belong to *C. divaricata* Nees et Blume (see there).

BENTHAM may have been led into error by HASSKARL (cf. Pl. Jav. rar. 403. 1848) who thought *C. glanduliflora* to the identical with *C. indecora* H. B. K. (and so, again, with *C. bicapsularis L.*, which is the correct name for *C. indecora* as was recognized by BENTHAM). HASSKARL's error is confirmed by his msc. names in the Herb. Reinw. (in L) to the specimens of *C. glanduliflora.*

N. Y. SANDWITH in a letter to C. A. BACKER (26.1.38), after studying the S. American specimens at Kew with a view of separating *C. bicapsularis* from *C. coluteoides* is « not convinced that (they) can be separated » as he found links. I prefer to follow BACKER because *C. bicapsularis* and *C. coluteoides* are easily separated as regards Malaysian specimens and, moreover, fresh specimens show some differences not easily noticed when dried. In *C. coluteoides* the orange-edged leaflets are black-dotted below and its curving stipules are yellow or orange while *C. bicapsularis* has its leaflets not black-dotted below and pallid-margined and its stipules are green and spreading or reflexed.

12. **Cassia biflora** Linnaeus

C. biflora Linnaeus, Sp. Pl. 540. 1753; Colladon, Hist. Cass. 103. 1816; Bentham, Trans. Linn. Soc. 27 : 543. 1871; Fawcett & Rendle, Fl. Jamaica 4 : 107. 1920; Corner, M.A.H.A. Mag. 5 : 46. 1935; Ways. Trees Mal. 388. 1940.

A shrub, 2–4 m tall, erect. Leaflets 6–10 (–13) pairs, chartaceous to membranaceous, elliptic-oblong, (usually widest above the middle), slightly unequal-sided, 1½-3½ (–4) cm long and 8–12 mm wide, lower surface glabrous, delicately dark punctate when dry, top rounded (midrib sparsely pilose and produced into a caducous 1 mm long mucro, marginal nerve evident), base rounded to cuneate; petiole 1–2 cm long, glabrous to puberulous, rhachis 6–8 cm long, bearing 2 ± clavate, brownish glands (upper gland caducous) between the two lower pairs of petiolules, and a gland between the uppermost petiolules; spots of glandlike hairs may occur between the other pairs; petiolules slender, puberulous, c. 1 mm long. Stipules subulate, 5–12 mm long, ± glabrous. Racemes axillary, single or paired, on top of the glabrous, terete, slender, 1½–2 cm peduncle emerge 2–3 flowers, the peduncle ending in a spindle-shaped caducous gland between the glabrous, slender, straight, c. 1½ cm long pedicels. Bracts boat-shaped, glabrous or thinly pilose, 3 mm long. Bracteoles absent. Flowers large or medium, yellow. Sepals: 2 outer less than half as large as the 3 inner, membranous, ovate, c. 3 mm long, 3 inner 7–8 mm long, broadly ovate, soon glabrous but delicately ciliolate on edge. Petals broadly ovate, very different in size, 1–2 cm long, slenderly clawed (claw 2–3 mm long), asymmetrical, glabrous. Stamens: 3 lower with a long crested, curved, 5 mm long anther, filament curved, 3 mm long, glabrous, 4 anthers 5 mm long, filaments shorter, 3 anthers reduced and empty, all anthers with lateral ridges. Ovary slender, recurved, sparsely pubescent, style glabrous, stigma inconspicuous. Pods on a slender stalk, raising from a persistent, ± swollen receptacle, 4–8 mm wide, flat, glabrous, thin-valved (margins somewhat raised), strap-shaped, 7–15 cm long, 10–20-seeded, short-beaked. Seeds lengthwise, flattened, narrowly oval, 5 mm long.

Type specimen. – *Linn. Herb. 528.21* (holotype in LINN).

Distribution. – Tropical and subtropical S. America. Cultivated in Malaysia.

Use. – Common in gardens (Malay Peninsula).

Note. – BENTHAM commented on the close affinity between *C. biflora* and *C. divaricata*. The latter is different in having a gland between the uppermost pair of petiolules, a longer pod, ± sessile petals and the 3 upper anthers are not reduced.

Peiranisia biflora (L.) Pittier (in Trab. Mus. Com. Venez. 3 : 158. 1928), a name, based on *Cassia biflora* L., is not that species as regards the specimens, judging from PITTIER's key and description.

13. Cassia coluteoides Colladon

C. coluteoides Colladon, Hist. Cass. 102. 1816, t. 12 ; De Candolle, Prod. 2 : 495. 1825 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 34. 1941.

Cassia indecora H. B. K. Nov. Gen. Sp. 6 : 271. 1823 ; Hasskarl, Pl. Jav. Rar. 403. 1848.

Chamaefistula indecora G. Don, Gen. Syst. 2 : 452. 1832.

Cassia indecora H. B. K. var. *advena* Vogel, Syn. Cass. 18. 1837.

Cassia chrysoloma De Notar. Ind. Sem. Hort. Gen. 1840 ; Linnaea 15(2) : Litt. Ber. 92. 1841.

Cassia reinwardtii Hort. Bog. ex Hasskarl, Ann. Sci. Nat. sér. 2, 14 : 58. 1840 ; Flora 1842, Beibl. 53 ; Tweede Cat.'s Lands Plt. 286. 1844 ; Miquel, Fl. Ind. Bat. 1(1) : 92. 1855.

Cassia bicapsularis var. *pubescens* Bentham in Trans. Linn. Soc. 27 : 525. 1871.

A shrub, 1–1 ½ m high ; young twigs delicately short tomentose. Leaflets 4–5 pairs, chartaceous, ± obovate, more or less unequal-sided, 2–2 ½ cm long, 11–15 mm wide, upper surface glabrous, lower glabrous or glabrescent, at the base (on the narrow half) locally pubescent (midrib very sparsely pubescent, hardly excurrent, marginal nerve evident) ; base broad, often cuneate, unequal-sided, top slightly retuse ; petiole c. 2 cm long slender, grooved, sparsely pubescent, rhachis 3–3 ½ cm long, grooved, pubescent, with a sessile, conical gland between the lowest petiolules and nearly not produced between the upper ; petiolules pubescent, very short, c. 1 mm long. Stipules very early caducous, linear, twisting, flabby, medially puberulous, membranous, c. 5–10 mm long. Racemes axillary, few-flowered, peduncle 3 cm long, rachis c. 1 cm long. Flowers medium, on

15–40 mm long, glabrous pedicels. Bracts similar to the stipules. Bracteoles absent. Sepals glabrous or ovate to oblong, broadly rounded, 7–11 mm long, the outer sometimes ciliolate on edge. Petals obovate, 1½–2 cm long, sessile, delicately veined, membranous, asymmetrical, rounded on top. Stamens : 2 longer with 11–12 mm long filaments, anthers c. 7 mm long, curved, opening by apical swollen, rounded pores, base blunt, 1 stamen with a c. 4 mm long filament, a more or less curved, c. 5 mm long anther, its top more or less rostrate ; 4 stamens short, on 1–2 mm long filaments ; reduced stamens 3, all anthers with lateral lines. Ovary sparsely puberulous, slender, c. 60-ovulate ; style glabrous ; stigma incurved, inconspicuous. Pods terete, bulging on the seeds, rimmed, glabrous, thin-valved, not dehiscent, up to 10 cm long, 5 mm through, one longitudinal half empty, the seeds in the other half transverse, enclosed in cells. Funicle minute. Seeds black, oval, flattened, 5 mm long, embryo large, embedded in copious albumen.

Type specimen. – A specimen in the herbarium Bouchet (MPU).

Distribution. – Tropical and subtropical S. America, in Malaysia occasionally as an introduced weed.

Morphological note. – The leaflets are orange-edged on account of the marginal nerve ; the stipules are orange. The seeds are decidedly smaller than those of *C. bicapsularis*, its closest ally, and appear to be provided, when boiled, with a scant mucilagineous layer, sometimes even apparently without it.

Note. – COLLADON saw a cultivated and dried specimen, its origin was unknown.

HASSKARL wrote on the label accompanying the type specimen of *C. reinwardtii* (*Herb. Lugd. Bat. 908.113-467*) as the author's name «Korth. (als)». He was in doubt as to who had coined the epithet (cf. l. c. 1840, p. 60).

C. advena is typified by Herb. *Willdenow* 7958.

C. decora Bl. ex Miq. (a msc. name of BLUME, published by MIQUEL in synon. l. c.) is based on *Herb. Lugd. Bat. 908.113-309*.

I have not seen the type of *C. indecora* H. B. K. but the description refers clearly to *C. coluteoides*.

14. Cassia didymobotrya Fresenius

14. *C. didymobotrya* Fresenius, Flora 22(1): 53. 1839; Rock, Legum. Pl. Hawaii 83. 1920, t. 33; Corner, M.A.H.A. Mag. 5: 47. 1937; Burkill, Dict. Econ. Prod. Mal. Penins. 1: 475. 1935; Backer, Bekn. Fl. Java em. ed. 5, fam. 118: 36. 1941; Steyaert, Fl. Congo Belge 3: 504. 1952, t. 36.

A shrub or small tree, 1½–3½ m tall, branches pubescent, finally glabrous. Leaflets 8–16 pairs, chartaceous, ovate-oblong to narrowly obovate or oblong, 2–6 cm long, 1½–2 cm wide, on both surfaces at first sparsely pubescent, later glabrescent, top rounded, mucronate by the shortly produced midrib, marginal nerve distinct, puberulous, base broad, very oblique; petiole terete, sturdy, (3-)6–8 cm long, pubescent, rhachis 25–35 cm long, terete, pubescent, glandless or with some rudimentary « glands », produced into a short, subulate mucro; petiolules pubescent, c. 1 mm long, slender. Stipules very broadly ovate, apiculate, 10–15 mm long, tardily caducous, reflexed, pubescent. Racemes erect, axillary, many-flowered, spike-like, 25–50 cm long; peduncle stout, 5–8 cm long, terete, pubescent. Bracts 12–15 mm long, broadly ovate, apiculate, pubescent, at first imbricate and enclosing the buds. Bracteoles absent. Flowers large, on 3–5 mm long, slender, densely pubescent pedicels. Calyx puberulous. Sepals ± equal, narrowly (ob)ovate, top rounded, c. 12 mm long. Petals (ob)ovate, at first incurved, later more spreading, 1½–2½ cm long, including the c. 1 mm long, very slender claw, glabrous, delicately veined. Stamens: two lower with slender, 3 mm long filaments and curved, 10–12 mm long anthers which open by two small apical pores, lateral rims distinct, base deeply split and spurred, three upper stamens staminodial, short, with empty anthers, 5 remaining anthers with 2 mm long filaments and 5 mm long, rimmed, biporous anthers. Ovary velvety pubescent, on a densely pubescent stipe, style glabrous, very slender, c. 1 cm long, recurved, stigma punctiform. Pods flat, glabrescent, ± indehiscent when dry, sutures raised, depressed between seeds, 7½–10 cm long, 1½ cm wide, 9–16-seeded. Seeds smooth, flattened, longitudinal, oblong.

Type specimen. – *Rüppell, s. n.*, in Abyssinia (locality unknown).

Distribution. – Tropical (and subtropical ?) Africa. Introduced into Malaysia.

Use. – Only ornamental in Malaysia.

Note. – The flowers are bright but pale yellow. In the axils of the leaves an abortive inflorescence is often present. The plant emits an unpleasant smell either in flower or when bruised. The seeds have a linear pleurogram.

15. Cassia divaricata Nees et Bl.

C. divaricata Nees et Bl. in Syll. Pl. Nov. Ratisb. **1**: 94. 1824; Miquel, Fl. Ind. Bat. 1(1): 97. 1855; Bentham, Trans. Linn. Soc. Bot. **27**: 554. 1871; Rolfe, J. Bot. **23**: 212. 1885; Vidal, Rev. Pl. Vasc. Filip. 116. 1886; Merrill, Philip. J. Sci. Bot. **5**: 49. 1910; Enum. Philip. Fl. Pl. **2**: 262. 1923; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 33. 1941. – Fig. 2.

Cassia glanduliflora Reinwardt ex Bl. Cat. Hort. Bog. 68. 1823, nom. nud. ex Steudel, Nom. Bot. ed. 2: 305. 1841.

Cassia reinwardtii Hasskarl in Tweede Cat.'s Lands Plt. 286. 1844; pro parte.

Cassia adenantha Zoll. & Mor. in Mor. Syst. Verz. 2. 1845.

Cassia bifida Zoll. Nat. Geneesk. Arch. **4**: 68, 80. 1846.

A shrub, 2–5 m tall, erect. Leaflets 6–11 pairs, membranous, elliptic-oblong (usually widest above the middle), slightly unequal-sided, 1½–4½ cm long, ½–1½ cm wide, lower surface at first sparsely and delicately pilose also on edge, top rounded (midrib produced into a 1 mm long mucro, marginal nerve evident), base rounded to acute; petiole 1–2 cm long, glabrous to puberulous, ribbed, rhachis 5–8 cm long, ribbed, thinly pilose, bearing a produced, 2 mm long, doleiform or clavate gland between the lowest petiolules, a spindle-shaped gland between the uppermost, and spots of gland-like hairs between the other pairs of petiolules; petiolules slender, puberulous, 1–2 mm long. Stipules linear-falcate, about 8–10 mm long, ± chartaceous, pubescent. Racemes axillary, single or paired; on top of the glabrous, terete, 1½-3 cm long peduncle emerge 2–3 flowers, the peduncle ending in a spindle-shaped gland between glabrous, 10–22 mm long pedicels. Bracts boat-shaped, glabrous, 1½ mm long. Bracteoles not seen. Flowers large. Sepals: 2 outer small, membranous, broadly ovate, 3½ mm long, 3 inner 1 cm long and 12 mm wide, orbicular, all glabrous. Petals broadly ovate, 1½-2½ cm long, very different in size, sessile or very nearly so, asymmetrical, glabrous. Stamens: 3

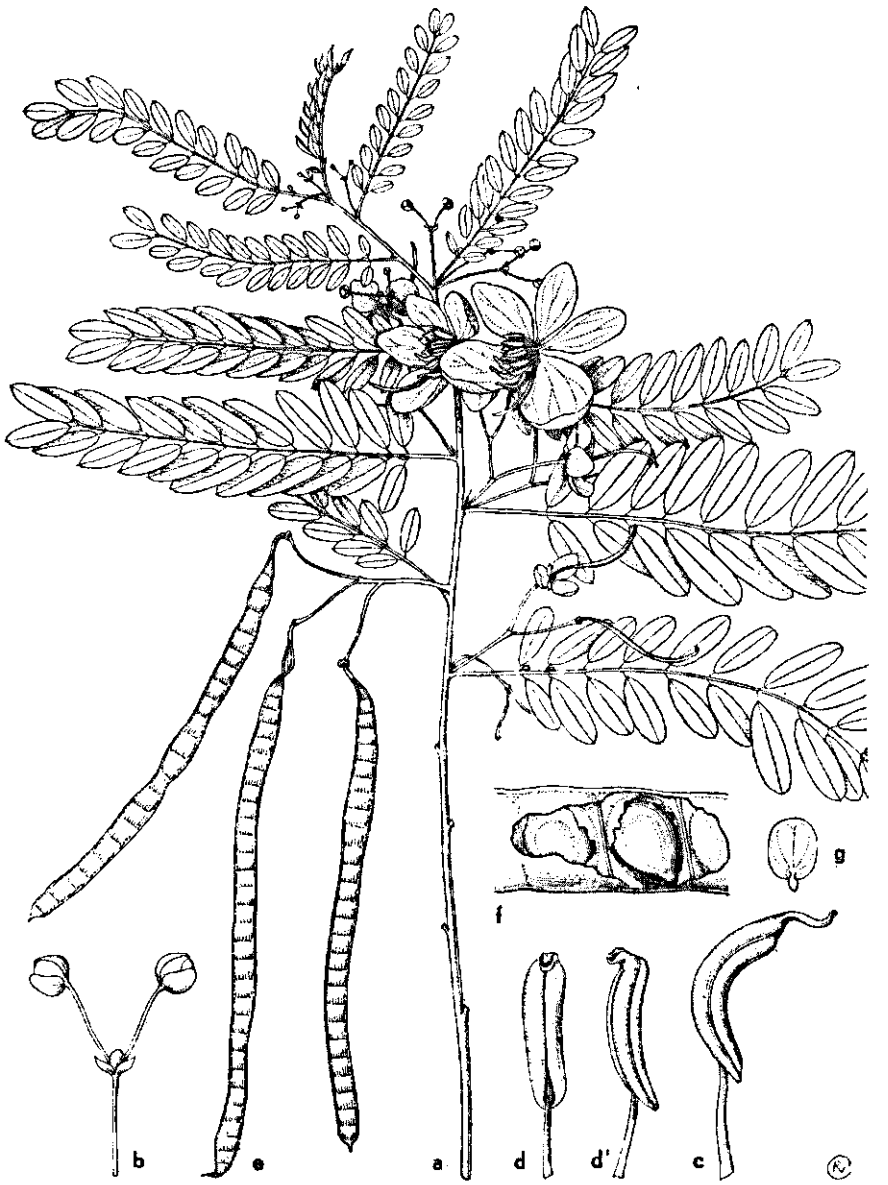

Fig. 2. – *Cassia divaricata* Nees et Blume. – **a.** Flowering branch, × ½ – **b.** inflorescence, nat. size – **c.** large stamen, × 3 – **d.** and **d'.** back and side-view of smaller anther, × 3 – **e.** pods, × ½ – **f.** opened pod showing seed and funicle, × 3 – **g.** embryo, × 3. [a-d after Blume (v. Hasselt) holotype, e. after Koorders 23476 (in L), f. and g. after Koorders 23251 (in L)].

lower with a crested anther, filament glabrous, 3 mm long, anthers curved, 9 mm long, crest 2 mm long, a single pore on the top, 7 smaller anthers at the top biporous, filaments 1½ mm long, all with lateral ridges. Ovary slender, delicately sparsely puberulous, sharp-edged, style glabrous, stigma inconspicuous. Pods on a slender stalk, raising from a persistent, ± swollen receptacle, 5–7 mm wide, flat, glabrous, thin-valved (margins somewhat raised), strap-shaped, 15–20 cm long, 15–50-seeded, short-beaked. Seeds lengthwise, flattened, narrowly oval, 5 mm long, albumen copious, appressed to the testa ; embryo large, flat.

Type specimen. – *Blume* (v. Hasselt) Java, *s. n.* (in L, no 908.112-431).

Distribution. – Malaysia : Java. Bali. Philippines (Luzon).

Ecology. – Occurring as a shrub or small tree between 300–1700 m alt., often near water courses or on marshy soils, in secondary forests or in clearings, sometimes in open places in old forests, scattered or in small groups, never very frequent.

Morphological note. – The leaves, when dry, are delicately black punctate or mottled. At the insertion of the petiolules gland-like hairs emerge, also on top of the peduncle at the insertion of the pedicels. The flowers are yellow but appear orange-brown in dried specimens.

Vernacular names. – Java : *Aringin, ketepeng, ontobogo* ; Philippines : *ataatab.*

Note. – BENTHAM placed this species in his sectio 6 (*Psilorhegma*) and comments on its similarity with *C. biflora* L. (l. c. pp. 544, 554). This similarity is so striking that I have seriously considered the desiderability of uniting *C. divaricata* with *C. biflora.* The stamens in *C. divaricata* are, however, all ten perfect (not 3 uppermost reduced as in *C. biflora*) and the pods are decidedly more compressed and with narrower, flat sides. Another character is that the subulate mucro ending the rhachis between the uppermost pair of petiolules is accompanied by a spindle-shaped gland in *C. divaricata* while this gland is absent in *C. biflora.* For these reasons I have accepted them as separate species.

Cassia glanduliflora Reinw. ex Blume in Cat.'s Lands Plt. Buitenz. 68. 1823 (nomen) or *Cassia glandulifera* Reinw. sec.

Steud. ex Miquel, Fl. Ind. Bat. 1(1): 92. 1855 was placed by BENTHAM among the synonyms of *C. bicapsularis*. The type specimen of *C. glandulifera* (in L 908.113-305) proves it to belong to *C. divaricata* Nees et Bl.

The type of *C. adenantha* L. et M. (l. c.) is *Zollinger 2854* (in L) and belongs here.

Though I suspect that *C. divaricata* is of S. American origin I have failed to identify it with any extra-Malaysian species. Its origin should be further investigated.

16. Cassia floribunda Cavanilles

C. floribunda Cavanilles, Descr. 132. 1802; Colladon, Hist. Cass. 88. 1816, t. 2; Vogel, Syn. Cass. 19. 1837; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 34. 1941.

Cassia laevigata Willdenow, Enum. Hort. Berol. 441. 1809; Colladon, Hist. Cass. 89. 1816, t. 5; Vogel, Syn. Cass. 19. 1837; Bentham, Fl. Bras. 15(2): 107. 1870; Trans. Linn. Soc. 27: 527. 1871; Prain, Journ. As. Soc. Bengal 66(2): 476. 1897; Rock, Legum. Pl. Hawaii 85. 1920, t. 34; Fawcett & Rendle, Fl. Jam. 4(2): 103. 1920; Corner, M.A.H.A. Mag. 5(2): 48. 1935; Ways. Trees Mal. 389. 1940; Steyaert, Fl. Congo Belge 8: 511. 1952.

Senna aurata Roxb. Fl. Ind. ed. Carey 2: 342. 1832; ed. Clarke 351. 1874.

Cassia aurata Roxb. Hort. Beng. 32. 1814, nom. nud.; ex Vogel, Syn. Cass. 17. 1837; Miq. Fl. Ind. Bat. 1(1): 91. 1855.

Cassia quadrangularis Zoll. & Mor. in Mor. Syst. Verz. 2. 1846; Miq. Fl. Ind. Bat. 1(1): 97. 1855; Bentham, Trans. Linn. Soc. 27: 527. 1871.

A herb, shrub, or small tree, 1½–4 m tall, branches thick, terete, smooth, green. Leaflets 3–5 accrescent pairs (lowest pair spurious), chartaceous, ovate to ovate-elliptic, ± equal-sided, 4–11 cm long and 2–3½ cm wide, glabrous, and ± dull on both surfaces, veins on upper surface prominulent (marginal nerve well-developed, green), top long acute to acuminate (midrib mucronate), base rounded to cuneate; petiole 1½–5 cm long, glabrous, grooved, rhachis 6–12 cm long, bearing a clavate or conical gland between all, or all except the upper pair of petiolules, produced when young into a short, broad mucro; petiolules sturdy, glabrous, c. 2 mm long. Stipules linear, falcate, 8–9 mm long, glabrous. Racemes axillary or terminal, 5–10 cm long (axis suddenly narrowing towards the end, glabrous), peduncle 2½–4 cm long. Bracts membranous, glabrous, linear, acute, 6 mm long. Bracteoles not seen. Flowers medium, on 1–2½ cm long,

glabrous pedicels. Calyx glabrous. Sepals membranous, oblong to ovate, blunt to rounded, 6–10 mm long, very different in size. Petals broadly ovate, orbicular to broader than long, 1–1½(–2) cm long, sessile, top round, glabrous. Stamens 3 longest, 2 filaments 10–11 mm, 1 filament 4 mm long, all glabrous, anthers 8 mm long, recurved, opening by an apical pore, not rostrate, deeply split at the base, with a lateral rim, 4 short filaments 2 mm long, anthers 4–5 mm long, 3 reduced, with empty anthers, shortest. Ovary glabrous, recurved, stigma punctiform, subapical. Pods terete, glabrous, thin-valved, tardily dehiscent, 6–10 cm long, 12–15 mm through, c. 50-seeded, transversely septate. Seeds olive, glossy, smooth, flat, transversely placed, notched at the hilum, ovate, 8 mm long; albumen copious, testa thin.

Type specimen. – Probably at MA.

Distribution & ecology. – Probably indigenous in tropical America. In Malaysia cultivated or as a weed.

BENTHAM ascribed this species to tropical and subtropical America, chiefly in wasted and cultivated places. It occurs in similar situations in tropical Asia, Africa, and Australia, probably in most cases introduced. CORNER (l. c.) thinks it is « native of trop. America and tropical W. Africa ».

C. floribunda occurs throughout Malaysia, planted or as an escape, from sealevel to 2000 m alt., though favouring altitudes between 900 and 1500 m, and, accordingly, it is cultivated in the Malay Peninsula « especially on the hills » (CORNER, l. c.). It occurs along roadsides or watercourses, in grassfields or thickets, on forested ravine slopes, also scattered in reafforestations. KOORDERS noted that on Mt Sindoro (1700 m alt.) *C. floribunda* occurred as a small tree, not as a shrub. It is an evergreen. The branchlets are hollow, very terete, glossy and thick, and the stalks of the inflorescences and leaves arising from them seem rather thin. The lower surface of the leaflets is glaucous or dull greyish green; the edge of the leaflets is not orange.

The flowers are bright yellow. Contrary to most ssp. of *Cassia* the testa of the seed becomes very soft after boiling; there is no pleurogram. Young pods in dry herbarium specimens show marked ± sunken sutures, running medially and broad, darker coloured, shrunken margins.

C. floribunda is said to be poisonous on occasion (cf. HURST, Pois. Pl. N. S. Wales 150. 1942, sub *C. laevigata*).

Vernacular names. – Sumatra : *Gelinggang, houro handang, katjang (mu)-gari, katjang magrip, simar-dali-dali.* Java : *kasingsat, orok-orok, tajuman, tjandung, trembalon.*

Uses. – It is of no or very little use, as is expressly stated by some collectors. BÜNNEMEIJER, however, found that at Sumatra W. Coast the sprouts were added to vegetable broth. Locally it is planted for hedges. It was tried on experimental plots on Mt Singalang (green manure).

Notes. – *C. quadrangularis* Zoll. & Mor. is based on *Zoll. 1670* and belongs here. The epithet « *quadrangularis* » is based on the appearance of the pod. Most isotypes are only leafy twigs but the specimen at Geneva consists of leaves and pod. The pod, I then found, belongs not in *Cassia* but is Bignoniaceous and quadrangular.

17. Cassia fruticosa Miller

C. fruticosa Miller, Gard. Dict. ed. 8, no 10 : 1768 ; Baillon, Adansonia 9 : 212. 1869 ; Fawcett & Rendle, Fl. Jam. 4(2) : 103. 1920 ; Amshoff, Meded. Bot. Mus. Herb. Utrecht 52 : 20. 1939 ; Fl. Surinam 2(2) : 59. 1939 ; Backer in Bokn. Fl. Java, em. ed. 5, fam. 118 : 30. 1941 ; Corner in Ways. Trees Mal. 388. 1940, t. 84, f. 131.

Cassia bacillaris Linnaeus f. Suppl. 231. 1781 ; Colladon, Hist. Cass. 87. 1816 ; Bentham, Fl. Bras. 15(2) : 98. 1870, t. 31 ; Trans. Linn. Soc. 27 : 521. 1871.

Cassia puberula H. B. K. Nov. Gen. Sp. 6 : 452. 1824.

Chamaefistula bacillaris Don, Gard. Dict. 451. 1832 ; Britton & Rose, N. Am. Fl. 23, 4 : 235. 1930.

Chamaefistula fruticosa Pittier, Trab. Mus. Com. Venez. 3 : 152. 1928 ; Britton & Rosen l. c. 237.

A shrub or small tree, up to 4 m tall ; young parts greyish puberulent. Leaflets 2 pairs, membranaceous, obliquely ovate, very unequal-sided, upper pair much the larger, 4–16 ½ cm long, 2–7 cm wide, glabrous or glabrescent on the upper surface, on the lower puberulous, top acute to acuminate (midrib often slightly excurrent), base obliquely cuneate ; petiole slender, puberulous, c. 3 cm long, rhachis slenderer, half as long, bearing an oblong, nipple-shaped gland between the lower pair of petiolules, produced into a caducous, short mucro between the upper petiolules ; petiolules puberulous, c. 3 mm long. Stipules linear, 3–4 mm long, puberulous, acute, caducous. Racemes short, slender, 4–5 cm long

(including the c. 2 cm long peduncle), rhachis puberulous. Bracts linear, acute, in appearance like the stipules. Bracteoles obovate, rounded-cupshaped, enclosing the greater part of the bud, like the bracts very early caducous. Flowers rather large, on c. 2½ cm long, puberulous, slender pedicels. Calyx puberulous. Sepals membranous, oblong, round-topped, c. 1 cm long, free. Petals orbicular to broadly obovate, broadly rounded, externally puberulous, 2–3 cm long, 2 cm wide, blade narrowing into a 1–3 mm long claw, conspicuously veined. Stamens : 7 (or 6) antheriferous ; filaments of the 3 lower slender with a puberulous rim, 4–5 mm long, bearing thick, 7 mm long curved anthers, rostrate at the apex, rounded at the base, with lateral lines, filaments of the 4 lateral thick, glabrous, 8–3 mm long, carrying 8–9 mm, still thicker anthers, which are rostrate at the apex and rounded at the base ; upper 3 stamens absent, if, rarely, present bearing reduced anthers. Ovary curved, slender, appressed pubescent ; stipe, style, and stigma not conspicuous. Pods pendent, terete, slightly annulate, 15–25 cm long, 1¼ cm through, long beaked, not septate, margins very broad, flat, raised. Seeds more than 100, embedded in sticky pulp.

Type specimen. – To be designated in K.

Distribution. – Indigenous in Central America and the W. Indies. Cultivated throughout the tropics and in Malaysia, rarely as an escape.

Ecology. – From Celebes, I saw a single specimen (*Eyma 3411*), which was found in the shade of a sagu-swamp.

Vernacular name. – English : *Drooping Cassia.*

Use. – A commonly grown ornamental.

18. **Cassia garrettiana** Craib

C. garrettiana Craib, Kew Bull. 151. 1912 ; Gagnepain in Lec. Fl. Gén. Indo-Ch. 2 : 169. 1913, f. 15 ; Craib, Fl. Siam. Enum. 2 : 510. 1928.

A shrub or small tree, branchlets puberulous. Leaflets 7–9, slightly accrescent pairs, firmly chartaceous, ovate-lanceolate to broadly ovate, nearly equal-sided, 3½–8(–10) cm long, 2–4½(–5) cm wide, glabrous on both surfaces, top acute or acuminate,

base rounded to cuneate (the lower pairs generally broader and rounder than the upper); petiole 3½–5 cm long, glandless, puberulous, glabrescent, slightly grooved above, rhachis 10–12(–25) cm long, produced beyond the upper petiolules into an early caducous, c. 5 mm long mucro ; petiolules slender, nearly glabrous, 3–6 mm long, grooved ; stipules not seen. Racemes axillary, aggregate in panicles towards the end of the branches, as a rule paired, up to 11 cm long, many-flowered, axis softly and densely pubescent. Flowers on 2½–3 cm long, pubescent pedicels. Bracts early caducous, c. 4 mm long, pubescent, acute or pointed. Bracteoles reduced to minute, pubescent squamulae at the base of the pedicel. Sepals 2 outer much the smaller, 5 mm long, the 3 inner 9–10 mm long, all rounded or broadly elliptic, puberulous. Petals obovate or elliptic-obovate, 1–1½ cm long, 8 mm wide, claw short. Stamens : 2 largest, filaments c. 7 mm long, flat-winged ; anthers 7–9 mm long ; curved, beaked, opening by 2 apical pores, 4–5 similar but shorter and with sligtly smaller anthers, 2–3 small, with reduced anthers. Ovary nearly glabrous, subsessile, style glabrous, stigma inconspicuous. Pods very flat, papery-valved, 10–15(–22) cm long, 2½–3 cm wide, 16–20-seeded, glabrous. Seeds oblong, in ± semilunar compartments and surrounded by a membrane, brownish, 9 mm long and half as wide or less, pleurogram narrow, more than half as long, funicle capillary, 1 cm long.

Type specimen. – *Kerr 2067* (lectotype in K).

Distribution. – Siam, Cambodia, Cochinchina.

Note. – Closely allied to *C. siamea* but distinguished by its very flat, much broader, papery-valved pods, which contain long, narrow seeds and are always deeply warped above their insertion.

Also allied to *C. racemosa* Mill. but different in having paired inflorescences, shorter peduncles, and larger flowers.

So far this species was not collected in Malaysia. *Hamid 3808* from Prachuap (cf. CRAIB, l. c. 1928) occurred, however, close to the Kra Isthmus and possibly the species occurs also south of it, that is in Malaysia.

C. garrettiana was cultivated in the Botanic Gardens at Bogor (Buitenzorg). TEYSMANN introduced it from Radburi.

19. **Cassia hirsuta** Linnaeus

C. hirsuta Linnaeus [Hort. Cliff. 159. 1737] Sp. Pl. 378. 1753; Syst. Veg. 327. 1774; Linnaeus f. Suppl. Pl. 231. 1781; De Candolle, Prodr. 2: 497. 1825; Vogel, Syn. Cass. 32. 1837; Bentham, Fl. Bras. 15(2): 114. 1870, t. 34; Trans. Linn. Soc. 27: 534. 1871; Baker in Hook. f. Fl. Br. Ind. 2: 263. 1878; Merrill, Sp. Blanc. 173. 1918; Fawcett & Rendle, Fl. Jam. 4(2): 105. 1920; Ridley, Fl. Mal. Pen. 1: 618. 1922; Merrill, En. Philip. Fl. Pl. 2: 263. 1923; Heyne, Nutt. Pl. Ned. Ind. 743. 1927; Corner, M.A.H.A. Mag. 5: 48. 1935; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 31. 1941; Steyaert, Fl. Congo Belge 8: 513. 1952.

Cassia tomentosa (non L.) Wall. Cat. 5304; ex Baker l. c.; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 1: 286. 1834.

Ditramexa hirsuta Britton & Rose, Sci. Surv. Porto Rico 5: 372. 1924; N. Am. Fl. 23, 4: 256. 1930.

A herb, 20 cm – 2½ m tall, erect, hairy, stinking; twigs grooved, with ribbed marrow. Leaflets (2–)3–5(–6) accrescent pairs, chartaceous, more or less obovate, slightly unequal-sided, 6–9 cm long, 2–3½cm wide, roughly villose on both surfaces (hairs often bulbous-based), top acute or acutely acuminate (midrib minutely produced), base acute or rounded (in the lower pairs generally broader and rounder than in the upper); petiole stout, 5½–6½ cm long, villose, above the increased insertion with a sessile, oblong gland, rhachis 7–9 cm long, glandless, produced beyond the upper petiolules into a 2–3 mm mucro; petiolules slender, villose, 2 mm long, often not quite opposite; stipules linear-acute, often not persisting, roughly hairy, 7–15 mm long. Racemes axillary or, rarely, terminal, c. 1 cm long, aggregate in leafy panicles, 2–5-flowered. Flowers on 1¼–2 cm long, densely pubescent pedicels. Bracts early caducous, 4–5 mm long, hirsute. Sepals: 2 outer much the smaller, roughly hairy, obovate, rounded, 5–6 mm long, 3 inner membranous, partly glabrous, 7–9 mm long. Petals obovate, 14–17 mm long, membranous, glabrous, claw (nearly) absent. Stamens: 2 largest, filaments 5–6 mm long, flat-winged; anthers 7–8 mm long, curved, beaked, opening by apical pores, lateral rim not evident, 4 similar but half as long, 1 (outer whorl, lowermost) equalling the 4 former but with a narrow anther, 3 staminodial, short, anthers empty. Ovary woolly, grey-hirsute, recurved, style short, glabrous, stigma small, subapical, hairy. Pods numerous, septate, 50–90-seeded, strigose, ± straight, 10–14 cm long, 4–6 mm through, angulate. Seeds dark olive, slightly

compressed, pointed at the radicula, c. 3 mm long, transverse, funiculus capillary, short, curved, albumen copious, embryo flat.

Type specimen. – To be designated in K.

Distribution. – Tropical America. Occurring as a weed in Malaysia but not yet found in the Philippines.

Ecology. – *C. hirsuta* is a weed in Malaysia, and never found extensively established. It favours the vicinity of dwellings, heaps of rubbish, railroads, and occurs not above 700 m alt. In West Java it is decidedly more common than towards the East.

Biological notes. – Fresh plants have a strong, unpleasant smell, described as foetid. The lower part of the stem is somewhat lignified and stout.

It flowers throughout the year. The disc of the flower is flattened and the ovary rises obliquely from it or is partly appressed to it. The usually numerous pods are bent when young and characterized by somewhat raised, glabrescent suturae and woolly strigose sides. The albumen of the seeds swells to a gummose mess in boiling water but the testa appears to be only slightly mucilagineous and bears an indistinct, large, obovate pleurogram. The transverse septs in the pods, though thin, are well developed.

Vernacular name. – Java : *Kasingsat.*

Uses. – HEYNE (l. c.) refers to various trials of *C. hirsuta* as a green manure and a possible medicinal virtue in curing excema.

Notes. – *C. hirsuta* has been repeatedly recorded for the Philippines but this rests on a misidentification ; the specimens belong to *C. leptocarpa* Benth.

20. Cassia leptocarpa Bentham

C. leptocarpa Bentham, Linnaea **22** : 528. 1849 ; Fl. Brasil. **15**(2) : 111. 1870 ; Trans. Linn. Soc. **27** : 531. 1871.
Cassia longisiliqua (non Linné f.) Blanco, Fl. Filip. 338. 1837.
Cassia sulcata (non DC.) Blanco, Fl. Filip. ed. 2 : 236. 1845 ; ed. 3, 2 : 76. 1878.

20a. var. hirsuta.

Var. *hirsuta* Bentham, Trans. Linn. Soc. **27** : 531. 1871.

A herb or undershrub, up to about 1 m tall, softly but shortly and thinly hairy, stinking ; twigs manifestly grooved, narrow

ribbed. Leaflets 5–7 accrescent pairs, chartaceous, ovate to oblong, slightly unequalsided, up to 5 cm long, about 1½ cm wide, softly and thinly short-hairy on both surfaces, top acutely acuminate, mucronate, base more or less oblique, rounded to cuneate (in the lower pairs generally broader and rounder than the upper); petiole stout, 2½–3½ cm long, sulcate, thinly hairy near the insertion with a sessile, oblong gland, rhachis 7–10 cm long, glandless, produced beyond the upper petiolules into a rather thick, 2 mm long mucro; petiolules slender, pubescent, 1 mm long, often not quite opposite; stipules linear, early caducous. Racemes aggregate in leafy panicles at the end of the branches, axillary; peduncle about 5-flowered, ½–1 cm long. Flowers on slender, pubescent, 8–12 mm long pedicels. Bracts early caducous, subulate, hairy, about 5 mm long. Sepals: 2 outer much the smaller, pubescent, oval, rounded, about 5 mm long, 3 inner membranous, ± acute, puberulous, about 8 mm long. Petals irregularly orbicular, 13–15 mm long, thinly membranous, glabrous or outside with a central patch of puberulousness; claw slender, 1–2 mm long. Stamens: 2 largest, filaments 3–5 mm long, flat-winged; anthers 5 mm long, curved, beaked, opening by apical pores, lateral rim not evident, 4 similar but half as long, 1 (outer whorl, lowermost) equalling the 4 former but with a narrow anther, 3 short, staminodial, anthers empty. Ovary densely grey strigose, style short, glabrous, stigma subapical, hirsute. Pods extremely long and slender; ripe pods not seen.

Type specimen. – Of the species to be designated in LE; of the variety to be designated in K.

Distribution. – Central and tropical America, in Malaysia only seen from the Philippines.

Ecology. – « An introduced weed in the Philippines, scattered in the settled areas at low altitudes » (MERRILL). BENTHAM notes that the S. American specimens were foetid.

Vernacular names. – Philippines: *Balbalatungan, katanda, tighiman.*

Notes. – Specimens belonging to *C. leptocarpa* Benth. were distributed as « Species Blancoanae No 449 » by MERRILL; they belong to the variety *hirsuta* Benth. *C. leptocarpa* var. *leptocarpa* is so far not collected in Malaysia.

21. Cassia multijuga Richard

C. multijuga Richard, Act. Soc. Hist. Nat. Paris 108. 1792 ; Bentham, Fl. Br. 15(2) : 123. 1870, t. 37 ; Trans. Linn. Soc. 27 : 546. 1871 ; Corner, M.A.H.A. Mag. 5 : 48. 1935 ; Amshoff, Fl. Surinam 2(2) : 65. 1939 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 38. 1941.

Cassia calliantha Meyen, Fl. Esseq. 169. 1818.

Cassia richardiana Kunth, Mim. 139. 1824, t. 42 and in H. B. K. Nov. Gen. Sp. 6. 1824 ; Miquel, Linnaea 18 : 583. 1844.

Cassia ampliflora Steudel, Flora 26 : 760. 1843.

A tree, 4–20 (or more) m tall, young parts puberulous. Leaflets 18–40 pairs, chartaceous, oblong-elliptic, nearly equal-sided, 13–40 mm long, 4–10 mm wide, on both surfaces delicately minutely puberulous, top (flatly) rounded, mucronate (midrib excurrent), base very oblique (the proximal half lower inserted, narrower) ; petiole 1–1½ cm long, puberulous, grooved (groove flat, wide), bearing at the top a yellowish-brown, conical gland (1½ mm long) between the lowermost pair (its leaflets spurious, early caducous) ; rhachis 22-35 cm long, bearing 0–4, up to 2 mm long glands near the top and gland-like hairs between the other petiolules, produced in a small, caducous mucro ; petiolules ± 1 mm long, stout, finely puberulous, to thinly pubescent ; stipules subfalcate, long-acute, narrow, at the base lobed, c. 1 cm long, early caducous. Panicles up to 30 cm long and 40 cm wide, at the end of leafy branches ; peduncles 2–4 cm long, puberulous. Bracts ovate, acute, puberulous to tomentose, c. 2 mm long, very early caducous. Bracteoles absent. Flowers medium, « rich yellow », on 14–20 mm long, puberulous pedicels. Sepals membranous, ovate, the two outer much smaller (3 mm long) than the 3 inner (5 mm long), rounded, finally reflexed. Petals very unequal-sized, the lowermost (outher) 2–3 cm long, falcate-spathulate, the claw very short and fleshy, the four upper with a 4–6 mm long, slender claw and broadly elliptic, 1–2 cm long blade, all glabrous. Stamens : 3 lower filaments 9–11 mm long, glabrous, at the top swollen ; anthers 6–7 mm long, curved, rostrate, with lateral rims, 4 lateral with 1–2 mm long filaments, shorter, very shortly rostrate, 3 upper stamens reduced. Ovary slender, glabrous, style thick, recurved, stigma punctiform, subterminal. Pods flat, 10–20 cm long, 15–22 mm wide, margins irregularly indented, glabrous,

thin-valved, very tardily dehiscent (valves not warping), septate between the 30–100 seeds, sutures sinuate. Seeds tawny, glossy, smooth, flattened, linear, longitudinal, 6 mm long, $1^3/_4$ mm wide, pleurogram central, narrow; funiculus capillary, 1 mm long, albumen sparse.

Type specimen. – Lectotype in PC (s. n., a specimen labeled « Para. Cassia multijuga.... ainsi nommée dans l'herbier de M. de la Marck »).

Distribution. – Brazil, Guyana. Widely cultivated, also in W. Malaysia.

Ecology. – Occurring from sea-level to c. 100 m alt.

Vernacular names. – Sumatra: *Radja, hau.* English: *Leafy Cassia.*

22. **Cassia obtusifolia** Linnaeus

C. obtusifolia Linnaeus, Sp. Pl. 377. 1753 (haud ref. cit. Dillen. et Rumph.); Loureiro, Fl. Cochinchin. ed. Willd. 323. 1793; Colladon, Hist. Cass. 95. 1816; De Candolle, Prodr. 2: 493. 1825; Baker, Fl. Br. Ind. 2: 263. 1878 (sub *C. tora*, pro parte); Prain, Journ. As. Soc. Beng. 66(2): 159, 475. 1897; Ridley, Fl. Mal. Pen. 1: 618. 1922; Heyne, Nutt. Pl. Ned. Ind. 745. 1927; Merrill, Comm. Lour. Fl. Cochinchin. 189. 1935; Burkill, Dict. Econ. Prod. Mal. Pen. 1: 478. 1935; Corner, M.A.H.A. Mag. 5: 49. 1935; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 35. 1941.

Cassia toroides Roxburgh Hort. Beng. 31. 1814, nom. nud.

Senna toroides Roxb. Fl. Ind. ed. Carey 2: 340. 1832; ed. Clarke 351. 1874.

Cassia tora L. var. β Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 291. 1834 (haud ref. cit. Rheede et Lam).; Miquel Fl. Ind. Bat. 1(1): 95. 1855.

An erect, subglabrous undershrub or herb, ½–2 m tall, usually annual ramifications light-coloured, terete, glabrescent. Leaflets 3 accrescent pairs, membranous, obovate, nearly equal-sided, the larger 1½–6 cm long and ½–3 cm wide, upper surface dull glabrous, lower surface dull, appressed pubescent, in colour like the upper surface, top broadly rounded but the tip delicately acute (midrib excurrent to a delicate, subpersistent mucro, margin thin, not green, roughly pubescent), base long-tapering, cuneate to acute (slightly), oblique; petiole 2–3 cm long, grooved, sparsely pubescent, glandless; rhachis 2–4 cm long, produced into a subulate, pubescent, caducous mucro beyond the upper petiolules, bearing a single, slender, cylindric, 2 mm long gland between the lower petiolules; petiolules slender, very short pubescent.

Stipules linear, membranous, roughly pubescent on edge, long-acute, falcate, 15–20 mm long and 1–1 ½ mm wide, subpersistent. Racemes short, peduncle ± glabrous, c. 2 mm long, bearing a single pair of flowers, axillary, usually solitary, a few asembled near the top of the twig. Bracts linear-acute, glabrous except the roughly pubescent edge, 4–8 mm long. Pedicels 13–23 mm long (in fruit up to 3 cm), thinly pubescent. Sepals membranous, ovate, acute to rounded (narrowly), ovate, 6–7 mm long, glabrous or pubescent on edge. Petals unequal, ± ovate, obtuse or rounded, 12–15 mm long, the standard truncate or emarginate, narrowed at the base but claw indistinct. Stamens : 3 lower longest, filaments slender, glabrous, 4 ½–5 ½ mm long, anther c. 5 mm long, top shortly produced, base knob-like produced at the attachment of the filament, 4 lateral smaller, filaments 3 mm long, anthers 3 mm long, 3 upper staminodial, small, short. Ovary ± glabrous, ribbed, style glabrous, stigma the truncate ending. Pods ± terete (subtetragonous), ± glabrous, dull, thin-valved, indehiscent, 10–18 cm long, 4–6 mm through, septate, 20–50-seeded, septs papery. Seeds rhomboidal, glossy, dark-brown, 4–5 mm long, longitudinal, funiculus capillary, undulate, albumen copious, embryo involute.

Type specimen. – Neotype in LINN, No *528.11* (cf. SAVAGE, Cat. Linn. Herb. 73. 1945).

Distribution. – Tropical America. A weed in Malaysia, rare in the Malay Peninsula.

Vernacular name. – Java : *Ketepeng (lembut)*.

Uses. – Leaves as a vegetable, as a purge, and pounded as a poultice for skin complaints (see Heyne & Burkill, ll. cc.).

Note. – BENTHAM (Trans. Linn. Soc. *27* : 536. 1871) considered *C. obtusifolia* L. synonymous with *C. tora* L., the latter being variable in some of its characters (pods curved or straight, foliar glands single or two, etc.). BENTHAM was followed by FAWCETT & RENDLE (Fl. Jamaica *4* : 105. 1920), and other authors (CORNER, AMSHOFF). PRAIN (l. c. p. 475), and later BACKER found that *C. obtusifolia* and *C. tora* could be separated on account of the presence of either one or two foliar glands coupled with either long or short pedicels (Bekn. Fl. Java, em. ed. 5, fam. 118 : 35. 1941 and in sched. herb.). The strong, foetid smell of *C. tora* is

nearly absent in *C. obtusifolia*. It appears that these characters hold true throughout Malaysia and though *C. obtusifolia* and *C. tora* are obviously very closely related I have preferred to follow BACKER. Authors as DE CANDOLLE (in COLLADON, Hist. Cass.) and ROXBURGH (l. c. p. 342) are of the same opinion.

The designation of a type specimen in the Linnean Herbarium was necessary, as the literature references given by LINNAEUS in support of his entirely unsatisfactory description are inadequate (cf. PRAIN, l. c. p. 475).

MERRILL distributed among the Species Blancoanae (No 300) *C. obtusifolia* under the name *C. tora* L.

23. Cassia occidentalis Linnaeus

C. occidentalis Linnaeus [Hort. Cliff. 159. 1737] Sp. Pl. 377. 1753 ; Colladon, Hist. Cass. 107. 1816 ; De Candolle, Prodr. 2 : 497. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 290. 1834 ; Vogel, Syn. Cass. 21. 1837 ; Miquel, Fl. Ind. Bat. 1(1) : 94. 1855 ; Bentham, Fl. Bras. 15(2) : 112. 1870 ; Trans. Linn. Soc. 27 : 532. 1871 ; Baker, Fl. Br. Ind. 2 : 262. 1878 ; Prain in Journ. As. Soc. Beng. 66(2) : 160, 474, 476. 1896 ; Bailey & White in Queensl. Agric. Journ. 5(1) : 40. 1916, pl. 2 ; Fawcett & Rendle, Fl. Jamaica 4(2) : 104. 1920 ; Rock, Legum. Pl. Hawaii 87. 1920, t. 36 ; Ridley, Fl. Mal. Pen. 1 : 618. 1922 ; Heyne, Nutt. Pl. Ned. Ind. 1 : 745. 1927 ; Corner, M.A.H.A. Mag. 5 : 49. 1935 ; Burkill, Dict. Econ. Prod. Mal. Pen. 1 : 478. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 31. 1941 ; Quisumbing, Med. Pl. Philip. Dpt Agric. Nat. Res. Techn. Bull. 16 : 382. 1951 ; Steyart, Fl. Congo Belge 3 : 513. 1952.

Gallinaria acutifolia Rumph. Herb. Amb. 5 : 283. 1747, pl. 97, f. 1.

Cassia planisiliqua Linnaeus, Sp. Pl. 377. 1753.

Cassia foetida Persoon, Synops. 1 : 457. 1805.

Cassia occidentalis var. *aristata* (non DC.) Hasskarl, Pl. jav. rar. 405. 1848.

Senna occidentalis Roxburgh, Fl. Ind. ed. Carey 2 : 343. 1832 ; ed. Clarke 352. 1874.

Ditramexa occidentalis Britton & Rose, Sci. Surv. Porto Rico 5 : 372. 1925 ; N. Am. Flora 23(4) : 256. 1930.

An erect, diffuse, subglabrous herb or undershrub, 60 cm to 2½ m tall, usually annual. Leaflets 3–5(–6) accrescent pairs, membranous, ovate to ovate-oblong, sometimes unequal-sided, (2½–) 5–12(–17) cm long and 2–4 cm wide, upper surface dullish, glabrous, lower surface dull, glabrous, ± pruinose to finely puberulous, lighter-coloured, not quite glaucous, top long tapering into a very acute or acuminate tip (midrib hardly excurrent, margin often purple, thin, glabrous, rough or ciliolate), base narrowly or broadly rounded ; petiole 3–4½ cm long, nearly terete, glabrous,

or thinly puberulous at the basal joint with a purple, large, sessile, globose or ovoid, glossy gland ; rhachis 8 ½–12 cm long, produced in a very early caducous, subulate, 3 ½ mm long tip ; petiolules puberulous or glabrescent, c. 2 mm long. Stipules linear-acute, membranous, glabrous, acute, ± falcate, 9–20 mm long. Racemes very short (peduncle 1–4 mm long), 2–4-flowered, arranged in terminal (leafy ; the leaves often indicated by a clavate gland) panicles. Bracts linear-acute, tardily caducous, 10–20 mm long, glabrous. Pedicels puberulous, 6–9 mm long. Sepals membranous, ovate, acutish to rounded, 7–10 mm long, glabrous. Petals subequal, obovate-obtuse, 1 ¼-1 ½ cm long, sessile. Stamens : 3 lower longest, filaments glabrous increasing to the top, 6–8 mm long, anthers glabrous, c. 6 mm long, top broadened, produced, opening by an apical pore, 4 lateral with 2 mm long filaments and 5 mm long light-coloured anthers, 3 upper with capillary, 1 ½ mm long filaments and reduced, empty anthers. Ovary short tomentose, slender, recurved, on a broad stipe, style glabrous, c. 5 mm long, stigma lateral, small, glabrous. Pods flattened, glabrous brown with lighter margins, thin-valved, not dehiscent, 10-12 ½ cm long, 7–10 mm wide, 30–45-seeded, linear, slightly curved, sutures broad, septs papery. Seeds pale-brown, dull, surface unequal, ± orbicular, flat, transversal, 4 mm long, funiculus capillary, straight, albumen copious, soluble in hot water.

Type specimen. – Holotype in LINN *528.13* (cf. SAVAGE, Cat. Linn. Herb. 73. 1945).

Distribution. – A circumtropical weed, possibly of S. American origin, occurring throughout Malaysia.

Ecology. – In the Malay Peninsula it is a very common weed of waste places. BACKER found it from sea-level to 1200 m, in various places, often near houses ; sometimes on Java and Madura cultivated.

Biological note. – Flowers appear throughout the year. The calyx is white, the petals are yellow, veined orange. Roxburgh found « the smell of every part heavy and offensive in the extreme ».

Vernacular names. – Mal. Peninsula : *Kachang kota, kutepang hutan.* Sumatra : *boelinggang (tepi), galinga (laut), gulinggang sawah, kopi andelan, kopi djawa, tépéng molag.* Java : *kasingsat, katjangan, kopi durjat, senting, sinting, tjingtjingsat.* Borneo : *tadjirin.* Kangean Arch. : *kopi djepang,* Sumba : *tandamala.* Celebes : *ré rénggé, tidelunggi.* Halmaheira : *obat gatel.* Ambon : *daun*

sumbir, katjang pemali, kelor utan. Philippines : *andalasi, balatong-aso, duda, gulinggam, kabalkabalan, katangan-aso, suka, sumting, tambalisa, tighiman.* English : *stinking weed, negro coffee, coffee senna.*

Uses. – In Borneo (Martapura) the wasted seeds are used as coffee. In Sumba a decoction serves against head-ache. In the Moluccas it is known as « obat gatël » ; application uncertain. Literature references and its various applications in the world are summarized by QUISUMBING (l. c.).

Note. – COLLADON published in 1816 (l. c. p. 108) a variety *aristata* in *C. occidentalis*. He saw specimens from St Domingo and Guadeloupe. DE CANDOLLE admitted this variety in 1825 (l. c.). VOGEL distinguished two varieties, « *grabra* » (recte : *glabra*) and *scabriuscula*, the latter with doubt. He made no mention of var. *aristata*. BENTHAM, in his revision of *Cassia* (l. c.) referred to none of these varieties.

HASSKARL, however, gave an extensive description of *C. occidentalis* var. *aristata* and said it occurred near Batavia. On examining HASSKARL's specimens I found them not different from specimens of *C. occidentalis* as commonly present in Malaysia, nor have I seen Malaysian material referable to any of the above-mentioned varieties.

In the synonymy given by VOGEL (Syn. Cass. 21. 1837) for *C. occidentalis* appears the name « Senna orientalis Roxb ». It seems certain that VOGEL intended to refer to *S. occidentalis* (L.) Roxb. which appears on the page quoted with the name. The epithet « orientalis » was only used by PERSOON combined with *Cassia* (Syn. 457. 1805) and repeated the name *Cassia orientalis* coined by TABERNAEMONTANUS.

For a discussion of the typification of *C. planisiliqua* L. see sub 30. *C. surattensis*.

23a. var. **schinifolia** (DC.) De Wit

C. occidentalis L. var. *schinifolia* (DC.) De Wit comb. nov.
Cassia schinifolia DC. Mém. Soc. Phys. Hist. Nat. Genève 7 : 299. 1836.
Cassia sophera var. *schinifolia* (DC.) Bentham, Fl. Austr. 2 : 283. 1864.

All characters as in *C. occidentalis* L. but leaflets generally markedly narrower and the peduncle is 10–20 mm long. The foliar gland is in shape and position similar and so are the shape and size of the bracts.

Type specimen. – Probably in Herb. Genève.

Distribution. – Of uncertain origin, possibly S. American. In Malaysia : E. New Guinea (Astrolabe Range ; Port Moresby), N. Australia.

Note. – In Flora Australiensis (*2* : 283. 1864) *Cassia schinifolia* DC. is entered as a variety in *C. sophera*. Later on, BENTHAM reduced it to the synonymy of *C. sophera* without retaining its varietal rank (Trans. Linn. Soc. *27* : 533. 1871).

Australian botanists adopted the view expressed in Flora Australiensis and retained *C. sophera* var. *schinifolia* (DC.) Benth. (e. g. WARDEN, Census New S. Wales Plants 97. 1916 and BAILEY, Compr. Cat. Queensl. Pl. 151. 1909).

C. schinifolia probably deserves no specific status but it is a distinguishable taxon. I have retained it as a variety in *C. occidentalis* but it is certainly also nearly related to *C. sophera*. The characters of the foliar gland and bracts made it preferable to remove it from *C. sophera* and to include it in *C. occidentalis*.

C. schinifolia DC. was cultivated at Bogor and collected by HALLIER in 1893 (323a-b). Grown under the climatic conditions at Bogor its characteristics proved to be constant. It seems to be indigenous in E. New Guinea and in Northern Australia and it is possibly another instance of the close convergency of Asiatic and American taxa in *Cassia*.

24. Cassia pachycarpa De Wit

C. pachycarpa De Wit sp. nov. – Fig. 3.

Species nova foliolis elliptico-oblongis, subtus pubescentibus, foliis 15–17-jugis, legumine crasso, venato-rugoso, longitudinaliter diviso a septis duobus, tamen parte dextra transversis septis multiloculato, parte sinistra vacuo, non septato.

A tree, c. 20 m tall, branchlets pubescent. Leaflets 15–17 pairs, middle pairs largest, elliptic-oblong, 4–5 cm long and 11–18 mm wide, on the upper surface shining and, when young, puberuous, lower surface rusty densely and softly pubescent, broadly rounded (tip shortly mucronate), side-nerves numerous, evident on both surfaces, margin slenderly revolute, base unequal-sided, rounded ; petiole sturdy, c. 2½ cm long, woolly pubescent, rhachis

20-22 cm long, terete, woolly brown pubescent, glandless; petiolules densely rusty pubescent, stout, c. 2 mm long. Pods on a short, thick stalk, terete, glabrous, coarsely veined, the ventral suture with two stout, rounded, longitudinal ribs, the dorsal side with a similar, single rib, ca. 30 cm long, c. 4 cm through, inside separated in two halves by two longitudinal septs, left half not septate, right transversely septate, containing c. 60 flattened, oval, c. 1½ cm long, transversely placed seeds; funicle capillary, albumen very copious, occupying the larger part of the seed.

Type specimen. – *Carr 11958* in L (SE. New Guinea, Koitaki).

Ecology. – CARR collected the type and only specimen known in a « wood by stream », at c. 500 m alt. on 19.4.1935, a specimen with fruits only.

Morphology – The hard, woody-valved pod is divided in two parts. The left is hollow, a longitudinal cavity originated by withdrawal of the endocarp towards the centre of the pod. The right side is septate, the septs are thin, distanced at 6–7 mm. The embryo in the seed is small, twisted and almost entirely surrounded by copious albumen; a ligulate excrescence emerges from the radicle between the cotyledons.

Note. – Only the fruit and leaves of *C. pachycarpa* are known but these are distinctive. The longitudinal sept in the pod indicates that it is to be placed in subgenus *Senna*. Otherwise the appearance of the pod, though it is shorter, is strikingly similar to that of *C. grandis*, a S. American species, but this has the transverse septs in the pods entire, which places it in subgenus *Cassia*. The leaflets are also strikingly similar. I have no doubt that the flowers will prove to be very different and in accordance with the floral characters peculiar to subgenus *Senna*.

25. Cassia retusa Vogel

C. retusa Vogel in Linnaea 15(1): 72. 1841; Bentham, Fl. Austral. 2: 285. 1864; Trans. Linn. Soc. 27: 555. 1871; Bailey, Comp. Cat. Queensl. Pl. 152. 1909.
Cassia horsfieldii Miquel, Fl. Ind. Bat. 1(1): 99. 1855.

A shrub or small tree; branchlets ribbed, woolly pubescent to more or less villose and glabrescent. Leaflets 6–10 slightly

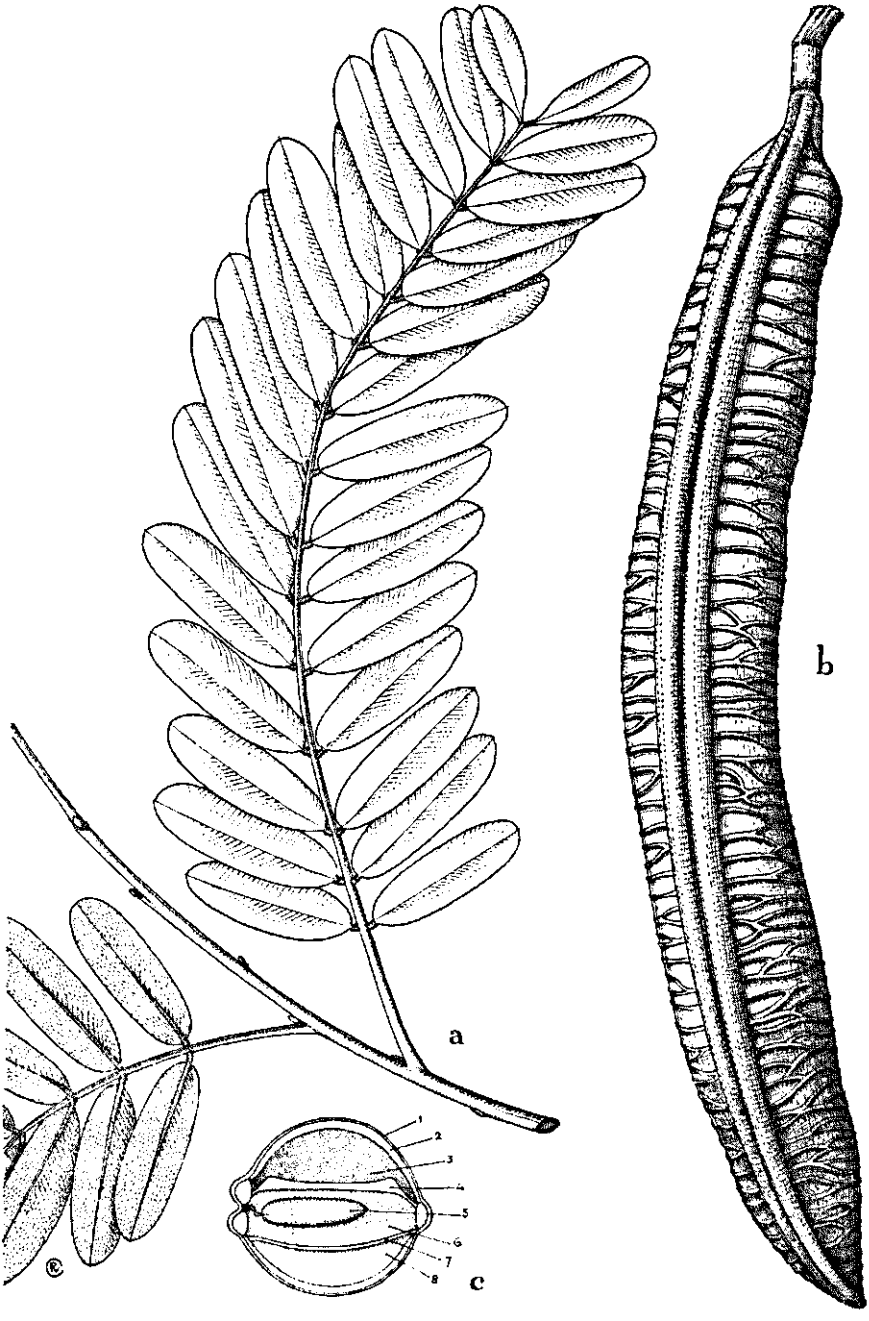

Fig. 3. – *Cassia pachycarpa* De Wit. – **a.** Leaves, × ½ – **b.** pod, × ½ – **c.** cross section through the pod showing outer layer (1), inner hard layer (2), longitudinal cavity (3), longitudinal sept (4), seed (5), transverse sept (6), second longitudinal sept (7), seedless cavity and transverse sept (8). (All drawings of the type.)

increasing pairs, chartaceous, elliptic to obovate, nearly equal-sided, (2½–)3–3½(–5) cm long, 1.2–1.8 cm wide, upper surface glabrescent to velvety, lower sparsely appressed, yellow pilose, denser so on the midrib and margin, top rounded, nearly entire to retuse (midrib not excurrent), base short or long tapering, unequal-sided, petiole stout, ribbed, yellow pubescent, 2½–3½ cm long, rhachis 7–12 cm long, bearing a slender, stiped, c. 2 mm long gland between 1–4 pairs of the lower petiolules, produced in a short mucro, ribbed, pubescent; petiolules tomentose, sturdy, 2 mm long. Stipules linear-falcate, pubescent, c. 15 mm long, persistent. Racemes axillary, solitary, peduncle straight, stout, ribbed, pubescent, 6–8 cm long, rhachis c. 1 cm long, 6–10 flowered. Bracts ovate, 8–10 mm long, acute, puberulous, not reflexed, persistent, sometimes with an axillary gland. Flowers subumbellately arranged, on 2½–3 cm long, pubescent pedicels. Sepals: 2 outer smaller, blunt, c. 6 mm long, 3 inner increasing to 8–10 mm long, broader, rounded, all nearly glabrous, minutely ciliolate on edge. Petals obovate to suborbicular, broadly rounded 15–22 mm long including the slender, 2–3 mm long claw, largely glabrous except some puberulousness on the claw and lower nerves externally. Stamens 10, apparently all fertile, filaments thick, glabrous, one 4 mm long, the others 1–3 mm, all anthers ± equal, nearly straight, 7–8 mm long, opening by lengthrims beginning with a small terminal pore. Ovary appressed pubescent, slender, stipe pubescent, rising obliquely from the disc, style glabrous, ending in an inconspicuous stigma. Pods flat, sparsely or densely pubescent, glabrescent, thin-valved, with slightly grooved suturae, strapshaped, 20–15 cm long, c. 10 mm wide, septate, 10–20-seeded, seeds lengthwise.

Type specimen. – *Solander s. n.* (holotype in BM).

Distribution. – Australia (Queensland). Malaysia: Java; Sumba (Laora); Sumbawa; Timor (Sufa); Moluccas (Obi; Halmaheira).

Ecology. – HORSFIELD first collected this species near Surakarta on Java; later BACKER found Javan specimens in April flowering in teak forest, at an altitude of 150 m. Walsh found *C. retusa* at 600 m alt. in Timor (Sufa), as a tall tree and it was frequent there.

Notes. – A specimen from the Astrolabe Range (? *Chalmers 75*,

Melbourne Herb.) had at the insertion of the stalk of the pod 5 narrow, persistent, lengthened calyx-lobes and 3 glands.

BENTHAM cited SOLANDER as the author of *C. retusa* (Trans. Linn. Soc. 27 : 555. 1871). VOGEL, however, is the first to publish the name (l. c.) and, on publishing, referred to « Mus. Brit. », not to SOLANDER. The correct author's reference is therefore « Vogel ».

C. retusa is closely allied to *C. surattensis*. It differs in being decidedly more hairy, in the shape of the leaflets (top rounded, not tapering, often obovate), in the persistent stipules and bracts. The seeds are (only ripe Australian specimen seen) disc-shaped and not much longer than wide, and there are less seeds to the pod. The specimens of the Australian continent are still more different in having smaller leaflets and as a rule a yellow pubescence (« auricoma »). On the other hand, while the presence or absence of an indument seems a good differential character, the difference in leaf-shape tends to disappear in the marginal areas and the specimens of *C. surattensis* found in New Guinea and in India show leaflets of the *retusa* kind being rounded at the top and often obovate. In a general monograph it will be necessary to decide whether *C. retusa* is to be kept as a species or is better reduced to a subspecies as regards the E. Malaysian and Australian specimens.

C. retusa in also allied to *C. timoriensis*. The ± toothed margin of the stipules is found in both species. *C. retusa* is, however, readily distinguishable by the conspicuous foliar gland.

26. Cassia siamea Lamarck

C. siamea Lamarck, Encycl. Méth. Bot. 1 : 648. 1785 ; Colladon, Hist. Cass. 114. 1816 ; Bentham, Fl. Bras. 15(2) : 126. 1870 ; Trans. Linn. Soc. 27 : 549. 1871 ; Kurz, For. Fl. Br. Burma 1 : 392. 1876 ; Baker in Hook. f. Fl. Br. Ind. 2 : 264. 1878 ; Trimen, Fl. Ceyl. 2 : 108. 1894 ; Prain, Journ. As. Soc. Beng. 66(2) : 163. 1897 ; Merrill, Philip. Journ. Sci. Bot. 5 : 51. 1910 ; Fawcett & Rendle in Fl. Jamaica 4(2) : 109. 1920 ; Rock, Legum. Pl. Hawaii 81. 1920, t. 30 ; Merrill, Enum. Philip. Fl. Pl. 2 : 264. 1923 ; Heyne, Nutt. Pl. Ned. Ind. 747. 1927 ; Craib, Fl. Siam. Enum. 1 : 513. 1928 ; Burkill, Dict. Econ. Prod. Mal. Pen. 1 : 480. 1935 ; Corner, M.A.H.A. Mag. 5 : 49. 1935 ; Ways. Trees Mal. 390, pl. 89, 90 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 37. 1941 ; Steyaert, Fl. Congo Belge 3 : 506, 1951.

Cassia florida Vahl, Symb. 3 : 57. 1794 ; De Candolle, Prodr. 2 : 499. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 288. 1834 ; Miquel, Fl. Ind. Bat. 1(1) : 98, 1855.

Cassia sumatrana Roxb. Hort. Beng. 31. 1814, nom. nud. ; De Candolle, Prodr. 2 : 506. 1825 ; Wall. Cat. 5305.

Cassia gigantea Bertero ex De Candolle, Prodr. 2 : 492. 1825.
Senna sumatrana Roxburgh, Fl. Ind. 2 : 347. 1832.
Chamaefistula gigantea G. Don, Gen. Syst. 2 : 452. 1832.
Cassia arborea Macfad. Fl. Jam. 1 : 343. 1837.
Cassia arayatensis (non Llanos) Naves in Blanco, Fl. Filip. 3rd ed. 1877-83, t. 426 ; Merrill, Sp. Blanc. 13. 1918 ; Enum. Philip. Fl. Pl. 2 : 264. 1923.
Sciacassia siamea Britton & Rose, N. Am. Fl. 23(4) : 252. 1930.

A tree, 2–20(–30) m tall, with spreading branches, young shoots ribbed. Leaflets 4–16 pairs, subcoriaceous, oblong to ovate-oblong, nearly equal-sided, recrescent, 3–7½ cm long and 12–26 mm wide, upper surface more or less glossy, glabrous or finely fugaciously puberulous, lower dull, rough to delicately puberulous (on the midrib sparsely puberulous), top rounded to retuse or blunt, often minutely mucronate, base unequal-sided, rounded to cuneate ; petiole 2½–3½ cm long, glabrescent, slightly grooved, glandless, rhachis 10–25 cm long, glabrous to puberulous, flatly channelled, glandless but with transverse bars between the petiolules, when young produced into an early caducous, slender mucro ; petiolules sturdy, glabrous or puberulous, 2–4 mm long. Stipules very early caducous, minute, subulate, pubescent, 1 mm. long. Flowers in long (up to 40 cm), erect, terminal, often leafy panicles composed of many, dense corymbs which are up to 10 cm long and 5–6 cm wide. Bracts obovate in lower half, suddenly narrowing and produced into a linear, acute top, early caducous, puberulous, c. 6 mm long. Bracteoles absent. Pedicels sturdy, 2½–3½ cm long. Sepals thick, rounded-ovate, unequal, 5–6 mm long, puberulous, repanding-reflexed, long persistent. Petals orbicular-obovate, rounded to truncate, 1½–2 cm long, the standard suddenly contracted into a 1–2 mm long claw. Stamens : the 3 lower with stout, glabrous, c. 6 mm long filaments, anthers c. 5 mm long, nearly straight, at the base deeply split, opening by a large apical pore, subrostrate, 4 lateral with 3–4 mm long filaments, anthers like the former, nearly as long, 3 upper much reduced. Ovary shortly tomentellous, style stout, glabrous, stigma subterminal, punctiform. Pods flat, strap-shaped, glabrescent, dull, alternately bulging and depressed in the centre, rims thick, finally ± dehiscent, 15–30 cm long, 12–16 mm wide, veined, 20–30-seeded. Seeds light brown, longitudinal, glossy, very flat, oval, 2 cm long, albumen copious, embryo flat.

Type specimen. – *Commerson s. n.* (? in PC ; cf. Lamarck l. c.).

Distribution. – Native in SE. tropical Asia, doubtful whether indigenous in the Malay Peninsula and in Sumatra, elsewhere only cultivated but commonly found throughout Malaysia.

Biological note. – Flowering throughout the year. CORNER described the tree as an evergreen « with rounded crown becoming straggling and misshapen with upright and drooping branches ».

Vernacular names. – Mal. Peninsula : *Busok busok, guah hitam, jaha, jahor, jeragor, johor, jual, sebusok.* Sumatra : *bujuk* (Palembang), *djohar, dulang dulang.* Borneo : *saga* (Br. N. Borneo). Java : *johar, juhar, juwar.* English : *kassod tree.*

Uses. – A favoured garden tree. It produces excellent fire-wood, the heart-wood is very hard and suitable for rulers (MOH. DACHLAN, in Bandjermasin). TRIMEN (Ceylon) judges the blackish-brown durable heart-wood to be « beautiful and useful » for small articles. In Perak, the root was tied to the neck for protective charm against convulsions. At Djakarta the leaves are used medicinally (SORGDRAGER). BÜNNEMEYER found in the Lingga Archipelago that an infusion of dried leaves was administered after child-birth. Further particulars given by HEYNE and BURKILL, ll. cc.

Note. – D. BURGER cultivated *C. siamea* at the Forest Research Station (Bogor) in 1922. The first leaves of the seedling appeared to be 1-jugate.

27. Cassia sophera Linnaeus

C. sophera Linnaeus, Sp. Pl. 379. 1753 ; Loureiro, Fl. Cochinchin. ed. Willd. 1 : 324. 1793 ; Colladon, Hist. Cass. 90. 1816 ; De Candolle, Prodr. 2 : 492. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 287. 1834 ; Junghuhn, Battaländer 21. 1847 (« Cassia stophora ») ; Miquel, Fl. Ind. Bat. 1(1) : 92. 1855 ; Bentham, Trans. Linn. Soc. 27 : 532. 1871 ; Vidal, Rev. Pl. Vasc. Filip. 116. 1886 ; Prain, Journ. As. Soc. Bengal 66(2) : 161. 1897 ; Merrill, Govt. Lab. Philip. Publ. 6 : 30. 1904 ; Philip. J. Sci., Bot. 5 : 50. 1910 ; Fawcett & Rendle, Fl. Jamaica 4 : 105. 1920 ; Merrill, Enum. Philip. Fl. Pl. 2 : 264. 1923 ; Heyne, Nutt. Pl. Ned. Ind. 747. 1927 ; Merrill, Comm. Lour. Fl. Cochinchin. 189. 1935 ; Corner, M.A.H.A. Mag. 5 : 49. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 32. 1941 ; Quisumbing, Med. Pl. Philip. Dpt Agric. Nat. Res. Techn. Bull. 16 : 384. 1951.

Cassia indica Poiret in Lam. Dict. Suppl. 2 : 127. 1811.

Cassia esculenta Roxburgh Hort. Beng. 31. 1814, *nomen nudum.*

Cassia purpurea Roxburgh Hort. Beng. 31. 1814, *nomen nudum.*

Cassia sopheroides Colladon, Hist. Cass. 133. 1816.

Senna esculenta Roxburgh, Fl. Ind. ed. Carey 2 : 346. 1832 ; ed. Clarke 353. 1874.

Senna purpurea Roxburgh l. c. 342. 1832 ; l. c. 351. 1874.

Senna sophera Roxburgh l. c. 347. 1832 ; l. c. 353. 1874.

Chamaefistula sophera Don, Gen. Syst. 2 : 452. 1832.

Cassia atroviridis Spanoghe in Linnaea 15 : 201. 1841.

Cassia atropurpurea Span. ex Benth. Trans. Linn. Soc. 27 : 533. 1871 (err. pro *C. atroviridis* Span.).

An erect shrub, diffusely branching, 1–3 m tall, living a few years. Leaflets 4–10(–12) accrescent pairs, membranous, oblong to ovate-oblong or lanceolate, somewhat unequal-sided, 3–9 cm long, 1 ½–2 ¾ cm wide, upper surface dull, glabrous, lower surface ± glabrous, glaucous, margin very shortly ciliate, not purple, midrib very shortly, persistently excurrent, top acute, base obliquely rounded to cuneate; petiole 4–5 cm long, glabrescent, shallowly channelled, bearing a single, large, narrow, ± clavate gland above its insertion, rhachis 10–16 cm long, glandless but with transverse rows of hairlets between the petiolules, produced into a short, stout mucro beyond the upper petiolule; petiolules nearly glabrous, slender, about 2 mm long. Stipules ovate, caducous, ± glabrous, about 6 mm long. Flowers in axillary, distinctly peduncled, 4–10-flowered corymbs; peduncle ½–1 ¾ cm long, roughly pubescent like the 10–14 mm long pedicels. Bracts ovate, 4–5 mm long, ± acute, pubescent. Bracteoles absent. Sepals ovate, rounded, about 6 mm long, finely puberulous and glabrous. Petals orbicular to obovate, rounded, 12–14 mm long and about 7 mm wide, gradually narrowing towards the base, ± clawed. Stamens: the 3 lower with glabrous, 6–7 mm long filaments, anthers about 6 mm long, rostrate, curved, opening by apical pores; 4 (or 3) lateral with 2 mm long filaments and equally long but narrower, otherwise similar anthers, 3 or 4 stamens much reduced. Ovary shortly pubescent, style glabrous, stigma slightly swollen. Pods terete or at least swollen, slightly curved or straight, sutures slender but margins broad, light-coloured, 9–10 cm long, ½–1 cm through, transversely and longitudinally septate, glabrous, ± glossy, 30–40-seeded. Seeds ovoid, differently compressed, pointed at the hilum, 4 mm long, dull, brown-olive; albumen copious, embryo warped, funicle capillary, applied with a broadened end to the hilum.

Type specimen. – In *Herb. Hermann* (BM; cf. FAWCETT & RENDLE, Fl. Jamaica *4*(2): 105. 1920).

Distribution. – As an introduction throughout Malaysia. I have seen no specimens from the Malay Peninsula; in the Philippines only on Luzon so far.

Ecology. – An « occasional weed », at low and medium altitudes (on Timor to 1250 m).

Vernacular names. – Java : *Entjèng, antjèng, tèpèng.* Ternate : *daun santri.* Sumba : *landu kakakuda.* Philippines : *andadasi.*

Uses. – There are contradictory reports on its poisonous properties (cf. HURST, Pois. Pl. N. S. Wales 150. 1942). It is used by the Batta's (Sumatra) against scabies or scabies-like skin eruptions.

It is repeatedly reported as an anti-diabetic. QUISUMBING summarized its medical applications (l. c.).

Note. – MIQUEL (l. c.) placed with doubt *C. atroviridis* Span. with *C. alata* L. but this is inadmissible as is clear from SPANOGHE's description of the pod. BENTHAN coined « C. atropurpurea Span. » due to a slip of the pen. He referred later on (l. c. p. 534) correctly to *C. atroviridis* Span. and thought it synonymous with *C. sophera* L., which is certainly correct.

BENTHAM (l. c.) is uncertain whether *C. sophera* is « really any more » than a variety of *C. occidentalis* and whether *C. sophera* « had or had not its origin in the Old World ».

In CORNER's opinion it is « native of tropical Asia » but MERRILL (l. c.) thinks it « of American origin ». I consider it to be not indigenous in Malaysia.

28. Cassia spectabilis DC.

C. spectabilis De Candolle, Cat. Hort. Monsp. 90. 1813 ; Colladon, Hist. Cass. 115. 1816, t. 7 ; Bentham, Trans. Linn. Soc. 27 : 529. 1871 ; Corner, Ways. Trees Mal. 2nd Ed. 727. 1952 ; Steyaert, Fl. Congo Belge 3 : 506. 1952.

A small, evergreen tree, with long, spreading, leafy, terete, smooth branches containing much marrow ; young parts softly pubescent. Leaflets 10–15 slightly increasing pairs, chartaceous, ovate-oblong to narrowly elliptic, slightly unequalsided, 4–6(–8½) cm long, 1½–2(–2½) cm wide, puberulous on the upper, shiny surface, pubescent on the dull, lower surface, top acute, mucronate, base obliquely rounded ; side-nerves numerous, evident on both surfaces ; petiolules slender, 3 mm long ; petiole about 3 cm long, terete, rhachis 20-30 cm long, with 2 parallelous ribs, pubescent, glandless. Stipules linear, curving, early caducous, pubescent, about 1 cm long. Racemes along the ends of the branches arranged in large leafy panicles, solitary, axillary, 6–12 cm long ; peduncle up to about 2 cm long, like the rhachis velutinous.

Bracts ovate, small, early caducous. Flowers medium, bright yellow, finally turning white, 3–4 cm across, on velutinous 2½–3 cm long pedicels. Sepals : two outer pubescent, three inner larger, somewhat petaloid, membranous, flabby, glabrous, about 7 mm long. Petals shortly clawed, the lower largest, oblique, incurved, about 2–2½ cm long. The lateral and upper ones smaller, spathulate. Stamens : 7 fertile, equally long. Filaments sturdy, 2–3 mm long. Anthers slightly widening towards the rounded, biporous top, each theca with a lateral slit, dorsally grooved near the base. Staminodes 3. Ovary slender, glabrous, recurved. Style inconspicuous, fringed with minute ciliae. Pods on a short stalk, glossy black, nearly terete, glabrous, annulate, septate, more than 1 cm through, 18–23 cm long, tardily dehiscent, 50–70-seeded. Seeds olive, ± orbicular, pointed at the radicle, 5 mm across, enveloped by longitudinal, papery septs, pleurogram elliptic, distinct ; funicle straight, capillary, about 4 mm long ; albumen in water jelly-like, copious.

Type specimen. – Probably in G, Herb. De Candolle.

Distribution. – Of Central American origin (cf. PITTIER, Trab. Mus. Com. Venez. **3** ; 148. 1928).

Uses. – Cultivated in various parts of Malaysia and an increasingly used, beautiful ornamental.

29. **Cassia splendida** Vogel

C. splendida Vogel, Syn. Cass. 17. 1837 ; Bentham, Fl. Bras. **15**(2) : 105. 1870 ; Trans. Linn. Soc. **27** : 524. 1871 ; Corner, Ways. Trees Mal. 390. 1940.

A shrub ; branchlets terete, glabrous. Leaflets 2 accrescent pairs, firmly chartaceous, oblong to elliptic-oblong, equal-sided or nearly so, 4–8 cm long and 3–3½ cm wide, upper surface nearly shiny, lower surface dull, both glabrous and with numerous prominent side-nerves ; top blunt or rounded, sometimes emarginulate, base broadly cuneate to rounded ; petiole slender, about 2 cm long, glabrous, glandless, rhachis 1–1½ cm long, slender, with a 3–5 mm long, stout gland between the lowest, slender, glabrous, 2 mm long petiolules. Stipules leafy, inserted very close to the insertion of the leaf, subpersistent, 10–13 mm long, 5 mm wide, oblong,

acuminate, curving, nerves evident on both glabrous surfaces. Racemes axillary, solitary, numerous at the end of slender branches and there forming a leafy panicle, 5–8 flowers. Bracts ovate-oblong, nearly glabrous, subpersistent, 2 mm long. Bracteoles absent. Hypanthium cup-shaped, nearly glabrous, solid. Flowers large, 5–12 along a stout, 5–8 cm long (including the peduncle) nearly glabrous rachis, on 3–4 cm long, nearly glabrous pedicels. Calyx glabrous. Sepals increasing, 6 to 15 mm long, veined, membranous, more or less elliptic, broadly rounded. Petals broadly obovate, rounded, up to 4½ cm long and 2 cm wide, sessile or very shortly clawed, finely puberulous, especially on the nerves. Stamens : 2 anterior lateral with 10 mm long, slender filaments and a curved, 12 mm long, beaked, at the top biporous anther ; 5 with a 3–5 mm long filament and similar, though smaller anther. Staminodes 3, comparatively large. Ovary with an indistinct stipe and style, very long and slender, glabrous. Style increased at the top but the stigma small, subterminal, inconspicuous. Pods (not seen) nearly terete and smooth, many-seeded, slender, 15–45 cm long, over 1 cm through.

Type specimen. – *Sellow s. n.*, inter Rio et Bahia (loc. preserv. typ. sp. unknown).

Distribution. – Brazil. Introduced into the Malay Peninsula.

Morphological note. – The stout pedicels, in dry specimens, are shrunk considerably at the base and at the top. Axillary trichomes are present. In dried material the margins of the leaflets are revolute at the base. The solid cup-shaped hypanthium might be interpreted as an increased disc. The stipe is connate with it and emerges laterally; possibly this is, in some degree, to be compared to the swollen disc and « lateral » ovary in *Lasiobema* (*Bauhinieae*).

Uses. – Here and there grown in gardens ; apparently so far only in the Malay Peninsula. A very beautiful ornamental.

30. **Cassia surattensis** Burmann f.

C. surattensis Burmann f. Fl. Ind. 97. 1768 ; Colladon, Hist. Cass. 105. 1816 ; Merrill, Enum. Philip. Fl. Pl. 2 : 265. 1923 ; Heyne, Nutt. Pl. Ned. Ind. 748. 1927 ; Corner, Ways. Trees Mal. 2nd Ed. 390. 1952.

Wellia tagera Rheede, Hort. Mal. 6 : 1686, t. 9–10.

Cassia glauca Lam. Encycl. 1 : 647. 1785 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 289. 1834 ; Vogel, Syn. Cass. 26, 1837 ; Hasskarl, Pl. Jav. rar. 406. 1848 ; Miquel, Fl. Ind. Bat. 1(1) : 96. 1855 ; Bentham Trans. Linn. Soc. 27 : 532, 555. 1871 ; Baker in Hook. f. Fl. Br. Ind. 2 : 265. 1878 ; Fernandez-Villars, Nov. App. 71. 1880 ; Naves in Blanco, Fl. Filip. ed. 3 : 1877-83, t. 426 bis ; Vidal, Rev. Pl. Vasc. Filip. 115. 1886 ; Prain, Journ. As. Soc. Bengal 66(2) : 157. 1897 ; Merrill in Philip. Journ. Sci. Bot. 5 : 49. 1910 ; Rock, Legum. Pl. Hawaii 81. 1920, t. 31 ; Ridley, Fl. Mal. Pen. 1 ; 616. 1922 ; Heyne, Nutt. Pl. Ned. Ind. 748. 1927 ; Corner, M.A.H.A. Mag. 5 : 47. 1935 ; Burkill, Dict. Econ. Prod. Mal. Pen. 1 : 481. 1935 ; Steyaert, Fl. Congo Belge 3 : 510. 1951.

Cassia arborescens Vahl, Symb. Bot. 3 : 56. 1794 ; Willdenow, Sp. Pl. 2 : 520. 1799.

Cassia sulphurea De Candolle ex Colladon, Hist. Cass. 84. 1816 ; Hasskarl, Flora 25 : 1842, Beibl. 2 : 92. 1842.

Senna arborescens (Vahl) Roxburgh, Fl. Ind. ed. Carey 2 : 345. 1832 ; ed. Clarke 352. 1874.

Cassia planisiliqua (non L.) sensu Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 23. 1941.

A shrub or small tree, 2–7 m tall, with glabrous or puberulous, smoothly ribbed branches. Leaflets 4–7 accrescent pairs, membranous to chartaceous, ovate to ovate-oblong, nearly equal-sided, 3–10 cm long, 1½–5 cm wide, upper surface glabrous, lower very sparsely appressed pubescent, glaucous, top tapering, blunt, ± emarginate (midrib scarcely excurrent), base cuneate to rounded ; petiole sturdy, 4–5 cm long, appressed puberulous, rhachis c. 15 cm long, produced beyond the upper petiolules as a caducous, triangular mucro, not channelled, between (1–)2–4 of the lower pairs with a clavate, c. 2 mm long gland ; petiolules tomentose, 3 mm long. Stipules linear-falcate, puberulous, 7–10 mm long, subpersistent. Racemes 5–13 cm long, 10–20 flowered ; peduncle 6–7 cm long, sparsely puberulous. Bracts ovate-acute, c. 6 mm long, finally reflexed, tardily caducous, sometimes with an axillary gland. Flowers on 2¼–4 cm long, sparsely puberulous pedicels. Sepals : 2 outer broadly-ovate to orbicular, c. 5 mm long, 3 inner increasing to 7–8 mm in length, glabrous but minutely ciliate on edge. Petals ovate-oblong, rounded, 2–3 cm long, blade narrowing into a 2–3 mm long, slender claw, externally locally finely appressed puberulous. Stamens 10, apparently all fertile, filaments thick, glabrous, one 4 mm long, the others 1–2 mm, all anthers ± equal, straight, 8 mm long, with lateral, longitudinal rims, opening by a length-slit. Ovary appressed pale puberulous, slender, recurved, style suddenly ending into an inconspicuous stigma. Pods flat, glabrous, dull, thin-valved, dehiscent, strap-shaped,

straight or curved, 15–20 cm long, 12–18 mm wide, septate, 20–35-seeded, seeds lengthwise. Seeds blackish, glossy, smooth, flattened, 9–10 mm long, 4 mm wide ; albumen copious, embryo flat, funicle straight, capillary, 4 mm long.

Type specimen. – In Herbarium Garcin (prob. in G).

Distribution. – Indigenous in SE. Asia, in the Malay Peninsula, Sumatra, and Java. Cultivated, perhaps throughout the tropics.

Note on the distribution. – RIDLEY and CORNER doubt if *C. surattensis* is indigenous in the Malay Peninsula. BACKER put it among the species indigenous in Java and peculiar to the teak forests, though he stressed its occurrence as a cultivated tree. I am in favour of considering *C. surattensis* to be indigenous in the SE. Asiatic continent, being introduced into Malaysia. Its counterpart, *C. retusa* is found in NE. Australia and eastern Malaysia to E. Java, and *C. surattensis* and *C. retusa* are to be regarded as examples of closely allied taxa occupying widely separated areas (cf. Note under *C. fistula*).

Ecology. – From sealevel to c. 200 m alt. Favouring teak forest climates and marl soils.

Biological note. – BEUMÉE noted (at Rembang, Java) that one year old specimens attained a height of c. 2 m and flowered.

The flowers are bright or pale yellow, also described as « pale primrose with faint greenish-yellow veins » (PRAIN l. c.).

A clavate, acute gland may occur on each side of the base of the pedicel, at its insertion, inside the bract.

Vernacular names. – Mal. Peninsula : *Gelenggang*. Moluccas : *kembang kuning*. English : *Glaucous cassia*.

Uses. – It was planted in mixed afforestations with Tectona. In the Philippines it is « widespread in cultivation as a shade tree » (Merrill, 1923). Rock (l. c.) found it, in Hawaii, « useful as a nedge plant ».

Note on typification. – According to BENTHAM (Trans. Linn. Soc. *27* : 532. 1871) « the plant representing C. planisiliqua in the Linnean Herbarium is *C. siamea*, which is certainly not the one from which he took his diagnosis ». *C. planisiliqua* L. is to be interpreted from the Linnean description first of all.

This description is nearly verbatim the same as A. VAN ROYEN's (Fl. Leydensis Prodr. 468. 1740, no 11). VAN ROYEN added that « siliquae lineares sunt, compressae, et ad semina torosae, suturis

utrinque prominulis ». LINNAEUS and VAN ROYEN add, as the only synonym « Plumier spec. 18 ».

I support BENTHAM's view that *C. planisiliqua* is to be based on the Linnean description and as this is identical with VAN ROYEN's (possibly a slightly improved repetition of it), the plant VAN ROYEN had should be accepted as the type specimen. That VAN ROYEN described a specimen at his disposal is reasonably certain. His *Cassia* no 11 is the only one which is furnished with a special observation (« obs. »), a remark he may have made with the intention to amend PLUMIER'S bad plate (cf. BENTHAM l. c.) from a knowledge he can only have acquired from some specimen(s). I have, however, not found specimens in VAN ROYEN's herbarium at Leyden.

BENTHAM concluded that LINNAEUS (and VAN ROYEN !) refer(s) to *C. occidentalis* L., which is very probably correct and *C. planisiliqua* L. is thus best reduced to the synonymy of the former (l. c. p. 532). I have, for this reason, not followed BACKER (Bekn. Fl. Java, em. ed. 5, fam. 118 : 32. 1941), who used the name *C. planisiliqua* L. for *C. surattensis* Burm. f. These are two different species.

COLLADON (and DE CANDOLLE) referred *C. surattensis*, after examining the type to *C. auriculata* L. (Hist. Cass. 105. 1816). However, DE CANDOLLE later declared *C. surattensis* to be identical with *C. glauca* Lam. (Prodr. *2* : 495. 1825). His view has been adopted by numerous authors (e. g. MIQUEL, BENTHAM, BACKER, and PRAIN) but « C. surattensis » has been rarely used, though it is the correct name.

30a. forma **ferox** De Wit.

forma *ferox* De Wit forma nova.

Forma Cassiae surattensis foliolis acutis, floribus minoribus, inflorescentiis elongatis ad 16–20 cm longis distincta. Bractearum angustarum in axillis glandulas agit. Ovaria tota velutina.

Type specimen. – bb. 21.434 = C.N.A. *de Voogd 2850* (Herb. Bogoriense).

Distribution. – Flores, near Manggarai (type) and Timor (*Jonkers 291*).

Note. – I have no doubt that this form is due to growth under exceptional circumstances.

31. Cassia timoriensis DC.

C. timoriensis De Candolle, Prodr. 2 : 499. 1825 ; Decaisne, Herb. Timor. descr. 17. 1835 ; Vogel, Syn. Cass. 35. 1837 ; Schlechtendal, Linnaea **15** : 201. 1841 ; Hasskarl, Flora **25** : Beibl. 2 : 97. 1842 ; Pl. Jav. rar. 407. 1848 ; Miquel, Fl. Ind. Bat. **1**(1) : 99. 1855 ; Bentham, Trans. Linn. Soc. **27** : 550. 1871 ; Heyne, Nutt. Pl. Ned. Ind. 748. 1927 ; Burkill, Dict. Econ. Prod. Mal. Pen. **1** : 481. 1935 ; Corner, M.A.H.A. Mag. **5** : 50. 1935 ; Ways. Trees Mal. 390. 1940 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 38. 1941 ; Meijer Drees in Comm. For. Res. Stat. Bogor **33** : 69. 1951.

Cassia exaltata Reinw. ex Blume, Cat. Gew. Buitenz. 68. 1823 ; Spanoghe, Linnaea **15** : 201. 1841, *nomen nudum*.

Cassia arayatensis Llanos, Fragm. 71. 1851 ; F.-Vill. & Naves in Blanco, Fl. Filip. ed. **3**(4) : 55. 1880 ; Merrill, Sp. Blanc. 173. 1918.

Cassia montana (non Heyne) Naves in Blanco, Fl. Filip. ed. **3** : 1880-83, t. 452 ; Merrill, Sp. Blanc. 173. 1918.

A tree, 4–12 m tall, young parts delicately yellow tomentose. Leaflets 10–20 pairs, subchartaceous, oblong, nearly equal-sided, 1½–5½ cm long, 8–17 mm wide, dull on both surfaces, on the upper surface glabrous to silky yellow pubescent, on the lower sparsely to densely delicately yellow pubescent to ± glabrous, top and base rounded (midrib excurrent in a subulate, 1 mm long mucro, ± glabrous to conspicuously spreadingly yellow pubescent, marginal nerve evident, side-nerves very slender, inconspicuous) ; petiole 1½–2½ cm long, yellow pubescent, ribbed or grooved, rhachis 13–20 cm long, yellow pubescent, ribbed or grooved, glandless though often with a spot of glandlike hairs between the petiolules ; petiolules slender, yellow pubescent, 2 mm long. Stipules linear-acute, about 9 mm long, tardily caducous, auriculate-pointed or -falcate, often lobed or dentate, about 8 mm long. Racemes numerous, axillary, on leafy twigs, 4–12 cm long, peduncle yellow, 1½–2 cm long. Flowers medium, on about 2–3 cm long, pubescent pedicels. Bracts linear-acute, 3–4 mm long, yellow pubescent, early caducous. Bracteoles not seen. Sepals : two lower ovate, about 5 mm long, externally yellow pubescent, acutish, 3 inner increasing to 1 cm in length, broadly ovate, all rounded. Petals obovate, 1½–2½ cm long, blade narrowing to an about 2 mm long claw, glabrous. Stamens : 2 lower (lateral) largest, filaments glabrous, 2–3(–5) mm long, anthers 8 mm long, subrostrate, nearly straight, opening by a double apical pore ; 1 (lower, outer) and 4 upper nearly equal but slightly smaller than

the former; 3 reduced stamens. Ovary nearly glabrous, slender, style sturdy, stigma inconspicuous. Pods flat, glabrous, thin-valved, dehiscent, septate, strap-shaped, 6–15 cm long, about 1½ cm wide, beaked, sutures scarcely raised, 10–20-seeded. Seeds lengthwise, brown, glossy, smooth, flattened, pointed at the hilum, pleurogram elliptic, 6 mm long; funicle capillary from a broad base, deeply curved, 3–5 mm long; albumen copious, appressed to the testa.

Type specimen. – To be designated in PC.

Distribution. – Malay Peninsula (Selangor, Perak, Kedah) and further throughout Malaysia. Also in tropical Australia, Ceylon, Burma, and SE. Asia generally.

Ecology. – Wild on limestone hills (CORNER, Mal. Pen.). A slender tree in dry savannahs (MIQUEL) or in open forest on grassy areas (BACKER). More common in E. and Central Java than in W. Java. Occurring from sea-level to 1100 m and flowering throughout the year. MEIJER DREES said that it was never wholly deciduous in Timor but fire-resistant, common in all types of monsoon forests, and found up to 1000 m in the *Santaletum*. In E. Sumbawa it was rare.

Biological note. – I noted at Buitenzorg that the flowers had a sweet, though weak, scent.

Vernacular names. – Mal. Peninsula: *Bebatai, baksa, bereksa, sinteng hutan*. Sumatra: *kriwang rimbau* (Djambi), *riengging*. Java: *aringin, ehèng, hing, njinging, waringinan, turèn*. Timor: *ai faluk, kenamoh, kistemah, krui*. Sumbawa: *salamiau*. Sumba: *dorre*. Flores: *keturu*. Celebes: *welampessi*. English: *limestone Cassia*.

Uses. – Planted as a wayside tree. In Timor it was found suitable in mixed afforestations for soil protecting purposes (MEIJER DREES l. c.). It was observed to be useful as a restorer of destroyed « blukar ».

31a. forma **xanthocoma** (Miq.) De Wit.

forma *xanthocoma* (Miq.) De Wit stat. nov. – var. β *xanthocoma* Miquel, Anal. Ind. 1: 10. 1850.

In all characters agreeing with forma *timoriensis* but the whole plant covered by a golden pubescence.

Type specimen. – *Herb. Lugd. Bat. 908.114-28* (holotype in L).

Distribution. – Throughout the area of distribution of the species.

Vernacular names. – Sunda : *Laringhin.* Java : *iningin, ihing.* Kangean : *toroj-torojan.*

Note. – MIQUEL distinguished a golden hairy specimen of *Cassia timoriensis* from Borneo as variety *xanthocoma.* Similar specimens may occur in various places and represent a variability in hairiness as is often seen in species of *Cassia.* They are best designated as a form, not a variety.

32. Cassia tomentosa Linnaeus f.

C. tomentosa Linnaeus f. Suppl. 231. 1781 ; Lamarck, Dict. 1 : 647. 1785 ; Persoon, Syn. Pl. 1 : 458. 1805 ; De Candolle, Prodr. 2 : 496. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 286. 1834 ; Hasskarl, Pl. Jav. rar. 410. 1848 ; Miquel, Fl. Ind. Bat. 1(1) : 94. 1855 ; Bentham, Trans. Linn. Soc. 27 : 528. 1871 ; Baker in Hook. f., Fl. Br. Ind. 2 : 263. 1878 ; Trimen, Fl. Ceyl. 2 : 106. 1894 ; Rock, Legum. Pl. Hawaii 81. 1920 ; Corner, M.A.H.A. Mag. 5 : 50. 1935.

A tall shrub, up to 4 m tall, entirely softly velutinous, twigs terete. Leaflets 4–8 pairs, chartaceous, oblong to elliptical, very unequal-sided, 2–3 cm long, c. 1 cm wide, densely grey woolly tomentose on the lower surface, upper surface thinly so, base very oblique, top rounded (mucronate, the midrib being excurrent) ; petiole terete, woolly tomentose, c. 1 cm long, glandless, rhachis 5–8 cm long, bearing small, conical, sessile glands between some or all pairs of leaflets, produced into a very caducous mucro ; petiolules stout, very short, densely tomentose ; stipules linear-acute, very early caducous, woolly tomentose, c. 5 mm long. Racemes terminal, aggregate in small, leafy panicles, corymbiform, 2–5-flowered. Flowers on 1½–2 cm long, tomentose pedicels. Bracts caducous, ovate, acute, 5 mm long, tomentose externally. Sepals : 2 outer much the smaller, oblong, hirsute, top rounded, 7 mm long ; 3 inner membranous, largely glabrous, 7–9 mm long. Petals obovate to spathulate, 10–13 mm long, sessile to shortly clawed. Stamens : 2 longest with 6–8 mm long glabrous filaments ; anthers 7–8 mm long, curved, apiculate, opening by apical pores, lateral rims present, one stamen with a 4–5 mm long filament and similar anther, 4 stamens with c. 3 mm long filaments and similar but straighter and 4–5 mm long anthers, 3 stamens reduced with small empty anthers. Ovary on a slender short stipe which is laterally adnate to the disc but free at the top, woolly tomentose but on the sutures near the top glabrous, style glabrous,

stigma punctiform. Pods ± straight, 10–14 cm long, somewhat compressed, 10–15 mm through, thinly tomentose, annulate with smoothly swollen margins, septate, 50–90-seeded. Seeds olive, compressed, pointed at the radicle, c. 5 mm long, transverse.

Type specimen. – Holotype in LINN *no 528.23*.

Distribution. – Tropical America. Occasionally cultivated mainly in the tropics. Malaysia : Mal. Peninsula.

Ecology. – The flowers are « deep golden yellow » (Corner).

Note. – I have seen no specimens from Indonesia.

33. **Cassia tora** Linnaeus

C. tora Linnaeus, Sp. Pl. 376. 1753 ; Loureiro, Fl. Cochinchin. ed. Willd. **1** : 322. 1793 ; Colladon, Hist. Cass. 96. 1816 (vide ib. pro ref. lit. prae-Linn.) ; De Candolle, Prodr. **2** : 493. 1825 ; Bentham in Fl. Bras. **15**(2) : 115. 1870 ; Trans. Linn. Soc. **27** : 535. 1871 ; Prain, Journ. As. Soc. Bengal **66**(2) : 158, 475. 1897 ; Gagnepain, in Lec. Fl. Gén. Indo-Ch. **2** : 163. 1913 ; Fawcett & Rendle, Fl. Jamaica **4**(2) : 105. 1920 ; Heyne, Nutt. Pl. Ned. Ind. 748. 1927 ; Williams, Fl. Trinidad & Tobago **1**(4) : 272. 1931 ; Merrill, Comm. Lour. Fl. Cochinchin. 189. 1935 ; Corner, M.A.H.A. Mag. **5** : 50. 1935 ; Burkill, Dict. Econ. Prod. Mal. Pen. **1** : 481. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 35. 1941 ; Quisumbing, Med. Pl. Philip. Dept Agric. Nat. Res. Techn. Bull. **16** : 385. 1951 ; Steyaert, Fl. Congo Belge **3** : 512. 1952.

Gallinaria rotundifolia Rumphius, Herb. Amb. **5** : 283. 1747, pl. 97, f. 2.

Cassia tala Desvaux in Morot, Journ. Bot. **3** : 73. 1814, t. 73.

Cassia gallinaria Colladon, Hist. Cass. 96. 1816.

Cassia humilis Colladon, Hist. Cass. 96. 1816.

Senna tora Roxburgh, Fl. Ind. ed. Carey **2** : 340. 1832.

Cassia borneensis Miquel, Anal. Bot. Ind. **1** : 9. 1850 ; Merrill, Bibl. Enum. Born. Pl. 300. 1921.

Cassia tora γ *borneensis* Miquel, Fl. Ind. Bat. **1**(1) : 95. 1855.

Emelista tora Britton & Rose, Sci. Surv. Porto Rico **5** : 371. 1925 ; N. Am. Fl. **23**(4) : 242. 1930.

An erect, foetid, subglabrous, usually annual, often profusely branching herb or undershrub, 30–120 cm tall ; ramifications light-coloured, terete, nearly glabrous, Leaflets 3 accrescent pairs, membranous, obovate, nearly equal-sided, the larger 2½–5 cm long and 1½-2½ cm wide, both surfaces finely pubescent, glabrescent or glabrous, top broadly rounded but the tip delicately acute (midrib slightly excurrent, margins thin, pubescent), base oblique, cuneate to rounded ; petiole 1½–4 cm long, ribbed and grooved, sparsely pubescent, glandless ; rhachis 1½–3 cm long, produced into a very short, subulate, pubescent, caducous mucro beyond the upper petiolules, bearing a slender, cylindric, 2 mm

long gland between both lower pairs of petiolules ; petiolules very short, pubescent. Stipules linear, membranous, roughly pubescent, long-acute, falcate, 10-15 mm long and about 1 mm wide, subpersistent. Racemes short, peduncle pubescent, about 3–4 mm long, bearing a single pair of flowers, axillary, usually solitary, a few assembled near the top of the twig ; bracts linear-acute, 2–4 mm long ; pedicels 4–10 mm long (in fruit up to 1½ cm), pubescent. Sepals membranous, narrowly ovate, blunt or rounded, 5–6 mm long, in the centre pubescent. Petals unequal, narrowly ovate, top rounded (standard retuse), narrowed towards the base (sessile or nearly so), 8–10 mm long. Stamens 7 developed, 3 largest on slender, glabrous, 2 mm long filaments, anthers 2–2½ mm long, opening by a double, apical pore (top not produced, base knob-like produced at the attachment of the filament), 4 lateral on similar, 1¼–1½ mm long, anthers similar, about 1½ mm long, 3 upper absent or staminodial. Ovary appressed, densely pubescent, ribbed, style glabrous, stigma the truncate ending. Pods terete, (subtetragonous), glabrescent, dull, thin-valved, often curved, indehiscent, 10–15 cm long, 4–6 mm through. Seeds rhomboidal, glossy, 20–30-seeded, dark, 5 mm across, longitudinal, funiculus capillary, undulate, albumen copious, embryo involute.

Type specimen. – Holotype in LINN *no 528.9*.

Distribution. – A weed throughout the tropics, probably of S. American origin, not indigenous in Malaysia.

Ecology. – Occurring between 100–400 m altitude in dry or marshy stations, sometimes on peaty soils or on dry, untilled sawahs, near the sea or inland, rarely in teak forests.

Uses. – Young leaves are eaten (Bawean Arch. ; Sumatra). On Timor it is believed to improve the soil on which it grows. In India, the roasted seeds serve as coffee. For detailed information see HEYNE and BURKILL ll. cc. QUISUMBING (l. c.) surveyed its pharmaceutical properties and medicinal applications.

Vernacular names. – Mal. Peninsula : *Gelenggang padang, gelenggang ketchil, kundu thakarai.* Sumatra : *gelingang, galinga padang, idarang (edarang) alas.* Java : *entjeng-entjeng, kebo, ketepeng, ketepeng sapi, ketepeng tjilik, orok, tepeng.* Timor : *papoös.* Ambon : *katiang, kajoe.* Philippines : *andadasi, andadasi-ngadadakkel, balatong-aso, baho-baho, kalu-kalu, katanda, katanda-aso, monggo-monggohan.* English : *foetid Cassia.*

Note. – See under *Cassia obtusifolia.*

Subgenus 3. **Lasiorhegma** (Vogel) Bentham

Bentham in Fl. Bras. 15(2): 86, 129. 1870; Trans. Linn. Soc. London 27; 513, 558. 1871.

Cassia sectio *Absus* De Candolle in Colladon, Hist. Cass. 82: 116. 1816.

Cassia sectio *Lasiorhegma* Vogel, Syn. Cass. 49. 1837; Linnaea 11(2): 692. 1837.

Herbs or (in Malaysia) rarely small trees. Leaves gland-bearing. Sepals acute. Bracteoles present. Stamens 10 perfect, rarely 5. Filaments of the stamens short, about equal. Anthers opening by apical pores, sometimes gradually splitting lengthwise. Pods flat, dehiscent. Seeds longitudinal, not embedded in pulp. Funicle short, increased, triangular or capillary and deeply curved.

Type species. – *Cassia absus* L. Sp. Pl. 376. 1753.

Distribution. – Mainly in S. America, also in Africa, possibly not indigenous in Malaysia.

Key to the species

1. Leaflets 2 (or 1) pairs, plants viscid, hairy. Stamens 5; no staminodes. 34. **C. absus**
1. Leaflets 6–40(–85) pairs, plant not viscid. Stamens usually 10, rarely 9 to 7 or 5.
   2. Foliar gland sessile. Stamens 10(–7).
      3. A tree. Pods 3–4-seeded. Leaflets, 4–5 mm wide, 10–14 pairs, between uppermost 1–4 pairs a caducous gland. 37. **C. mindanaensis**
      3. Herbs. Pods 8–15-seeded. Leaflets as a rule more than 15 pairs, glandless between the upper pairs, 0,8–2½ mm wide.
         4. Leaf-rhachis grooved; edges of the furrow not raised. Foliar gland(s) 1–2, on top of the petiole or not. Middle leaflets 7–25 mm long. Seeds ± as long as wide.
            5. Foliar gland single. Leaflets ciliate, otherwise glabrous, side-nerves evident on both sides of midrib. Two petals with basal red spots . . . . . 35. **C. lechenaultiana**
            5. Foliar glands 1–2. Leaflets delicately pubescent on both surfaces, side-nerves evident on 1 side of the midrib. Petals concolorous, yellow . . . . . 38. **C. patellaria**
         4. Leaf-rhachis seemingly serrate (edges of the furrow raised, closed or nearly so). Foliar gland single, between or touching at the lowest pair of petiolules. Leaflets 4–8 mm long and 0.8–1.3 mm wide. Seeds nearly twice as long as broad. 36. **C. mimosoides**
   2. Foliar gland distinctly stiped. Stamens 5 . . . . 39. **C. pumila**

34. Cassia absus Linnaeus

C. absus Linnaeus, Sp. Pl. 376. 1753 ; Burman, Fl. Ind. 95. 1768 ; Roxb. Hort. Beng. 31. 1814 ; Colladon, Hist. Cass. 117. 1816 (see there for pre-Linn. lit.) ; De Candolle, Prodr. 2 : 500. 1825 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 291. 1834 ; Vogel, Syn. Cass. 50. 1837 ; Miquel, Fl. Ind. Bat. 1(1) : 100. 1855 ; Bentham, Trans. Linn. Soc. 27 : 558. 1871 ; Baker in Hook. f. Fl. Br. Ind. 2 : 265. 1878 ; Backer, Schoolfl. v. Java 407. 1911 ; Bekn. Fl. Java, em. ed. 5, fam. 118 : 30. 1941 ; Steyaert, Fl. Congo Belge 3 ; 507. 1952.

Senna quadrifolia Burmann, Thes. Zeyl. 212. 1737, t. 97.

Cassia foliolis duorum parium obverse ovatis Linnaeus, Fl. Zeyl. 66, 1748.

Cassia exigua Roxburgh, Hort. Beng. 31. 1814, *nomen nudum.*

Cassia thonningii De Candolle, Prodr. 2 : 500. 1825.

Cassia coccinea Wall. Cat. 5315. 1828, *nomen nudum.*

Senna absus Roxburgh, Fl. Ind. ed. Carey 2 : 340. 1832 ; ed. Clarke 351. 1874.

Senna exigua Roxburgh, Fl. Ind. ed. Carey 339. 1832 ; ed. Clarke 351. 1874.

Cassia viscida Zollinger in Nat. Gen. Arch. 3 : 80. 1846.

A herb or undershrub, 10-60 cm tall, erect or widely branching, twigs often decumbent, indumentum sticky through viscose bristles. Leaflets in two accrescent pairs, membranous, obovate, very unequal-sided, 2–2.8(–3.5) cm long and 10–18(–25) mm wide, puberulous or pubescent on both surfaces, top round to blunt (midrib slightly excurrent to mucronate), base round or cuneate ; petiole slender, 2 ½–3 ½ cm long, viscose-bristly, rhachis 5–8 mm long ; petiolules 1 mm long, between the pairs with a ½ mm long, ligulate-acute glandlet. Stipules linear-acute with a strong midrib, c. 4 mm long, persistent, recurved, with viscid bristles. Racemes small, 4–12 cm long, ± sessile. Bracts ovate-earshaped, with viscose bristles, long acute, c. 2 mm long. Bracteoles half as long, ovate, acute, viscid-hairy. Flowers small, on 3–4 mm long, rough-hairy pedicels. Calyx imbricate, studded with coarse, viscose bristles. Sepals membranous, oblong to narrowly ovate, blunt, 4 mm long, finally free. Petals broadly obovate, 5–7 mm long, blade narrowing into a slender, 1–3 mm long claw, glabrous. Stamens 5 fertile, filaments glabrous, 2 mm long, anthers c. 1–2 mm long, with lateral rims splitting first at the apex and gradually downwards, though never reaching the somewhat narrower (not cordate) base, gradually decreasing ; staminodes absent. Disc with straight, 1–2 mm long bristles. Ovary densely strigose, sessile, c. 7-ovulate ; style glabrous, sturdy, 2 mm long ; stigma shell-shaped, incurved. Pods on a 5 mm long stalk, flat, coarsely hairy,

thin-valved, dehiscent, strap-shaped, 4 cm long, 8 mm wide, short-beaked, 5–8-seeded. Seeds black, glossy, smooth, flattish, ± ovate, longitudinal, pointed at the radicula, 4 mm across ; funiculus small, sturdy, with an aril-like, lighter-coloured excrescence ; albumen copious, appressed to the testa.

Type specimen. – Holotype in LINN, *no 528.4*.

Distribution. – Everywhere in the tropics of the Old World, also in Egypt. In Malaysia introduced and only locally more common (Java, Timor, Celebes) ; not seen from the Philippines or the Malay Peninsula.

Ecology. – In Malaysia *C. absus* is found as a weed from sealevel to 900 m alt., in dry sunny areas, untilled fields, denuded localities (erosion), in (teak) savannahs, on lava streams, along railroads, grassy roadsides, and sometimes not far from the sea or on lime soils. RAPPARD found it a conspicuous element in the spring flora on the W. Baluran (E. Java) savannahs.

Biological note. – The flowers are yellow and change to brick-red. In hot water, the albumen of the seed increases to loose, semi-fluent masses.

Uses. – The very bitter seeds are known in Egypt as « Chichsm-seed ». No uses are recorded in Malaysia.

Notes. – DE CANDOLLE (in COLLADON, Hist. Cass. 116. 1816) published *Absus* as a section in *Cassia*. The type species is *C. absus* L. VOGEL (1837) placed *Absus* as a subsection (l. c. p. 693) and proposed *Lasiorhegma* as the name for a section containing *C. absus*. VOGEL's illegitimate name *Lasiorhegma* was given to a subgenus (containing the section *Absus*) by BENTHAM (1870).

C. acacalis Royle (Journ. As. Soc. Bengal 1 : 462 [sphalm. 452]. 1832) is a nomen nudum, referred to *C. absus* in Index Kew.

35. Cassia lechenaultiana DC.

C. lechenaultiana De Candolle, Mém. Soc. Phys. Genève **2** : 132. 1824 ; Prodr. **2** : 504. 1825 ; Prain, Journ. As. Soc. Bengal **66**(2) : 165, 477. 1897 ; Knuth, Handb. Blüt. biol. **3**(1) : 373. 1905 ; Ridley, Fl. Mal. Pen. **1** ; 619. 1922 ; Petch, Ann. Roy. Bot. Gard. Peradeniya **9** : 229. 1924 ; Heyne, Nutt. Pl. Ned. Ind. 744. 1927 ; Corner, M.A.H.A. Mag. **5** : 48. 1935 ; Burkill, Dict. Econ. Prod. Mal. Pen. **1** : 477. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 27. 1941 ; Steyaert, Bull. Rijksplt. Brussel **20**(2) : 244. 1950.

A herb, sometimes at the base ± woody, ½-1½ m tall. Leaves ovate-oblong in circumference, 7–8 cm long and 3–3½ cm wide. Leaflets 8–24 decreasing pairs, chartaceous, very unequal-sided, 10-20 mm long, 2–2½ mm wide, glabrous or very nearly so, ciliolate on edge, straight to falciform, nerves on both sides of the midrib distinct and prominent, top rounded, more or less oblique (midrib exmedian, long mucronate), base obliquely truncate ; petiole 3–7 mm long, rough, bristly hairy, grooved, bearing an elevated (sometimes depressed in the centre), flat, ± sessile, discoid, large gland in or near the middle, gland sharp edged 1–2 mm across, on top usually not quite glabrous, rhachis grooved, hairy, between the petiolules with some gland-like hairs, produced beyond the upper petiolules into a subulate, persistent, 3½ mm long mucro ; petiolules nearly absent, very broad, joint-like. Stipules broadly linear, long acute, 10–15 mm long, with strong longitudinal nerves, ciliate on edge, base subauriculate, persistent. Racemes short, 3–10 mm long, axillary, usually paired (lower placed 3–4 mm above the axil, upper 6–8 mm), 3–4-flowered. Bracts like the stipules, 6–7 mm long. Bracteoles ovate, acute, 2–5 mm long. Flowers small, on c. 7 mm long, thinly pubescent pedicels ; buds ovoid, acute. Sepals membranous, ovate, long-acute, coarsely but thinly pubescent on the midrib and near the base, 6–7 mm long, finally reflexed. Petals oblong or obovate, 8–9 mm long, ± sessile, externally finely pubescent, with 2 minute appendages at the base. Stamens : filaments all of ± the same length, all anthers opening by 2 apical pores, 2 anthers 5–6 mm long, the others 2½–4 mm long. Ovary sessile, tomentose, c. 1 mm long, thick, style glabrous, thick, recurved ; stigma punctiform. Pod flat, at first coarsely pubescent, later glabrescent, thin-valved, glossy, dehiscent (valves twisting spirally), strap-shaped, 3–4 cm long, c. 4 mm wide, transversely grooved between the seeds, 10–12-seeded, seeds black, glossy, ± lozenge-shaped, flattened, 4 mm long, 3½ mm wide, albumen copious, embryo flat, funiculus deeply curved, capillary, c. 1 mm long.

Type specimen. – *Lechenault*, Bengal, *s. n.* (holotype, G).

Distribution. – SE. Tropical Asia, introduced in Malaysia.

Ecology. – Only occasionally found as a weed, especially in W. Java, 5–300 m alt.

Biological note. – The inflorescences are usually paired, sometimes solitary or in threes. The testa contains minute, circular glandlets.

Note. – STEYAERT spells « lechenaultiana » as DE CANDOLLE published his friend LECHENAULT's name in the former manner. DE CANDOLLE's spelling, though contrary to current usage, which is « leschenault », is to be followed. I found DE CANDOLLE's spelling also supported by LECHENAULT's own signature in a msc. on the plants of Java and Bali, kept in the Leyden National Herbarium. The signature, of 1806, is « Lechenault De Latour ». BLUME also spelt the name « lechenault » correctly.

DE CANDOLLE described the leaves as « contour nettement ovale » but it seems preferable to define the circumference of the leaves as ovate-oblong.

PETCH (l. c. p. 231, 235) distinguished *C. mimosoides* and *C. lechenaultiana* by the shape and position of the foliar gland(s). PETCH's statement that the leaflets in *C. mimosoides* end in a short mucro in gradual continuation of the leaflet-margin is often true, whereas *C. lechenaultiana* as a rule has a truncate leaflet-tip, abruptly ending in a bristle-like mucro. STEYAERT l. c. found that a serrate or furrowed leaf-rhachis is an easy character to use, and I agree to that (see however note sub *C. mimosoides*).

In living material the red spots near the base of two of the petals are easily observed; the stem is reddish, as are the rhachis of the leaf, the margin and nerves of the leaflets.

35a. Var. **auricoma** Graham ex De Wit.

C. lechenaultiana var. *auricoma* Graham ex De Wit comb. nov.

Cassia mimosoides L. var. *auricoma* Graham ex Bentham, Trans. Linn. Soc. **27** : 580. 1871 ; Baker in Fl. Br. Ind. **2** : 266. 1878 ; Trimen in Fl. Ceyl. **2** : 110. 1894 ; Prain, Journ. As. Soc. Bengal **66**(2) : 477. 1897 ; Petch, Ann. Roy. Bot. Gard. Peradeniya **9** : 233. 1924.

Cassia auricoma Steyaert, Bull. Jard. Bot. Bruxelles **20** : 246. 1950.

All vegetative parts covered by a golden yellow tomentum, when dry dark purple to blackish. Pedicels, sepals, and ovary hirsute.

Type specimen. – *Wall. Cat. 5322* (holotype, K).

Distribution. – India.

Note. – PRAIN assumed var. *auricoma* to represent a variety of *C. lechenaultiana* though formally he cited it under *C. mimosoides*.

36. Cassia mimosoides Linnaeus

C. mimosoides Linnaeus, Sp. Pl. 379. 1753 ; Walpers, Rep. 1 : 837. 1842 ; Thwaites & Hooker, Enum. Pl. Zeylanicae 96. 1859 ; Baker in Hook. f. Fl. Br. Ind. 2 : 266. 1878 ; Trimen, Handb. Fl. Ceyl. 2 : 110. 1894 ; Prain, Journ. As. Soc. Bengal 66(2) : 164. 1897 ; Merrill, Philip. Journ. Sci. Bot. 5 : 51. 1910 ; Backer, Schoolfl. Java 406. 1911 ; Gagnepain in Lec. Fl. Gén. Indo-Ch. 2 : 162. 1913 ; Merrill, Interpr. Rumph. Herb. Amb. 257. 1917 ; Rock, Legum. Pl. Hawaii 89. 1920, t. 37 ; Ridley. Fl. Mal. Pen. 1 : 619. 1922 ; Merrill, Enum. Philip. Fl. Pl. 2 : 263. 1923 ; Petch, Ann. Roy. Bot. Gard. Perad. 9 : 232. 1924 ; Heyne, Nutt. Pl. Ned. Ind. 744. 1927 ; Merrill, Comm. Lour. Fl. Cochinch. 189. 1935 ; Burkill, Dict. Econ. Prod. Mal. Pen. 1 : 477. 1935 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 27. 1941 ; Steyaert, Bull. Jard. Bot. l'Etat 20 : 240. 1950 ; Quisumbing, Med. Pl. Philip. Dpt Agric. Nat. Res. Techn. Bull. 16 : 382. 1951 ; Steyaert, Fl. Congo Belge 3 : 514. 1952.

Amaena maesta Rumph. Herb. Amb. 6 : 147. 1750, t. 67, f. 1.

Cassia procumbens (non L.) sensu Stickman, Herb. Amb. 28. 1754 ; Amoen. Acad. 4 : 139. 1759 ; Loureiro, Fl. Cochinch. 264. 1790, ed. Willd. 324. 1793.

Cassia nictitans (non L.) sensu Stickman, Amoen. Acad. 4 : 135. 1759.

Cassia angustissima Lamarck, Enc. Méth. Bot. 650. 1783 ; Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 1 : 292. 1834 ; Steyaert, l. c. 238. 1950.

A herb or undershrub, erect to decumbent, ½–1 m tall, twigs appressed pubescent. Leaves strap-shaped, narrowly oblong in circumference, 4–10 cm long and 7–11 mm wide. Leaflets 15–40 (–85) pairs, chartaceous, very unequal-sided, 4–8 mm long and 0.8–1.3 mm wide, glabrous but sparsely ciliolate on edge, straight or nearly so, top blunt to acutish, midrib excurrent into a short mucro, base truncate ; petiole c. 3 mm long, ribbed, sparsely pubescent, bearing at its top (between the lowest pairs of leaflets) a flat, discoid, sometimes hardly evident, sessile, glabrous gland ; rhachis in side-view seemingly serrate, ciliolate on the rim and sparsely pubescent on the lower surface, produced beyond the upper petiolules into a persistent, 2 mm long mucro ; petiolules nearly absent, very broad, joint-like. Stipules linear-acùte, c. 1 cm long, with strong, longitudinal nerves, ciliolate or glabrous on edge. Racemes short, ± 10 mm long, axillary, appressed to the twig, solitary or paired or 3 together, single-flowered. Bracts like the stipules. Bracteoles similar, linear, c. 5 mm long, glabrous. Flowers small, on 5–18 mm long, slender, pubescent pedicels ; buds narrowly ovoid, long acute, pubescent. Sepals membranous, (narrowly) ovate, long-acute, c. 8 mm long, sometimes glabrous. Petals obovate to orbicular, 7–11 mm long, blade narrowing into a slender, short claw, glabrous. Stamens 10–9, all filaments 1–2

mm long, all anthers opening by an apical double pore, 2 anthers 5–6 mm long, the others 2½–4 mm long, not rostrate, ± straight. Ovary sessile, tomentose, style glabrous, thick, recurved, stigma its flat, truncate ending, delicately hairy. Pods flat, at first pubescent, thin-valved, dehiscent, strap-shaped, 2½–4½ cm long and c. ½ cm wide, 8–14-seeded, grooved between the seeds. Seeds brown, glossy, smooth, flat, longitudinal, nearly 4 mm long, nearly 2 mm wide, albumen copious, embryo flat, funicle deeply curved, capillary.

Type specimen. – To be based on a Ceylon specimen preserved in the Bibliothèque Nationale at Paris (cf. STEYAERT, Bull. Jard. Bot. Bruxelles *20*: 236, 237. 1950).

Distribution. – Circumtropically, possibly indigenous in the SE. Asiatic Continent, probably introduced in Malaysia where it is an ubiquitous weed.

Ecology. – Sealevel to 2300 m alt., in sunny, dry areas, grassy fields, *Eucalyptus* savannahs, sometimes on lime soils; on fresh volcanic soils in dry areas among the pioneers.

Biological notes. – *Cassia mimosoides* is short-lived, as a rule one to two years. The form *perennis* may be more persistent, though this needs checking.

The roots are observed to have numerous nitrogenic nodules.

The leaves of *C. mimosoides* are thigmonastic and also photonastic as they turn upwards and press the upper surfaces against each other during the hottest (sunniest) hours of the day, during rainy weather, and during the night. The leaves are decidedly more sensitive than those of *C. lechenaultiana* and other allies and for that reason dried specimens of *C. mimosoides* can be, as a rule, distinguished at sight on account of their contracted leaves.

Flowers and fruits are borne throughout the year. The petals are bright yellow, the calyx and anthers sometimes discolouring to red.

Many specimens are golden yellow tomentose on the branchlets and leaf-rhachises and are an approach to a form «auricoma» such as is found in many species of *Cassia* (e. g. *C. retusa*, *C. lechenaultiana*, *C. timoriensis*).

While making with Dr POSTHUMUS a herbarium of the camp flora during our internment at Bogor, I collected on an often mown lawn a specimen with bicarpellate flowers.

Vernacular names. – Sumatra : *Palia tunggal, simar palia.* Java : *dinding, djewèr, djiwi, kakatjangan, kihirisan, sasawahan, sengong, sentingan, tuturian.* Celebes : *bulu perenné.* Moluccas : *pohon tekedjut.* Philippines : *karagain, kilkidis.*

Uses. – Sometimes tried as green manure for tea plantations (Sumatra). Its value as a useful plant is uncertain (cf. HEYNE and BURKILL ll. cc.), its possible medicinal virtue is reviewed by QUISUMBING, l. c.

Note. – STEYAERT stressed the importance of the occurrence of paired inflorescences in *C. lechenaultiana* (l. c. p. 245). In *C. mimosoides*, however, at least in the Javan specimens, paired inflorescences are usually found. The same author added a drawing of the leaf-rhachis in *C. mimosoides* var. *angustissima* (Lam.) Walp. and *C. mimosoides* var. *telfairiana* (Wall.) Hook. f. and indicated a difference in the dentation of the rhachis. It is possible that this difference exists between the Indian specimens STEYAERT examined but it is not so in the Javan specimens. These appear, according to STEYAERT's data, to belong to var. *telfairiana* but occasionally leaves characteristic of the var. *angustissima* are found on the same specimen (e. g. *Backer 20119* and also BACKER, Bekn. Fl. Java, em. ed. 5, fam. 118 : 27. 1941).

It is not warranted to keep apart taxa like « telfairiana » and « angustissima » as varieties.

Even at a cursory examination most specimens of *C. mimosoides* can be separated from *C. lechenaultiana* on account of the much smaller leaflets (which are drawn together in most herbarium specimens), the much shorter petiole, the very low and broad gland and the serrations of the rachis, which can be observed by the unaided eye.

36a. forma **perennis** De Wit

forma *perennis* De Wit form. nov.

Cassiae mimosoidis forma nova humilis et contracta vel erecta et ad 65 cm alta, radice principali crassa, ramisque lignosis, interdum prostratis et ad basin aggregatis vel ascendentibus et scopiformibus, foliis parvis, confertis.

Type specimen. – *De Voogd 2752* (BO).

Distribution. – Sumatra (Tapaniula, Toba) ; Java : Bantam (Menes), Muntilan, Bogor, Banjumas (Tjilatjap), Pasuruan, Tengger ; Bali ; New Guinea (Astrolabe Range). Also in India.

Ecology. – The specimens look like being infected by some gall insect.

Note. – DE VOOGD collected the type in July 1936 on Bali. It bears some dilapidated flowers and a few pods. Though in appearance quite different from *C. mimosoides*, being a very dense, somewhat stunted, low shrublet, while the leaf has only a very obscure glandlet or no glandlet at all and the rhachis is not serrate, it is best referred to *C. mimosoides*, being possibly one of the cushion-like or, at any rate, wind-swept forms as e. g. described by VAN STEENIS (Fl. Mal. I, 4[1] : xxix ff. 1948).

37. Cassia mindanaensis Merrill

C. mindanaensis Merrill, in Philip. Journ. Sci. 20 : 388. 1922.

A tree, about 5 m high, young parts somewhat appressed pubescent ; branchlets brown, terete, slightly pubescent, finally glabrous. Leaflets 10–14 pairs, subcoriaceous, oblong, upper surface delicately transverse rugulose, unequal-sided, 1–2 ½ cm long, glossy, finally glabrous, margin with minute, distant, spine-like hairlets, midrib exmedian, lateral nerves about 6 on each side of the midrib, ascending, top obtuse, minutely apiculate, base rounded, sessile ; petiole less than 1 cm long, at its top with a truncate, sessile gland, rhachis 7–10 cm long, the petiole near its middle with a single conspicuous gland, rachis ribbed or vaguely grooved, slightly pubescent, bearing 1–4 caducous, flat, broad, sessile, 1 mm high glands between the uppermost pairs of petiolules, produced in a 3 mm long mucro. Stipules linear-lanceolate, acuminate, 3 mm long. Racemes supra-axillary, few-flowered, usually in pairs, peduncle about 2 mm long, pedicels about 15 mm long, bracts and bracteoles about 2 mm long, abruptly linear-lanceolate, acuminate from a broad base ; in the upper part of the pedicel, linear-lanceolate, acuminate from a broad base. Sepals lanceolate to elliptic-lanceolate, sparingly appressed- pubescent, acutely acuminate, about 8 mm long. Petals obovate, glabrous, 10 mm long, 7–8 mm wide, rounded, base cuneate. Anthers 4–5 mm long, filaments about 1 mm long. Ovary (and style) about 10 mm long, appressed-pubescent, about 5-ovulate.

Pods thin, narrowly oblong, oblique at the base and apex, slightly acuminate, sparingly pubescent, obscurely reticulate, about 3 cm long, 6–8 mm wide, usually with 3–4 seeds.

Type specimen. – *For. Bur. 28245* (Mataya, Nov. 23, 1920).

Distribution. – Philippines. Mindanao. Davao Distr. (Mount Bulan, type ? ; Mount Hamignitan).

Ecology. – The type (which I have not seen) was found at 40 m altitude, « along the banks of streams ». MERRILL says that *C. mindanaensis* « strongly resembles *C. polyadenia* DC. » (= *C. polyadena* DC., Pl. rar. Jard. Genève, 2e rapp. 12, no date). A second specimen was collected by G. E. EDANO (*Field no 1687, Phil. Nat. Herb. 11149*), at 500 m altitude, along a stream on a forested slope. It flowered August-September, 1949 and bore a ripe pod.

The bracteoles are not quite opposite and finally 3 mm apart.

VERNACULAR NAME. – *Andanpong.*

38. Cassia patellaria DC.

C. patellaria De Candolle in Colladon, Hist. Cass. 125. 1816, t. 16 ; Bentham, Fl. Bras. 15(2) : 174. 1870 ; Trans. Linn. Soc. 27 : 578. 1871 ; Fawcett & Rendle, Fl. Jamaica 4(2) : 115. 1920 ; Heyne, Nutt. Pl. Ned. Ind. 746. 1927 ; Williams, Fl. Trinidad Tobago 1(4) : 275. 1931 ; Burkill, Dict. Econ. Prod. Mal. Pen. 1 : 479. 1935 ; Amshoff, Fl. Surinam 2(2) : 78. 1939 ; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118 : 27. 1941.

Chamaecrista patellaria Greene, Pittonia 4 : 115. 1890 ; Britton & Rose, N. Am. Fl. 23(5) : 294. 1930.

An erect, annual, softly pilose, ascendent herb, sometimes somewhat woody near the base, 20-60 cm tall. Leaflets 10–30 pairs, chartaceous, linear to linear-oblong, unequal-sided, the larger (below the middle of the leaf) 7–15 mm long, 1 ½–3 mm wide, both surfaces dull, pubescent, top obliquely rounded (tip acute by the slightly excurrent midrib which runs close to the distal margin), base obliquely truncate ; petiole 3–5 mm long, pubescent, with 1–2 large, sessile, shallowly excavated, orbicular glands, near or at the rhachis 2–4 cm long, pubescent, grooved, glandless, produced in a persistent, slender, 2–3 mm long mucro ; petiolules absent. Stipules linear, membranous, pubescent, ciliate, acute, 8–14 mm long, long persistent. Flowers 1–4 in the axils of the leaves or supra-axillary, on 2–4 mm long, pubescent pedicels. Bracts linear-acute, tardily caducous, pubescent, strongly veined,

about 7 mm long. Bracteoles ovate-acute, about 1½ mm long, pubescent. Sepals membranous, narrow, lanceolate, acute, 4–5 mm long, pubescent in the centre. Petals unequal, obovate to orbicular, 4–6 mm long, sessile. Stamens (10–)9, 3 lower largest, filaments glabrous, 1 mm long, anthers 2 mm long, opening at the increased top by a double apical pore, rest of the anthers gradually more reduced. Ovary appressed tomentose, style glabrous, recurved, short; stigma the flat ending, on margin ciliolate. Pods flat, hirsute, finally glabrescent, black, glossy, thin-valved, dehiscent, 2½–3½ cm long, 3–4 mm wide, strap-shaped, 6–10-seeded. Seeds dark brown, glossy, smooth, flattened, rhomboid, longitudinal, 3 mm long, funicle broad, short; albumen copious, embryo oblique, slightly warped.

Type specimen. – To be designated in G.

Distribution. – Brazil, Guyana, Columbia. Only locally as an introduction in Malaysia.

Note. – BACKER (1941) stated: «near Buitenzorg (Bogor), occasionally present, not persisting».

39. Cassia pumila Lamarck

C. pumila Lamarck, Dict. 1: 651. 1785; Bentham, Fl. Austr. 2: 290. 1864; Heyne, Nutt. Pl. Ned. Ind. 746. 1927; Backer, Handb. Suikerr. 282. 1930; Burkill, Dict. Econ. Prod. Mal. Pen. 1: 479. 1935; Backer, Bekn. Fl. Java, em. ed. 5, fam. 118: 26. 1941.
Cassia prostrata Roxburgh Hort. Beng. 32. 1814, *nomen nudum*.
Senna prostrata Roxburgh, Fl. Ind. 2: 352. 1832.

A decumbent, short-lived, slightly hairy, decumbent or sometimes erect herb or undershrub, 20–50(–100) cm tall. Leaflets 6–25 pairs, chartaceous, linear to linear-oblong, unequal-sided, the larger (below the middle of the leaf), 7–13 mm long, 1½–3 mm wide, both surfaces dull, glabrous or with some hairs scattered near or on the midrib, with a rough, often purple margin, top obliquely rounded (tip aristate by the long excurrent midrib, which runs close to the distal margin), base very obliquely truncate; petiole 2–5 mm long, pubescent, grooved, with a slenderly stiped gland in the upper third; rhachis 3–4 cm long, pubescent, grooved, glandless, produced in a persistent, slender, 2–3 mm long mucro; petiolules absent. Stipules linear-acute, membranous, 5–13

mm long, ciliate, long acute, strongly veined, persistent. Flowers 1–3 on a supra-axillary, up to 1 mm long glabrous peduncle on 4–6 mm long, pubescent pedicels. Bracts linear-acute, tardily caducous, very long-acute, c. 4 mm long. Bracteoles very acute, 2–3 mm long. Sepals membranous, lanceolate, long-acute, 5–6 mm long. Petals very unequal, narrowly oblong to broadly orbicular (and retuse), 3–5 mm long, narrowed towards the base and nearly clawed. Stamens 5, nearly equally developed ; filaments slender, glabrous, 1½–2 mm long ; anthers 2 mm long, nearly straight, opening at the top by a large, double, at the base slit-like, produced pore. Ovary appressed tomentose, style glabrous, recurved, short, stigma truncate, flat, peltate, small. Pods flat, thinly pilose, black, not glossy, thin-valved, dehiscent, 2–4½ cm long, c. 3½ mm across, strap-shaped, 8–16-seeded. Seeds light brown, glossy, smooth, flattened, rhomboid, longitudinal, 3 mm long, funicle broad, short, albumen copious, embryo oblique, slightly warped.

Type specimen. – To be appointed in PC.

Distribution. – Tropical Asia and Australia. Sumbawa (Bima Kapinta). Timor (Baumata, Dilli), Sumbawa.

Ecology. – Boiled flowers detached from herbarium specimens have dark violet petals, shorter than the sepals. The seed-coat contains punctiform glands ; a pleurogram is rarely visible.

At low altitudes, in regions with a pronounced dry season, often on stony sandy sites, also on lime soils. On tertiary marl soils in teak forests at Rembang.

In Sumbawa common, in teak afforestations. Flowers yellow, 50–280 m altitude. Flowering Febr.-March.

Vernacular name. – *Entjeng-entjeng* (E. Java).
Uses. – Tried at Bogor as green manure with little success.

Note. – *C. pumila* has in Australia long-stalked pods (stalks up to 2½ cm) and the foliar gland is variable ; sometimes it is slenderly stiped (like in the Malaysian specimens though always being fleshier) and sometimes it is subsessile.

SPECIES EXCLUDENDAE VEL IMPERFECTE NOTAE

Cassia angustifolia Vahl, Symb. *1* : 29. 1790 ; Colladon, Hist. Cass. 114. 1816 ; Vogel, Syn. Cass. 34. 1837 ; Batka, Monogr. Senna 30, 44. 1866, t. 2 ; Oliver, Fl. Trop. Afr. *2* : 279. 1871 ;

Bentham, Trans. Linn. Soc. *27* : 553. 1871 ; Burkill, Dict. Econ. Prod. Mal. Pen. *1* : 474. 1935 ; Anchel, Bull. Torrey Bot. Club 75 : 581. 1948.

Leaflets pallid green when dry, oblong, base unequal-sided, tapering from below the middle towards the acutish mucronulate top, strongly nerved, glabrous or with sparse, rigid hairs, about 3 cm long, 6–8 mm wide. Petiolules ½–1 mm long, ± glabrous, thick.

Vernacular name. – *Salamakit* (Malang, Java).
Uses. – Leaflets sold by native herb-dealers (see BURKILL l. c.).

Note. – ANCHEL (l. c.) found that *C. angustifolia* leaflets contained « cassic acid » or « rhein » an antibiotic substance which is effective against *Staphylococcus aureus*. The same substance is present in *Rheum officinale*. ANCHEL adds a list of literature on *Cassia* chemistry.

Cassia brewsterii F. Muell., 4th Ann. Rep. 17, no date ; Bentham, Fl. Austral. *2* : 282. 1864 ; Francis, Austr. Rain Forest Trees 164. 1951.

C. brewsterii F. Muell (l. c.) represents the subgenus *Cassia* in Australia and is allied to both *C. fistula* and *C. javanica*. The differences were made clear by F. MUELLER, Fragm. Phytogr. Austr. *1* : 110. 1859 (sub *Cathartocarpus brewsterii*).

BAILEY stated that his *C. brewsterii* var. *sylvestris* (Bot. Bull. 3, n. v.) was identical with RUMPHIUS's *Cassia fistula silvestris* (= *C. javanica*, see there) which would imply that *C. brewsterii* occurred in Malaysia. The varieties described in the Queensland Flora *2* : 455-456. 1900 (cf. also BAILEY, Compr. Cat. Queensl. Pl. 151. 1909) were raised to species by DOMIN (Beitr. Fl. Pflz. geogr. Austr. *1* : 791. 1921-1929) ; among these taxa *Cassia tomentella* (Benth.) Domin is closely related to *C. bartonii*.

I have no conclusive evidence of the occurrence of *Cassia brewsterii* in Malaysia.

Cassia brongniartii Gaud. in Voy. aut. Monde Bonite 1846, Atlas, t. 10.

C. brongniartii is of an unknown habitat. C. H. d'ALLEIZETTE (Voy. aut. Monde Bonite, explic. et descr. Atlas 59-60 : 1866)

added no data or descriptive details. *C. brongniartii* is therefore typified by the plate. BENTHAM made in his monograph no mention of this name but it seems very possible that it is identical with *C. conjugata* Ruiz & Pav. (Trans. Linn. Soc. *27* : 540. 1871), in which case the name *C. brongniartii* has priority. *C. conjugata* is native of tropical America.

Cassia fimbricata Noronha, Verh. Batav. Gen. 5, ed. 1, art. 4, 9 : 1790, is a *nomen nudum.*

Cassia mimosa Noronha Verh. Batav. Gen. 5, ed. 1, art. 4, 9. 1790, is a *nomen nudum.*

Cassia ? *sp. nov.*

TEYSMANN reported the occurrence of a new *Cassia* species close to *C. fistula* (Nat. Tijdschr. Ned. Ind. *37* : 113. 1877). He said it was white-flowered (the flowers turning yellow) and the fruits were much thinner and longer than those of *C. fistula.* This reference is substantiated by *13829 HB.* (TEYSMANN, Celebes, Saleyer, « Cassia sp. arbor, cor. albo-flavo »). This specimen is so poor (no flower or fruit) that I cannot decide whether a new species is at hand, if so, a description must wait till better material will be secured.

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RIASSUNTO

Vengono descritte le specie di *Cassia* L. presenti in Malesia e di esse viene data la chiave analitica. Risulta che relativamente poche sono le specie di *Cassia* indigene in Malesia; molte sono d'incerta origine. La maggior parte delle specie indigene appartengono al sottogenere *Cassia* (o « *Fistula* »). La maggior parte delle specie sono coltivate (come ornamentali) o si trovano come piante infestanti.

Il centro di sviluppo dell'eterogeneo genere *Cassia* L. sembra che sia nel Sud-America (ad eccezione forse del sottogenere *Cassia*) ed appare consigliabile perciò di non tentare o adottare una suddivisione di *Cassia* L. in generi distinti. Viene qui adottata la delimitazione dei sottogeneri proposta da BENTHAM.

Viene descritta una nuova specie, **Cassia pachycarpa**, della Nuova Guinea; e vari taxa infraspecifici sono proposti come nuovi, o rinominati in seguito a cambiamenti del rango sistematico. Tutti i taxa vengono tipificati conforme alle regole prescritte dal Congresso di Stoccolma (1950).