REVISION OF THE GENUS
PUERARIA DC. WITH SOME NOTES
ON TEYLERIA BACKER
(LEGUMINOSAE)

L. J. G. VAN DER MAESEN

Genetic Resources Unit
ICRISAT
P.O. Patancheru 502 324
Andhra Pradesh, India

Crop Evolution Laboratory
University of Illinois
Urbana, Illinois 61801, U.S.A.

Present address:
Department of Plant Taxonomy
Agricultural University
POB 8010 6700 ED Wageningen, The Netherlands

Received: 22-XI-1984
Date of publication 31-V-1985

lh
Agricultural University Wageningen
The Netherlands 1985
CONTENTS

1. INTRODUCTION ................................................. 5

2. HISTORY OF THE GENUS PUERARIA DC. ..................... 5

3. RELATIONSHIPS OF PUERARIA IN THE TRIBE PHASEOLEAE .... 6

4. MORPHOLOGY OF PUERARIA ................................. 7

5. GEOGRAPHICAL DISTRIBUTION AND ECOLOGY ............... 7

6. BIOSYSTEMATICS OF PUERARIA .............................. 8

7. DESCRIPTION OF THE GENUS ................................. 9

8. SECTIONAL ARRANGEMENTS ................................... 11
   8.1. Section Pueraria .......................................... 12
       8.1.1. Subsection Pueraria ................................... 12
       8.1.2. Subsection Nonnudiflorae van der Maesen subsect. nov. 12
       8.1.3. Subsection Pulcherrima van der Maesen subsect. nov. 12
   8.2. Section Schizophyllon Baker ............................ 13
   8.3. Section Breviramulae van der Maesen sect. nov. ....... 13

9. KEY TO THE SPECIES OF PUERARIA ......................... 13

10. ALPHABETICAL TREATMENT OF THE SPECIES ............... 15
    1. Pueraria alopecuroides Craib .............................. 15
    2. Pueraria bella Prain ....................................... 18
    3. Pueraria calycina Franchet ................................ 20
    4. Pueraria candellei Grah. ex Benth. ....................... 23
    5. Pueraria edulis Pamp. ...................................... 27
    6. Pueraria imbricata van der Maesen sp. nov. ............. 32
    7. Pueraria lacei Craib ....................................... 35
    8. Pueraria lobata (Willd.) Ohwi ............................ 37
    9. Pueraria mirifica A. Shaw. & Suvat. ..................... 63
   10. Pueraria pedicularis (Grah. ex Benth.) Benth. ......... 64
   11. Pueraria phaseoloides (Roxb.) Benth. ................... 71
   12. Pueraria pulcherrima (Kds) Merr. ......................... 88
   13. Pueraria rigens Craib ..................................... 93
   14. Pueraria sikkimensis Prain Craib ....................... 96
   15. Pueraria stricta Kurz .................................... 100
   16. Pueraria tuberosa (Roxb. ex. Willd.) DC. .............. 105
   17. Pueraria wallichii DC. .................................. 109

Agric. Univ. Wageningen Papers 85-1 (1985) 3
1. INTRODUCTION

The genus *Pueraria* has not been the subject of a monograph since Bentham's revision of 1867. Since then, *Pueraria* has served more or less as a receptacle for species not easily classified elsewhere. Some species of *Pueraria* are important as fodder, green manure crops, or weeds; some produce edible tubers; some have medicinal or poisonous properties, but many are rare or only locally abundant, and poorly collected. Because of its close affinity to *Glycine*, Lackey (1977, 1981) inspected the genus in some detail in the course of his study of the Phaseoleae. Based on the holdings at Kew, he tentatively reorganized the genus and his infra-generic classification formed a solid base for the present revision. He excluded many species obviously belonging to other genera and simplified the synonymy.

The present author prepared this monograph while on sabbatical leave from ICRISAT, India, at the Crop Evolution Laboratory, University of Illinois, Urbana, Illinois, USA, upon the suggestion of Drs. J. R. Harlan and T. Hymowitz. At Urbana the long-standing agricultural research program, is a major factor in the enormous increase in soybean, (*Glycine max* (L.) Merr.) production in the USA with the State of Illinois as the largest producer.

Since live material of only a few species of *Pueraria* was available, this study was first tackled as one of classical taxonomy. If and when more species become available, further biosystematic research should help to elucidate the infraspecific relationships of *Pueraria* spp. and those between *Glycine, Pueraria*, and other genera in Glycinae. When introgression of the related genera into *Glycine* proves possible, another germplasm pool can be created by tapping *Pueraria* spp. which might contribute valuable genes to the soybean. Some ethnobotanical aspects are touched upon in the notes, but for a detailed survey I refer to the paper by Bodner & Hymowitz.

The expertise available at the Department of Plant Taxonomy, Agricultural University, Wageningen, the Netherlands, was an important factor to getting this account published.

2. HISTORY OF THE GENUS PUERARIA DC.

De Candolle established the genus *Pueraria* in 1825 for two species, *Pueraria tuberosa* (Roxb. ex Willd.) DC. and *P. wallichii* DC., the former is generally accepted as the type species (Hutchinson, 1964). The genus was named after M. N. Puerari, a fellow Swiss and friend of De Candolle, a Professor at Copenhagen and a pupil and friend of the botanist Vahl. In 1831, Wallich’s Catalogue of the East Indian Herbarium listed some species names, which we now consider as nomina nuda, but which were used by Bentham and others. In 1852, Bentham
established the genus *Neustanthus* to accommodate *Dolichos phaseoloides* Roxb. and took in *P. wallichii* DC., since he thought the pod of *P. tuberosa* was articulate (see §4). Upon further investigation (BENTHAM, 1867) of the supposed articulations, the pods appeared to be contracted where an ovule had failed to develop, which is frequently so; therefore, BENTHAM merged his *Neustanthus* into *Pueraria* with nine species at that time.

Many more names have been proposed by independent workers since Bentham's time but most become synonymous when more adequate material representing a wider range of diversity is studied. LACKEY (1977, 1981) stated that the genus was in need of revision, since Bentham's work was the most recent treatment of the genus in its entirety. In 1868 GOMES (MERRILL, 1935) validated a herbarium name of Loureiro, *Zeydora agrestis* Lour. ex Gomes, which is actually *P. montana* (Lour.) Merr., in the present revision referred to a variety of *P. lobata* (Willd.) Ohwi.

### 3. RELATIONSHIPS OF PUERARIA IN THE TRIBE PHASEOLEAE

AUGUSTIN PYRAME DE CANDOLLE placed his *Pueraria* in the tribu des Lotéees, serie Clitoriées, near *Glycine* (1825). *Pueraria tuberosa*, earlier sent to him as *Hedysarum tuberosum* Roxb. ex Willd., did not actually have the articulated pod (§4) of the *Hedysarieae* as the casual observer might see it. BENTHAM (1867) found that incomplete fertilization frequently caused constrictions in the pods, which caused WIGHT and ARNOTT (1834) to revise their earlier opinion of placement in Clitoriæae. They decided that *P. tuberosa* might have to be reduced to *Desmodium*, in *Hedysarieae*. BENTHAM (1865) referred *Pueraria* to Phaseoleae Benth., subtribe Dioclieae, followed by TAUBERT (1894) and HARMS (who spelled 'Diocleinae').


Some species of *Pueraria* are difficult to place. Anomalous in the genus, they fit nowhere else satisfactorily. Species like *P. stricta* Kurz, *P. brachycarpa* Kurz and *P. bella* Prain are possibly referable to *Neonotonia*, according to LACKEY (1977c).
4. MORPHOLOGY OF Pueraria

As can be gleaned from the descriptions, Pueraria spp. are strong climbers, rarely shrubs, creeping in or over low vegetation or climbing high in tall trees. Pueraria lobata has the ability to smother forests, as in the southeast of the United States, while it apparently is not so aggressive in its native habitat, China, Indo China, Japan, and NE India. No other species is aggressive, but they are abundant at times. The trifoliolate leaves, flowers and flat to cylindrical long pods are typical of most Phaseoleae. The stipules may be attached at their base or below the middle, the basal lobe may be single, twin-lobed or fringed. The inflorescence provides important diagnostic characters, but often it is crowded and difficult to analyse in the herbarium. There are either 3, rarely 2, or 4 to 7 flowers per more or less thickened node (brachyblast). Flowers are mostly subsessile, or have short pedicels, tended by very caducous bracts and have 2 small persistent bracteoles near the calyx. The upper calyx lobes are partly or entirely connate. The vexillum base is clawed, auricled or not, but always inflexed near the base, with or without callosities. Pueraria pulcherrima and P. mirifica have very small flowers, P. lobata about the largest. Flower colour varies from pure white to all shades of blue and purple, sometimes with a green or yellow patch on the vexillum. The flowers are occasionally described as fragrant and beautiful. Indeed, P. lobata was and still is sold in the USA for gardening purposes. Pods are often flat, hairy or glabrous, pale brown to black, septate or aseptate. The seeds, up to 20 per pod, are flattened-oblong, seem smooth but are minutely pitted when viewed with a magnification of 40X or more.

5. GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

The maps in this monograph indicate the Asian origin and distribution of Pueraria spp. Two species, P. lobata and P. phaseoloides, are widespread. Their varieties may be of rather restricted origin, but some have been carried around the world as green manure, fodder, and cover crops. Pueraria spp. inhabit forests, more often the forest edges, or scrub vegetations with varying moisture regimes. A few, including P. peduncularis, tolerate dense shade. Pueraria lobata is sometimes cultivated, and sometimes considered a weed. Wild species other than P. lobata or P. phaseoloides may be harvested for fibers. Pueraria lobata inhabits temperate zones, or higher altitudes in the tropics (NE India). Other Pueraria spp. are adapted to low altitude monsoon forests of medium rainfall, some prefer wetter regimes. P. peduncularis occurs only at higher altitudes. Several species are confined to a restricted area and are only known from a small number of accessions. Burma, Thailand, Indo-China, Yun-nan and the North Eastern Hill States of India appear the most interesting areas.
for a search for seeds and specimens, which are now so woefully lacking. Other parts of India, Indonesia, the Philippines, and New Guinea are also areas where searches are warranted.

6. BIOSYSTEMATICS OF PUERARIA

At the moment nothing more than a few chromosome counts and some chemo-taxonomical data provide further insight in Pueraria. Pueraria lobata and P. phaseoloides, both of economic importance are the main species which have been studied to some extent. Only a very limited number of accessions are available as seed.

Darlington & Wylie (1945) listed three species without giving chromosome numbers, but in their 1955 edition $2n = 22$ and 24 were listed for both P. lobata and P. phaseoloides. The latter count was not confirmed in two varieties (var. javanica and probably var. phaseoloides) of P. phaseoloides (Frahm-Le Liveld 1953, 1957). Berger et al. (1958) claimed both $2n = 22$ and 24 for P. javanica (Benth.) Benth. Tixier (1965) counted $n = 10$ and $2n = 20$ for a Vietnamese P. phaseoloides. The $2n = 24$ counts in P. lobata refer to Suzuka (1950) and Sakai (1951). Hardas and Joshi (1954) and Simmonds (1954) found $2n = 22$ for P. lobata (as P. hirsuta). Larsen (1971) found $2n = 20$ for P. colletti (Prain), however, Newell (pers. commun.) found $2n = 44$, obviously a tetraploid, for specimen Floto 931. A diploid number of $2n = 22$ seems therefore more likely. Bir & Sidhu (1966, 1967) established $n = 11$ for P. tuberosa. Lackey (1977) concluded that the anomalous counts in Pueraria, at least $2n = 24$, are probably wrong. The Glycininae almost always have basic chromosome numbers of 10 and 11.

Anatomically the Glycininae have no striking features. Paraveinal mesophyll is common, but it is lacking in P. peduncularis and P. wallichii, another reason to distinguish these two species from other Pueraria spp. (Lackey, 1977).

Seed protein electrophoresis using polyacrylamide gels for P. lobata, P. peduncularis and P. phaseoloides was carried out in conjunction with other Phaseoleae, mainly Glycininae. Pueraria peduncularis has bands strikingly different from the others which are closer, and which have larger similarity index values (s) with Glycine spp. than P. peduncularis. Pueraria lobata has a high s value when paired with Neonotonia wightii (Arnot) Lackey = Glycine wightii (Arnot) Verdcourt (Lackey, 1977a). Other chemical data on Pueraria are equally inadequate. Watt (1892) referred to the presence of inulin-allied saccharine matter, an easily oxidizable resin and a resin acid as analyzed in P. tuberosa for the Pharmacographia Indica. The presence of a kind of fish poison in some accessions of P. tuberosa (Watt 9251, in herb.) has not been elucidated in any publication, though Campbell, cf. Haines (1922) referred to its use by tribals in Manbhum (India). Pueraria peduncularis roots can also be used as fish poison (Henry 12483A, from the Szemao Mts in Yunnan) and some parts, probably
the roots, also have insecticidal properties (Perry, 1980).

*Pueraria mirifica* contains a specific estrogen in its roots, miroestrol, which has rejuvenating properties (Cain 1960, see notes under *P. mirifica*). So far no other related species have been screened for estrogens. Canavanine has been found to be present in *P. colletii* and *P. wallichii*, and absent in *P. lobata*, *P. mirifica*, *P. peduncularis*, *P. phaseoloides* and *P. pulcherrima* (as *P. textilis*). In Glycine, as presently understood, canavanine is lacking (Lackey, 1977). Darnley Gibbs (1974) lists some of the specific compounds found in *Pueraria*: *P. lobata* (as *P. thunbergiana*) contains Puerarin (Diadzein-8-C-glucoside) and Puerarin-β-xyloside, both isoflavones, in the roots. D-Pinitol, a cyclitol, is found in a species undisclosed (probably *P. lobata*) and also saponins and tannins. Chinese *Pueraria* (*P. lobata*) flowers were reported to contain Kakkatin (6,4'-di-hydroxy-7-methoxy-isoflavone) by Kubo et al. (1977).

7. DESCRIPTION OF THE GENUS


Type species: *Pueraria tuberosa* (Roxb. ex Willd.) DC.

Synonyms: *Neustanthus* Bentham. in Miquel, Pl. Jungh. 1: 235(1852); Bentham., Fl. Hong Kong 86(1861).

Lectotype species: *Neustanthus phaseoloides* (Roxb.) Bentham. (lectotypus novus).


Type species: *Zeydora agrestis* Lour. ex Gomes (= *Pueraria lobata* (Willd.) Ohwi var. montana (Lour.) van der Maesen comb. et stat. nov.).

Description: Robust, more or less pubescent climbers or shrubs; stems woody, rarely herbaceous, terete or angled, 0.2-10 cm diameter. Leaves alternate, pinnately trifoliolate; petiole long, pulvinus at base inconspicuous or thick-
ened; petiolules hardly thicker than petiole; leaflets large, ovate or rhomboid, entire, scalloped or palmately lobed, venation reticulate, ribs prominent, especially below, often more pubescent than lamina, lateral ribs opposite at the base, subopposite or alternate otherwise. Stipules herbaceous, in some species peltate, then often bifid below, caducous or not. Stipellae present, rarely produced below point of insertion, rarely paired.

Inflorescence an elongate pseudoraceme, unbranched or paniculate, sometimes with stipule-like bracts below; axis more or less nodose, flowering often above the middle; bracts narrow, very caducous; bracteoles small, subpersistent or minute and caducous. Flowers (2-)3 or 4-7 per node, in some species appearing before the leaves. Calyx campanulate, with 5 teeth, upper teeth halfway to entirely connate. Petals veined, white or mostly purplish or blue in various shades; vexillum sometimes with a yellow or green patch, and callosities, clawed, reinforced at the base and with or without 2 inflexed auricles; alae auricled above and often below, keel triangular to oblique, clawed, frontally adnate. Vexillary stamen connate, at least in the middle, to the others, in several species free when ovary expands, rarely quite free; anthers uniform, alternatively on long and short filaments, basidorsifix. Ovary elongate, pubescent, style filiform or on a broadened base, glabrous except near ovary. Stigma globular, short-papillose, often penicillate. Pod hairy or glabrous, elongate, in most species flattened, continuous or septate within, (1-)5-20 seeded. Seeds black or brown, flattened oblong or barrel-shaped, minutely punctate, bearing a small strophiola or rim aril around the hilum, positioned lengthwise in the pod. Germination epigeal, first two leaves simple and opposite, petiololed.

Distribution: China, Indo-China, Japan, Malaysia, Oceania and the Indian subcontinent. Two species frequently introduced in Africa and America, and widespread.

8. SECTioNAl ARRANGEMENTS

Bentham (1876) did not name his three subdivisions of the genus; the nature of the stipules, the length of the calyx lobes and the pod shape deciding the arrangements. His second group, stated to cover species with non-peltate stipules, in fact includes three (out of four) with peltate stipules. Baker (1876) distinguished three subgenera: subgen. Pueraria proper, subgen. Neustanthus Benth., a motley array not including P. phaseoloides for which Bentham intended the genus Neustanthus at first, and subgen. Schizophyllum Baker, in which he placed P. phaseoloides including the synonyms P. javanica and P. subspicata. Prain (1897) added some species to Baker's classification, while Taubert (1894) preferred to call the subgenera 'sections'. He used the name Eupueraria, as Kurz (1876) also did, a usage the Code now does not recommend (Art. 21). Lackey
(1977) distinguished 4 groups (A, B, C, D) on the basis of flower number per node, stipule shape, the presence or absence of a slit in the united upper calyx lobes, the callosities of the vexillum and the pod shape and seed number. Group D, he advised, should be removed from *Pueraria* and groups B and C were distinct enough to form a genus of their own.

In the present treatment the sectional arrangements are an amalgamation of the criteria mentioned above, to arrive at more or less natural groups of species more closely related to each other than to those in different groups. The only division that could remain in its original concept is *Schizophyllum* Baker, although it is a misnomer since all three varieties of *P. phaseoloides* can have entire leaflets while var. *javanica* usually has lobed leaflets only.

8.1. Section *Pueraria*

Flowers (2-)3 per node. Stipules peltate, upper calyx teeth ± completely united. Vexillum with or without callosities. Pods flattened-oblong, coriaceous, seeds flattened-oblong, up to 15 per pod.

8.1.1. Subsection *Pueraria*

*Species volubiles, flores praecox.*

Flowers 3 per node, produced before the leaves develop.

*P. tuberosa* (Roxb. ex Willd.) DC.

*P. sikkimensis* Prain

*P. candollei* Grah. ex Benth.

*P. mirifica* Airy Shaw & Suvat.

8.1.2. Subsection *Nonnudiflorae* van der Maesen subsect. nov.

*Species volubiles, flores synanthi.*

Flowers (2-)3 per node, produced when in leaves.

*P. lobata* (Willd.) Ohwi

*P. imbricata* van der Maesen sp. nov.

*P. edulis* Pamp.

*P. alopecuroides* Craib

*P. calycina* Franch.

*P. lacei* Craib

*P. bella* Prain

8.1.3. Subsection *Pulcherrima* van der Maesen subsect. nov.

*Species volubiles, flores parvi. Stipulae amplexicaulae caducae.*

Flowers 3 per node, small, subsessile at first, peltate stipules amplexicaul, covering buds.

*P. pulcherrima* (Kds.) Merr.
8.2. SECTION SCHIZOPHYLLON BAKER

Flowers 4-6 per node, produced when leaves are present, stipules not produced at the base, upper calyx teeth distinct, vexillum without callosities, pod ± cylindrical with papery partitions between the 15-20 barrel-shaped seeds.

*P. phaseoloides* (Roxb.) Benth.

8.3. SECTION BREVIRAMULAE VAN DER MAESEN SECT. NOV.

*Species erectae vel volubiles, nodi racemulorum parvi vel condensati, 4-10 flori.*

Flowers 4 or more per node, on short or condensed racemuli, stipules not or hardly produced below the base, upper calyx teeth distinct or not, vexillum without callosities, pods flat, papery or sturdy, 4-10 seeded, seeds flattened-ovoid.

*P. peduncularis* Grah. ex Benth.

*P. stricta* Kurz

*P. wallichii* DC.

*P. rigens* Craib

9. KEY TO THE SPECIES OF Pueraria

1a. Erect shrubs or rigid stragglers. shrubs. Flowers 4-10 together on brachyblasts (short laterals), short-pedicelled, inflorescence sometimes branched ........................................ 2

1b. Vines, or shrubs with more or less straggling branches ............ 3

2a. Corolla 3-5 times as long as the calyx, calyx lobes short-obtuse. Erect shrub, rarely stragglng ........................................ 17. *P. wallichii*

2b. Corolla less than twice as long as the calyx, calyx lobes acute to lanceolate. Rigid woody climber ............................................. 13. *P. rigens*

3a. Vines ............................................................................. 4

3b. Erect or straggling shrubs; pods flattened, ca 5-10 seeds per pod; bracts soft, more or less hooked at flowering, hard and hooked in fruiting stage, more or less pubescent ........................................... 15. *P. stricta*

4a. Corolla 2-3 times as long as the calyx, slender and long-pedicelled. Flowers not crowded, 4-7 per node; pods flat, papery; inflorescences unbranched, 1-2 per axil ........................................... 10. *P. peduncularis*

4b. Flower pedicels short, not very slender ................................ 5

5a. Flowers 2-3 per node, stipules peltate, upper calyx teeth almost or completely united; pods flat ............................................. 6

*Agric. Univ. Wageningen Papers 85-1 (1985)*
5b. Flowers 4 or more per node, stipules not peltate, upper calyx teeth distinct; pods rounded, ca 20 barrel-shaped seeds per pod, papery partitions between the seeds 11. P. phaseoloides

6a. Flowers less than 7(-12) mm long; fruits hairy mainly on edges. Leaflets entire, lanceolate, stipules large, amplexicaul, covering buds, caducous, leaving a line scar 12. P. pulcherrima

6b. Flowers more than (10-) 12 mm long; fruits, if hairy, both on edges and sides. Leaflets often lobed, stipules present, if shed leaving an oval scar

7a. Pseudoracemes unbranched or with 1-2 branches 8

7b. Pseudoracemes branched and/or with stipule-like bracts on the lower portion 10

8a. Stipellae 4 near petiolules of side leaflets, leaflets always prominently lobed; upper calyx lobes minutely distinct 5. P. edulis

8b. Stipellae 2 near petiolules of side leaflets, leaflets lobed or not; upper calyx teeth united or minutely distinct 9

9a. Leaflets long-elliptic, not lobed; calyx lobes obtuse 2. P. bella

9b. Leaflets ovate to orbicular, trilobed or not; calyx lobes acuminate

10a. Vine densely woolly-pubescent; calyx teeth long 11

10b. Vines slightly or short-pubescent; calyx teeth at most twice as long as the tube 12

11a. Leaflets 5-7 cuspidate; flowers 2 per node; calyx teeth 3-4 times the tube 3. P. calycina

11b. Leaflets ovate-rhomboid; flowers 3 per node; lower calyx tooth 4-6 times the tube 7. P. lacei

12a. Inflorescence with few branches, foxtail-like; flowers dense, bracts long, 10-15 mm, and long-hairy, 3 mm, caducous, bracteoles as long as the calyx tube, flowering when in leaves 1. P. alopecooides

12b. Inflorescence more or less copiously branched; bracts up to 10 mm, hairs to 2 mm, caducous, bracteoles half as long as the calyx tube or less 13

13a. Flowering when in leaves, or on old branches without leaves; calyx lobes lanceolate-acute, imbricate 6. P. imbricata

13b. Flowering when leafless; calyx lobes deltoid-obtuse 14

14a. Inflorescence crowded, rusty pubescent 14. P. sikkimensis

14b. Inflorescence long and open, yellow-brown pubescent or glabrous 15

15a. Vexillary stamen free, calyx yellow-brown or greyish pubescent; pods copiously hairy 16. P. tuberosa

15b. Vexillary stamen united, calyx grey or brown appressed-pubescent; pods almost glabrous 16

16a. Inflorescence often more than 30 cm long; calyx purplish green, sparsely pubescent; flowers 12-15 mm long 4. P. candollei

16b. Inflorescence up to 30 cm long; calyx quite densely short appressed-pubescent; flowers 8-10 mm long 9. P. mirifica
10. ALPHABETICAL TREATMENT OF THE SPECIES

1. Pueraria alopecuroides Craib *(Map 2, p. 17; Plate 1, p. 16)*


Lectotype: Upper Burma, Shan Hills, Gokteik 600 m, _Meekold 8058_ (K, holo), appointed by CRAIB (1928) from the two syntypes.

Paratype: China, S. Yunnan, Szemao to Chenlung, Mengwan?, _Bons d’Arty 255_ (K).

Description: Woody climber, perennial. Branches strong, up to 6(-10) mm diameter, several m long, vaguely striate, covered with brown bulbous-based caducous hairs of ca 3 mm. Stipules peltate, sagittate, tips acute, papery, striate, with brown bulbous-based hairs, 2-3 cm long, 0.6-0.8 cm wide. Leaves pinnately trifoliolate; petiole canaliculately striate, with brown bulbous-based hairs, 5-14 cm long; rachis 1.5-5 cm long. Leaflets ovate-rhomboid, side leaflets obliquely so, 8-17 cm long, 4-13 cm wide, apex acuminate, base rounded to truncate, thinly bulbous-based pubescent above, densely adpressed-silky pubescent below, hairs brown to greyish; ribs prominent below, laterals irregularly paired, ca 10-12 each side; petiolules slightly thickened, 4-8 mm long; stipellae linear-lanceolate, striate, 4-15 mm long, ca 1 mm wide. Inflorescences foxtail-like, densely flowered at first, 10-35 cm long, branches few, striate, somewhat nodose, with grey dense short and brown sparse long hairs, bracts at the base stipule-like, 10-15 mm long, lower teeth short; pedicels short, up to 6 mm at maturity, flowers (2-)3 per node, bracts narrowly ovate-lanceolate, 10-15 mm long, 1-1.5 mm wide, with 3 mm long hairs, ventrally glabrous, very caducous, bracteoles 2 per flower, linear-lanceolate, long-pubescent, 6-8 mm long, ca 1 mm wide. Calyx pubescent, grey dense short and brownish sparse long hairs, glabrous inside, tube ca 4 mm long, teeth lanceolate, upper ones connate except at the tip, ca 7 mm long, side teeth ca 6 mm long, lowest tooth ca 8 mm long. Vexillum obovate, ca 13 mm long, 11 mm wide, apex emarginate, base clawed, auricles reinforced, violet or white with yellow spot. Alae obovate, base auriculate, purple, ca 12 mm long, 4 mm wide, keel petals oblique, clawed, ventrally adnate, purple, ca 12 mm long. Ovary elongate, grey silky appressed pubescent, ca 9 mm long, ca 6 ovules, style perpendicular to ovary, ca 3 mm, glabrous, stigma terminal, globular, penicillate at base. Stamens connate, vexillar filament free at base only, ca 13 mm long, free part 2-3 long upcurved, anthers uniform, dorsifix, alternatively on long and short filaments. Pods flattened-oblong, acuminate at base and apex, tipped with rest of style, constricted where ovules failed, with dense short grey and sparse long brown bulbous-based hairs, to 9 cm long and 7-10 mm wide. Seeds not available.

_Agric. Univ. Wageningen Papers 85-1 (1985) 15_
Distribution: Upper Burma, Yunnan-China and Thailand.

Ecology: Climber in mixed jungle or among grasses.

Agric. Univ. Wageningen Papers 85-1 (1985)
Altitude: 100-600 m.

Flowering: January-April. Fruiting: April.

Vernacular names: Not recorded.

Specimens examined:

BURMA: Katha, 100 m, Katha distr., Lace 5717 (E, CAL, K); Loi Mwe, S. Shan State, MacGregor 103 (E); S. Shan State, id. 1273 (E, K); Gokteik, Shan State, Meebold 8058 (K, holo); Shweli Valley, Ruby Mines distr., Mogok, Rodger 146 (CAL).

CHINA: Szezao to Chenlung, Mengwan? S. Yunnan, Bons d’Arty 255 (K, para); Hsiushuang Panna, Yunkinghung, Manbulai, Yunnan, K. M. Feng 20057 (KWA); Manhao nr Tonkin border, Yunnan, von Handel-Mazzetti 1023 (K, W); betw. Muanghai and Kenghung, Cheli, valley of Nam Ha, Rock 2499 (US).


2. Pueraria bella Prain *(Map 2, p. 17; Plate 2, p. 19)*


Type: Burma, Kachin mts nr Myitkyina, King’s collectors (Shaik Mokim) (CAL, holo; iso: CAL, K).

Description: _Woody climber_, perennial. _Branches_ to at least 5 mm diameter, presumably several m long, terete, almost glabrous to slightly pubescent. _Stipules_ caducous, leaving a lenticular rim, greyish. _Leaves_ pinnately trifoliolate, petiole ribbed, canaliculate above, almost glabrous, 6-8 cm long, rachis 1.5-3 cm long. Top leaflets long-elliptic, side leaflets obliquely so, 8-18 cm long, 3.5-8 cm wide, apices long-acuminate, base cuneate-rounded, green above, greyish green below, sparingly short-pubescent both sides, veins prominent below, in ca 7 unequal pairs; petiolules barely thickened, 5-6 mm long; stipellae setaceous, to ca 7 mm long. _Inflorescence_ axillary, to 35 cm long, unbranched, short-pubescent, slightly nodose, 3 flowers per node; bracts unavailable, bracteoles 2 per flower, caducous, broad-ovate, ca 2 mm long and wide, striate, short-hairy both sides, apex obtuse to acute. _Calyx_ short velvety pubescent, inside also, margins longer hairy; tube ca 4-6 mm long, teeth obtuse, upper ones connate but clearly emarginate, to ca 3-4 mm long, side teeth ca 3-4 mm, lower tooth ca 2.5 mm, more acute than other teeth. _Vexillum_ orbicular-ovate, white to pale violet, ca 14-17 mm long, ca 12 mm wide, apex emarginate, base clawed, auricles inflexed; alae elongate-ovate, pale violet, to ca 14-16 mm long, 4-6 mm wide, claw 3-4 mm, auricle 1 mm, base margin also lobed; keel petals rhomboid, auricled near claw, pale violet, to 13-16 mm long, 4.5 mm wide, ventrally and basally long-adnate. _Ovary_ elongate, shortly adpressed pubescent, ca 9 mm long, ca 15 ovules; style short, upcurved, ca 2 mm long, stigma terminal, penicillate at

_Agric. Univ. Wageningen Papers 85-1 (1985)_
PLATE 2. Pueraria bella Prain (Shaik Mokim s.n.)

Base. Stamens monadelphous, vexillary stamen free with age, filaments ca 14 mm, free part 2-3 mm, upcurved, anthers uniform, basidorsifixed, alternately on long and short filaments. Pods unknown.

_Agric. Univ. Wageningen Papers 85-1 (1985)_
Distribution: Burma, India.

Ecology: In hills; sprawling over boulders in river bed.

Altitude: 200-1000 m.

Flowering: August, December. Fruiting: October, February?

Vernacular name: Not recorded.

Specimens examined:

BURMA: Kachin mts near Myitkyina, Shaik Mokim (CAL, holo; iso: CAL, K).
INDIA: Arunachal Pradesh: above the Dihang river, mouth of side river, Abor hills, Burkill 36125 (CAL); Delei valley, Mishmi hills, Kingdom-Ward 11062 (BM); Chenaing to Khela, Tirap Frontier Div., Panigrahi 14490 (CAL).

Note: Only four accessions are known, found ± 400 km apart. This species is very rare, and only known from areas difficult to reach. When better known, Lackey (1977c) suggests a possible transfer to Neonotonia, but the shape of inflorescence and flowers make it fit well in Pueraria. I presume an alliance to P. candollei may be likely, although P. bella keys out with P. lobata.

3. Pueraria calycina Franchet *(Map 2, p. 17; Plate 3, p. 21)*


Type: China, Yunnan, calcareous hills along Long-teou-chan river above Hee-gni-tang nr Tapintze, Delavaye 3590 (P, holo, not seen; iso: F, K).


Type: China, Yunnan, descent to Yangtze river from E boundary of Lichiang valley, lat. 27°15’ N, 7800 ft, _G. Forrest_ 10732 (E, holo; iso: BM, E, K).

Paratype: China, Yunnan, Yung-peh Mts, lat. 26°40’ N, 8000 ft, _Forrest_ 15312 (CAL, K, E).

Description: Woody, pubescent climber, perennial. Branches up to 6 mm diameter, up to 5.5 m long, vaguely ribbed, covered with spreading short and long golden-brown hairs, caducous with age, the long hairs ca 3-4 mm, base somewhat bulbous. Stipules peltate, striate, long and short pubescent, upper half ovate-obtuse, 10-20 mm long, 4-8 mm wide, base bilobed, linear to lanceolate, tips acute, lobes 5-10 mm long. Leaves pinnately trifoliolate; petiole ribbed, 5-12 cm long, with long and short spreading hairs; rachis 2-6 cm long, similar pubescent; leaflets suborbicular, unlobed or with 3 lobes, top leaflet broadly orbicular, side leaflets obliquely so, apices obtuse, margins 5-7 tufted-cuspidate,
base rounded-truncate, 7-16 cm long, 6-14 cm wide, semi-spreading grey-pubescent above, densely appressed grey-pubescent below, ribs prominent, more densely hairy as are the margins, laterals in 3-4 pairs, (sub)opposite, top leaflets

*Plate 3. Pueraria calycina Franchet (Forrest 15312)*

*Agric. Univ. Wageningen Papers 85-1 (1985)*
3-nerved at base, side leaflets with one basal vein less prominent; petiolules hardly thickened, somewhat more hairy than the rachis, ca 5-8 mm long. Stipellae lanceolate, long and short pubescent, 5-10 mm long, 4 at insertion of side-leaflets. Inflorescences axillary, 10-25 cm long, ribbed, unbranched, long-pubescent, slightly nodose; flowers 2 per node, purplish pink; bracts ovate-lanceolate to lanceolate, 5-10 mm long, ca 1-2 mm wide, caducous; pedicels short, ca 3 mm, up to 10 mm at maturity; bracteoles 2 per flower, ovate-lanceolate, 2-3 mm long, ca 1 mm wide. Calyx long-pubescent, interior short-appressed pubescent, tube 3-5 mm long, teeth long, 11-15 mm, lanceolate, upper ones connate except at the tip. Vexillum obovate, apex emarginate, base shortly clawed, auricles inflexed, ca 16 mm long, 13-15 mm wide. Alle obovate, base biauriculate, ca 15-17 mm long, 5 mm wide. Keel petals oblique, clawed, base rounded, ventrally adnate, ca 17 mm long, 5 mm wide. Ovary elongate, stipitate, grey silky adpressed pubescent, ca 12 mm long, ca 5 ovules, sutures thickened; style glabrous, ca 5 mm, upcurved; stigma terminal, globular, penicillate at base. Stamens dia-dellphous, vexillary stamen free, ca 16 mm long, free part 3-5 mm long, upcurved; anthers uniform, basidorsifix, alternatively on long and short filaments. Pods flattened-oblong, cuneate at base, obtuse at apex, hardly constricted where ovules fail, with dense spreading golden-brown hairs, up to 7-8 cm long and 8-12 cm wide, valves papery, puckerered (base of hairs) and broad-ridiculate. Seeds reniform, flat, reddish to black-brown, 7-9 mm long, 5-6 mm wide, 2.5-3 mm thick, strophiole scarcely raised, oval, 1 mm long.

**Distribution:** China (Yunnan).

**Ecology:** Climbing on scrub, calcareous slopes, open dry situations and near rivers.

**Altitude:** 2000-2600 m.

**Flowering:** July-August. **Fruiting:** July end, August.

**Vernacular names:** Not recorded.

**Specimens examined:**

**China, Yunnan:** slopes of Long Teou Chan above Hee Gni Tang, nr Tapintze, Delaway 3590 (P, holo; iso: CAL, E, K) ibid., *id.* 4275 (P); *id.*, *id.* 4719 (P); descent to Yangtze river from E. boundary of Lichiang valley, 27 15 N, Forrest 10732 (BM, E, K); Yung-pch mts, 26 40 N, Forrest 15312 (E, K); nr Yunnan Tsu, Myotte's collector s.n., herb. d'Aleizette (L); on Yangtze river nr Taku, betw. Chuntien and Lichiang, Schneider 2161 (K).

**Note:** Evans must have been unaware that Franchet had named this species earlier, the type specimens are almost identical (Lackey, 1977).


Type: Burma, Pegu, Ripa Saluan ad Phanoe, 1827, Graham in Wallich Herb. 5355 (K, holo; iso: BM, G, K).

Paratypes: Burma, Pegu, Lobb s.n. (K); ibid., MacLelland s.n. (K).

Description: Woody climber, perennial. Branches strong, to ca 12 mm diam., (see note), up to 12 m long, terete, ribbed with age, sparsely clad with caducous adpressed light brown hairs, glabrous with age. Stipules peltate, elliptic, both ends fringed-obtuse, 3-6(-10) mm long, up to 5 mm wide, caducous, leaving a round scar. Leaves pinnately trifoliolate, petiole striate-canaliculate, glabrescent, 12-20 cm long, rachis ca 3 cm long. Leaflets ovate, side leaflets very obliquely so, 10-22 cm long, 8-18 cm wide, apex long-acuminate, base broadly cuneate to truncate or vaguely cordate, green and very thinly greyish-pubescent above, glabrous with age, lighter green and appressed grey-pubescent below; ribs prominent, in 6-8 unequal pairs; petiolules barely thickened, glabrescent, up to 11 mm long. Stipellae small ovate perules, whitish, striate, 3-5 mm long, 1-3 mm wide. Inflorescences narrow-branched, mainly at the base, sometimes unbranched, up to 30-80 cm long, branches usually many, ridged, at the top almost winged, clearly nodose, pendulous, covered with short grey hairs, bracts at the base stipule-shaped, striate, pubescent, ca 5-9 mm long, 3-5 mm wide, obtuse, pedicels short, up to 3-5 mm at maturity, flowers (2-)3 per node, bracts linear-lanceolate, up to 10 mm long, 1-2 mm wide, striate, dorsally long-pubescent, ventrally short-pubescent, sometimes (or always?) covering a second bract, ovate-obtuse or lanceolate, 1-2 mm long, 1 mm wide, both very caducous, bracteoles 2 per flower, ovate, tip obtuse, 1-3 mm long, 1-2 mm wide, pubescence long, hairs brown. Calyx purplish, very sparsely grey-pubescent, inside as well, margins of teeth and center of upper and lower teeth long-pubescent, tube ca 4-5 mm long, teeth short, deltoid, obtuse, upper teeth connate, 3-6 mm long, side teeth 2-5 mm, lower tooth 3-6 mm long. Vexillum orbicular-ovate, ca 12-18 mm long, 12-15 mm wide, apex emarginate, base clawed, auricles inflexed, with 2 callosities near the base, blue to dark purple or lilac, margins inflexed. Alae lanceolate, 12-17 mm long, 4-5 mm wide, claw 3-4 mm, auricle hooked, 1.5 mm. Keel petals rounded along base, ventrally adnate, ca 10-17 mm long. Ovary elongate, grey silky appressed pubescent, ca 8-10 mm long, ca 10 ovules, style almost glabrous, ca 2 mm as flattened extension of the ovary, ca 3 mm perpendicularly...
upcurved, stigma terminal, globular, penicillate at base. Stamens monadelphous, vexillary stamen attached in the middle, with a knee, ca 11-15 mm long, free part 1-4 mm, upcurved; anthers uniform, dorsifixed below the middle, alternatively on long and short filaments. Pods flattened oblong, up to 8 cm long.

Agric. Univ. Wageningen Papers 85-1 (1985)
PLATE 5. *Pueraria candollii* Grah. ex Benth. (Winit 696)

1.1 cm wide, up to 8(-10) seeded, narrow-rounded at base, acuminate at apex, tipped with rest of style, constricted where ovules fail, sutures thickened, locule outline visible, glabrous or with age, valves reticulate. Seeds (immature) flattened ovoid, ca 2.5 mm long, 1.5 mm wide, 1 mm thick, reddish brown, minutely pitted, with a narrow strophiole.

*Agric. Univ. Wageningen Papers 85-1 (1985)* 25
Distribution: Bangladesh, Burma, India (the Andamans, Assam), Thailand.

MAP 3. *Pueraria candollei* in Burma and adjacent countries.

*Agric. Univ. Wageningen Papers 85-1 (1985)*
Ecology: In deciduous scrub jungle, on limestone rocks, open situations, stream or lake banks, climbing in shrubs or low trees.

Altitude: 0-1300 m.

Flowering: (January-) February-April, in Thailand also in September-October. Fruiting: February-April.

Vernacular names: Thailand: Kua ta Ian, Kua kao pu (N. Lao), Khamphi noi (NE); Kwao khrua (N). Burma: Ma U Nwè.

Specimens examined:

BANGLADESH: Seetakond Hills, Chittagong, Clarke 6606 (BM, CAL, K); ibid., id., id. 199864 (CAL, K); Demajin, Lister 189 (CAL); Kaptai Lake shore, Chittagong Hill Tract, van der Maesen 3728 (ICRISAT, K, WAG).

BURMA: Sindawng hill, Yaunghwe, Inle Lake, Annandale 483 (CAL); Sami Valley, Arakan Yomahs, Minbu distr., Aubert & Gage s.n. (CAL); Siva Fuel reserve, N. Toungoo distr., Bake 9364 (E); Tenasserim, Beddome 2204 (BM); Shan Hills Terai, Collett 364 (K); Haka, Sin Khua, Dickason 7619 (E, L); Iaping valley, 24.35 N, Forrest 12240 (E, K); Thongshuyen, Tenasserim, gallally 60 (CAL); Youngsaeleen river, Tenasserim, id. 479 (CAL); Kabaung reserve, bank of Thikangbauk stream, Toungoo distr., Gilbert Rogers 227 (OXF); Sabyin reserve, compartm. 2, Toungoo distr., id. 355 (CAL, OXF); nr Okshitaing, Yamethin distr., id. 565 (CAL); nr Thabyeining village, Magwe distr., id. 911 (E); Hanalui, Upper Chindwin distr., Kingdon Ward 11261 (BM); Martaban, Kurz 1721 (CAL); Pegu, Kurz 2533 (L, P); Aungdon-Kun reserve, Sinnakadin Chaung stream, Pegu distr., Lace 6106 (CAL, E, K); Moulmein, Lobb s.n. (K, para); Myebo, on or nr beach, McKee 6104 (K); King Tung, Mac Gregor 1327 (CAL); Pegu, McLelland s.n. (K, para); 34 km SO of Bhamo, along Ledo rd, McMillen 2263 (US); Kyauktwin, Tenasserim, Moore 15181 (CAL); Myedaung, Henzada distr., Shaik Mokin 1367 (CAL); Snapyoge, Henzada distr., id. 1641 (CAL); Myauangta, Insein distr., Parkinson 602 (CAL); Thenbun Chaung stream, Mai nam wat, S. Tenasserim, Parkinson 1904 (K); Navilao, Kachin Hills, Pottinger s.n. (CAL); on Salween river nr Phanoe, Wallich 5355 (K, holo; iso: BM, G, K).

INDIA: Assam: Kandlair, Lushai hills, Party 202 (K).

LAOS: Muang Pun, Sam Neua prov., Potlane 1931 (P).

THAILAND: New Muang? Kerr 992 (BM, CAL, K); Sisawat, Kanburi, id. 10156 (BM, K); Wangka, Kanburi, id. 10306 (BM, K); Ta Kaanawon, Surat, id. 12342 (BM, K); NW of Ssi Yok, Larsen 9049 (K); N. Lampang, Thoen, (Muang Tun), Mae Mawk, Samaphuddi 23028 (L); Lampang nisor, Khooon Wint 696 (K); Lampang, Muang Laung, id. 1609 (K).

Notes: P. candollei need not be lectotypified, as BENTHAM referred to the Graham specimen from Pegu in the Wallich Herbarium in the first instance, and quoted the paratypes at the end of his description. The herbarium number published is, however, erroneous: it should be 5353, not 5355, as corrected by BAKER (1876). Tubers have not been collected or reported, but are likely to be present.

5. Pueraria edulis Pamp.


_Agric. Univ. Wageningen Papers_ 85-1 (1985) 27
PLATE 6. *Pueraria edulis* Pamp. (McLaren's collector AA 239)


Type: China, Yunnan, mountain forests near Yunnan-sen, *Maire 100* (FI, holo; iso: P).

Type: Sikkim, Yoksun, 5000 ft, C. B. Clarke 25147 (K, holo; iso: BM, CAL, K).


Lectotype: China, Yunnan. From the syntypes Ducloux 6683, 6684 (ar Pin-tchuan (Pinchwan) and 5805 (Kiaokia region) a lectotype must be chosen. I have not seen this material (probably in P). Ducloux 6687 (also from Pin-tchuantcheou (Pinchwan)) (BM, F, D, US) was determined as *P. edulis* Pamp. by GAGNEPAIN.

Description: Woody climber, perennial, with tuberous roots. Branches up to 3-5 (-9) mm diameter, to 3-7 m long, striate, glabrous or slightly pubescent. *Stipules* peltate, striate, upper part ovate-obtuse to acute, 5-11 mm long, lower part often bifid, apices entire, fringed or acute, 3-8 mm long, 3-6 mm wide at insertion, leaving an oval scar if lost, (sub)glabrous, margins hairy. *Leaves* pinnately trifoliolate, petiole ribbed, more or less hairy, quite hairy when unfolding, soon glabrous, 3.5-16 cm long, rachis canaliculate above, 2-4 cm long. *Leaflets* deeply lobed, occasionally ovate, top leaflet with 3 lobes and 3 basal veins, side leaflets with 2 lobes, occasionally a shallow third one, 7-18 cm long, 4-16 cm wide, apices obtuse to acuminate, base broad-cuneate, rounded or truncate, green and thinly short puberulous above, glaucous green and thinly adpressed-pubescent below, hairs greyish; ribs prominent below, in 5-7 irregular pairs, petioles slightly thickened, winged, 3-8 mm long; stipellae ovate to lanceolate, striate, sometimes bifid, inconspicuously produced below the base, 4-10 mm long, 1.5-3 mm wide, 4 near side leaflets in 2 often unequal pairs, broader than near top leaflet, glabrous to slightly hairy. *Inflorescences* axillary, to ca 30(-75) cm long, unbranched or with 1 branch, supported by a stipule-like bract, branches finely striate to ribbed, glabrous to slightly hairy, basal part without flowers, slightly nodule, 3 flowers per node, pinkish to dark purple; pedicels thin, up to 7 mm at anthesis, sturdy and up to 10 mm at maturity; bracts ovate-acuminate, striate, glabrous, or slightly hairy at margin, 4-6 mm long, 1-2(-3) mm wide, caducous; bracteoles 2 per flower, ovate-acute, 2-3 mm long, 1-2 mm wide, striate, both sides glabrous to slightly hairy. *Calyx* glabrous to thinly pubescent, inside pubescent; tube 3-5 mm long; teeth lanceolate, upper ones connate-emarginate at the obtuse or acute tip, 5-7 mm long, side teeth acute, 4-5 mm, lower tooth acuminate-cuspidate, 5-7 mm long, in bud longer than upper teeth. *Vexillum* obovate, ca 14-18 mm long, ca 12-14 mm wide, apex emarginate, base clawed, auricles inflexed, 2 callosities near base; alae long-obovate, to ca 16 mm long, 4.5 mm wide, claw ca 4 mm, upper auricle ca 1.5 mm, lower auricle conspicuous; keel petals abovate-oblique, ventrally and partially basal adnate, ca 17 mm long, 6 mm wide. *Ovary* elongate, thinly pubescent, ca 12
mm long, 12 ovules; style glabrous, 5 mm the broadened extension of the ovary, 5 mm upcurved, narrow; stigma terminal, globular, penicillate at the base. *Stamen* monadelphous, vexillary stamen attached except near the base and upper 6 mm, filaments to ca 18 mm, free part 3-5 mm, upcurved; anthers uniform, basidorsifix, alternately on long and short filaments. *Pods* flattened oblong, to 6-9 cm long and 1.1 cm wide rounded at base, acuminate at apex, tipped with rest of style, blackish, sparsely covered with bulbous-based spreading somewhat caducous hairs, valves reticulate, sutures thickened and denser pubescent, outline of the 9-12 seeds visible. *Seeds* flattened-ovoid, ca 4 mm long, 2.5 mm wide, 1.5 mm thick, reddish brown, strophiole slightly protruding, circular, ca 0.8 mm diameter.

**Distribution**: Bhutan, China (Yunnan), India (Manipur and Sikkim).

**Ecology**: Climbing over dwarf bushes or oak trees, on hill slopes, in forests, near streams, on schistaceous, sandy, and rocky soils.

**Altitude**: 1300-3300 m.

**Flowering**: July-August (Bhutan), June-September (China), September-October (Sikkim). **Fruiting**: August-September (Bhutan), September-October (China), October-November (Sikkim).

**Vernacular names**: Not recorded.

**Uses**: MAIRE (cf. Pampanini’s protologue) mentioned that the tuber is edible. FORREST suggested that a specimen he collected (no 149) was probably an escape from the plant commonly grown for food in the valleys. He may have mistaken this species for the quite similar *P. lobata*.

**Specimens examined**:

- **BHUTAN**: Doteria Timpu, Cooper 3306 (E); Sali Kurted, id. 4479 (BM); Bagla la, Kurmed, id. 4596 (BM, E); Lometsawa, Wof Wangdu Phodrang, Grierson & Long 2689 (E).
- **CHINA, Yunnan**: nr Tapintze, Delavay s.n., 506 (P); Ta Long Tan forest nr Tapintze, id. 3566 (P); Chong Shan valley, Ducloux 399 (NY); Y dje nr Loulan, id. 3759 (P); Pinchwan-chou, id. 6887 (BM, F, P, US); 25.28 N, Forrest 149 (E); NE of Tengyueh, id. 8232 (E, K); S of Tengyueh, id 8778 (E); Chungtien mts, id. 10827 (BM, E, K); Chienschuan-Mekong divide, id. 22022 (E); betw. Tsuyung & Gwagdung, Handel-Mazzetti 4851 (K, W); Ludsgau nr Likiang on Yangtze river, id. 6998 (E, K, US, W); Yunnan mts, Maire s.n. (FL, holo; iso: P); Tsekou, Monbeig s.n. (E, K, P); Tali, middle Sia Tseng mts, McLaren’s collectors C63 (BM, E); top of Lien Wang mts, Likiang range, id. L143 (BM, K); Paiching, mountain top, id. AA239 (C, E); Likiang range, id. 308D (BM); W slopes of Likiang Snow range, Yangtze watershed, Rock 5412 (NY, P, US); Tsekou bridge, Soulie 1100 (P); ibid., id. 1001 (K, P); Chii tselo, HT Tsai 54166 (PE); Kangpu, Weisi hsien, C. Wang 74375 (P); Molangpo nr. Yuenjiang, von Wissmann 429 (W).
- **INDIA**: Manipur: Ukhrul, Kingdom Ward 17918 (BM, NY); Sikkim: Yoksun, Clarke 25157 (K), holotype of *P. quadristipellata* C. B. Clarke ex W. W. Smith, iso: BM, CAL, E, K); Pingleng, id. 25437 (BM, CAL, K); Karpouang, Ribu & Rhomao 4653 (CAL).

*Agric. Univ. Wageningen Papers 85-1 (1985)*
MAP 4. *Pueraria edulis*, *P. imbricata*, and *P. mirifica* in south Asia.
Notes: The heterotypic synonyms resulted from three independent studies on material described in Florence, Kew or Calcutta, and Paris in 1910, 1913, and 1916 respectively (LACKEY, 1977). The syntypes of P. bicalcarata were not seen, so no lectotype could be chosen. When GAGNEPAIN described his P. bicalcarata, he also had material of the closely related P. edulis Pamp. at his disposal, including the type. GAGNEPAIN added descriptions of fruits to PAMPANINI'S protologue of P. edulis, where no fruits are described, but he had no fruits of his own P. bicalcarata. The differences quoted are compact, hairy inflorescences and sharp upper calyx teeth for P. bicalcarata, elongate (glabrous) and obtuse upper calyx teeth for P. edulis (GAGNEPAIN, in Fl. Gén. Indo-Chine). The bifid lower stipule parts of P. bicalcarata are not compared with those of P. edulis, but the illustrations of PAMPANINI shows this clearly bifid, and the description is also clear, while GAGNEPAIN claims exclusivity for these stipules in P. bicalcarata. PAMPANINI did not see or describe bracts, GAGNEPAIN observed that they are similar in length to the bracteoles, but so is the case in P. bicalcarata. In both instances the calyx lobes are similar in length, while the upper connate teeth may be obtuse to acute. The vexillum is shortly auriculate, so the differences are not significant, and are probably due to ecological diversity. If genotypic variation can be observed, it is not at species level.

Phenotypic diversity encompasses leaflet size, size of inflorescence and flowers, and pubescence. The width and indentation of the stipelles varies, but there are always two pairs near the petiolules of the side leaflets. Apparently the availability of water influences leaf size; specimens from Bhutan and Tsekou, China, are more lush than usual when collected from other areas.

6. Pueraria imbricata van der Maesen sp. nov. *(Map 3, p. 26; Plate 7, p. 33)

Pueraria imbricata van der Maesen sp. nov.

Type: Laos, Sam Neua prov., betw. Muong Pun and Xieng Mene, Poilane 1931 (P, holo).

Paratypes: Thailand, NW of Sai Yok, Larsen 9049 (K; also in C, not seen); Thailand, Maehongson, Khun Yuam, Larsen & Larsen 34073 (K; also in AAU, not seen).

Caulis volubilis vel serpens, pubescens, deinde glaber. Foliola ovata-rhomboidea, subtus adpressae canescens, stipulae peltatae, pilosae. Pseudoracemi racemosi, ad basim stipulata, bracteae lineari-lanceolatae, bracteoleae minoribus vel subaequantes, bracteoleae late ovatae. Calyx pubescens, dentibus imbricatus, lanceolatus; vexillum elliptica-ovatum, apice emarginata, basi auriculata; alae elongata-obovatae, auriculatae; carina naviculara; ovarium elongatum, 10-14 ovulatum; staminae diadelphae, stamina vexilla a priori adnata, ad basim geniculata. Legumen ignotum.

Description: Trailing or climbing perennial. Branches ca 4 mm diameter, striate, 2-5 m long, pubescence spreading when young, bark glabrous and grey
when old, with small lenticels. *Stipules* peltate, 14-17 mm long, ca 5 mm wide at point of insertion, acuminate or fringed both ends, leaving a round scar when fallen. *Leaves* pinnately trifoliolate, petiole striate-canaliculate, golden-brown
and spreading pubescent, ca 8 cm long, rachis 3-4 cm long. **Leaflets** ovate-orbicular, side leaflets obliquely so, ca 9-13 cm long, ca 6-8 cm wide, apex acute to acuminate, base broad-cuneate to rounded, green and pubescent above, light green and densely grey-pubescent below, ribs prominent, in ca 6-7 unequal pairs, petiolules barely thickened, ca 5 mm long. **Stipellae** linear-lanceolate, striate, 7-13 cm long, 1-1.5 cm wide, dorsally pubescent. **Inflorescence** branched, sometimes unbranched, branches flowering quite near the base, (6-)12-47 cm long, more or less ribbed, brown pubescent, hardly nodose, bracts at the base and supporting branches stipule-like, but narrower than those, striate, dorsally pubescent, bracts supporting bud pedicels linear-lanceolate, half to equal the size of the bracteoles, dorsally pubescent, caducous, 1-2.5 mm long, 0.5 mm wide; flowers blue, 3 per node or short (7 mm) lateral, pedicels short, 0.5-3 mm, **bracteoles** 2 per flower, ovate, apex acute, 1.5-2.5 mm long, ca 1 mm wide, striate, pubescent, fairly persistent. **Calyx** purplish green, pubescent, tube 3-5 mm long; teeth lanceolate-acute, imbricate, apices often curved upwards, upper teeth almost entirely connate, 5-7.5 mm long, often longer than the lowest tooth, side teeth 3.5-5.5 mm long, lower tooth 3-7.5 mm long. **Vexillum** elliptic-ovate, 10-17 mm long, 7-12 mm wide, apex emarginate, base clawed, auricles reinforced, inflexed, callosities present near base. **Alae** elongated-ovobate, 9-17 mm long, 2.5-3.5 mm wide, upper auricle hooked, 1-2 mm, claw 2-3 mm. **Keel** petals boat-shaped, 8.5-17 mm long, 3-4 mm wide, long-adenate. **Ovary** elongate, appressed pubescent, 5-10 mm long, 10-14 ovules, style glabrous except at the base, 4-7 mm long, ca 3 mm perpendicularly upcurved with time, stigma terminal, globular, penicillate at the base. **Stamens** diadelphous, vexillary stamen attached at first, geniculate near the base, 7-16 mm long, upper 2-3 mm free, upcurved, anthers uniform, basidorsifixed, alternatively on long and short filaments. **Pods** and **seeds** unknown.

**Distribution**: Laos and Thailand.

**Ecology**: Trailing and twining in shrubs.

**Altitude**: 600-700 m.

**Flowering**: September, December.

**Specimens examined**: type and paratype material (*vide supra*).

**Note**: *Pueraria imbricata* sp. nov. is related to *P. lobata*, but has the branched inflorescences of *P. candollei*, to which a specimen had been assigned earlier (*THUAN*, in herb.). *P. candollei* has much shorter calyx lobes, those of *P. imbricata* are long and overlapping to some extent. The leaves are similar to those of *P. lobata* var. *montana*, but the flowers are larger (19 mm). The holotype has been earlier referred to var. *montana* (*THUAN*, 1979). The flowers of the Thai specimens are larger than those from Laos.
7. *Pueraria lacei* Craib

*(Map. 2, p. 17; Plate 8, p. 36)*


Type: Burma, Shandatgyi, Thayetmyo distr., 800 ft, *Lace 2685* (K, holo; iso: CAL, E, 2 specimens).

Description: Woody climber, perennial, branches 4 mm diam., vaguely ribbed, densely spreading rusty-pubescent, hairs up to 3-4 mm long. Stipules peltate, 20-25 mm long, 5-7 mm wide, upper part ovate-obtuse, 8-10 mm long, sometimes torn, lower part bifid, sometimes fringed, 5-15 mm long. Leaves pinnately trifoliolate, petiole almost terete, hairy as the branches, 5-8 cm long, leaflets ovate-rhomboid, side leaflets obliquely so, 6-11 cm long. 4.5-7.5 cm wide, apex long-acuminate, base rounded to broad-acuminate, green and adpressed pubescent above, greyish green and densely woolly adpressed-pubescent below, ribs prominent, in 6-7 unequal pairs, petiolules barely thickened, pubescent, 4-7 mm long. Stipellae linear-lanceolate, striate, 12-16 mm long, 1-1.5 mm wide. Inflorescence axillary-solitary or terminal-branched, basal part with several stipule-like bracts, flowers (2-)3 per node, pedicel supporting bracts linear-lanceolate, 12-15 mm long, up to 2 mm wide, dorsally spreading long-pubescent, ventrally short-grey-pubescent, caducous; pedicels ca 3 mm, bracteoles 2 per flower, ovate-lanceolate, tip acute, ca 4 mm long, ca 1.5 mm wide, striate, pubescent, rather persistent. Calyx spreading pubescent, interior sparsely so, tube ca 4 mm, teeth lanceolate, tip acute except at the tip, ca 10-12 mm long, side teeth ca 10-12 mm long, lower tooth ca 12-15 mm long. Vexillum ovate-orbicular, 15-17 mm long, 10-12 mm wide, base clawed, auricles inflexed, without callosities, color not recorded. Alae lanceolate 14-18 mm long, ca 5 mm wide, claw 5 mm long, auricle 2 mm long. Keel petals rounded along the base, ventrally adnate, ca 15-17 mm long, ca 5 mm wide. Ovary elongate, greyish silky appressed pubescent, ca 10 mm long, ca 9 ovules. Style glabrous, ca 2 mm as flattened extension of the ovary, ca 3 mm perpendicularly upcurved, stigma terminal, globular, penicillate at the base. Stamens diadelphous, vexillar stamen adhering at first, ca 15-16 mm long, free part 3-4 mm long, upcurved, anthers uniform, basidorsifixed, alternatively on long and short filaments. Pods not known.

Distribution: Burma.

Ecology: not recorded, presumably climbing in shrubs and trees.

Altitude: ca 300 m.

Flowering: December. Fruiting: January?

Vernacular names: not recorded.

*Agric. Univ. Wageningen Papers* 85-1 (1985)
Specimens examined: only known from the type specimens.

Note: Craib compared Pueraria lacei with his P. alopecuroides, with which
it has the leaves and hairiness in common. The calyx lobes are much longer, and the vexillary stamen is free, making it also close to *P. calycina*, as Lackey (1977) suspected. *Pueraria lancei*, as *P. alopecuroides*, has no lower alae spurs like those in *P. calycina*. Overall facies is more that of *P. alopecuroides* and not of *P. calycina*, as claimed by Lackey (l.c.).

I suspect that the branches will grow thicker than 4 mm, that the flowers are purplish as is most common in *Pueraria*, and that the fruits will be flat and hairy.

8. *Pueraria lobata* (Willd.) Ohwi

*(Map 5-7, p. 40, 41, 49; Plates 9-12, p. 44, 54, 55, 59)*

*Pueraria lobata* (Willdenow) Ohwi. For typification, literature and synonymy see varieties.

Description: Extensive woody climber, perennial, with very large tubers up to 2 m long and 18-45 cm wide or up to 180 kg when old. Branches strong, ca 0.6-2.5(-10) cm diameter, up to 30 m long, striate when young, bark vertically ribbed with age, adpressed to spreading, grey to brown pubescence, glabrescent with age. Stipules peltate, entire to bifid or fringed below the point of insertion, 8-16(-25) mm long, 2.5-6 mm wide, obtuse to acute above, striate, variously pubescent, leaving an oval scar. Leaves pinnately trifoliolate, petiole striate, grey to golden brown-hairy, hairs appressed to spreading, 8-13(-21) cm long, rachis (1.5)2.5-7 cm long, pulvinus thickened. Leaflets ovate to orbicular, unlobed to trifoliated to various degrees, 8-20(-26) cm long, 5-19(-22) cm wide, side leaflets obliquely so and often somewhat smaller, apex long-acuminate, straight or bent in plane of leaflet, base narrow to wide-acuminate or truncate to somewhat cordate, green and thinly appressed pubescent above, light to greyish green and thinly appressed pubescent below; ribs prominent, basal pair of the laterals opposite, other laterals not opposite, total 5-6 each side, petiolules barely thickened, 4-10 mm long. Stipellae ciliate to lanceolate, striate, 5-18(-30) mm long, 0.5-1.5 mm wide. Inflorescence mostly unbranched, occasionally with a lateral, flowering from near the base, (5)-10-25(-35) cm long, vaguely angled-striate, densely short grey appressed-pubescent to spreading golden-brown pubescent, slightly nodose, upright, few bracts at the axis base ovate-acuminate, striate, thinly pubescent, remaining or falling, 6-12 mm long, 2-4 mm wide, bracts supporting bud pedicels ovate-acuminate to linear-lanceolate, or setaceous, glabrescent to densely hairy, early caducous, 4-10(-13) mm long, 0.5-1(-2) mm wide, flowers 3 per node, pedicels short, up to 6-10 mm at maturity; bracteoles 2 per flower, ovate, apex acute, 2-4 mm long, 1-2 mm wide, striate, pubescent both sides, rarely glabrous, fairly persistent.

Calyx variously grey to golden-brown pubescent, hairs longer along the margin of teeth, inside pubescent, tube 3-5 mm long, teeth more or less overlapping, unequal, broad-acute to narrow lanceolate-acuminate, upper teeth connate or split at the top, 3.5-9 mm long, at base 3-5 mm wide, side teeth 3-7 mm long, 1.5-3 mm wide, lowest tooth 4.5-13 mm long, 1.5-4 mm wide, curved. Vexillum
ovate to rounded, 10-25 mm long, 9-16 mm wide, apex emarginate (or rounded),
base clawed, auricles reinforced, inflexed, callosities present, purplish to blue
or pink often with a yellow or green spot. Alae lanceolate-obovate, 12-19 mm
long, 3-6.5 mm wide, variously auricled, upper auricle triangular to short or
long (5 mm) hooked, basal auricle triangular to absent, claw up to 5 mm. Keel
petals rounded along base to perpendicularly angled, long-adnate, 11-22 mm
long, 3.5-7 mm wide. Ovary elongate, appressed pubescent, 8-15 mm long, ca
12-17 ovules, style almost glabrous, 2-4 mm as flattened extension of the ovary,
ca 3-4 mm perpendicularly upcurved; stigma terminal, globular, more or less
penicillate round the base. Stamens monadelphous, or vexillum stamen free with
time, 9-22 mm long, in fruit even more expanded, upper 1-5 mm free and up-
curved; anthers basidorsifix, alternatively on long and short filaments. Pods flat-
ten oblong, straight to falcate, 4-13 cm long, 0.6-1.3 cm wide, ca (5-)10-15
seeded, rounded at base, acute or bent at apex, tipped with the rest of the style,
occasionally constricted where ovules fail, valves densely spreading pubescent,
hairs golden brown, somewhat bulbous-based, not curling when ripe, outline
of seeds visible. Seeds flattened-ovoid, reddish brown with black mosaic, ca 4-5
mm long, 4 mm wide, 2 mm thick, hilum small, strophiole elliptic, 1 mm longest
diameter, seed coat minutely pitted. Seedling epigeal, first two leaves simple
and opposite, ovate to orbicular, 12-16 mm long and wide, apex obtuse, base
truncate to cordate.

Distribution: Japan, China, E. India, Indo China and SE Asia, Papua-
New Guinea and Pacific Islands, now widely spread into other tropical and sub-
tropical areas, common in SE USA.

Taxonomic notes: Pueraria lobata (Willd.) Ohwi, the Kudzu, the most
common and widespread species of the genus is very variable, hence the formid-
able synonymy. Variants have been described as species on account of differences
in vigour, leaf shape (which may vary within one plant), inflorescence
and flower size, indumentum and geography. Several nomina nuda were given
and some combinations have been made more than once by different authors,
when publication was obscure. The nomenclatural difficulties, interwoven with
the identities of Dolichos trilobus L. and D. trilobatus L. (now Vigna trilobata
(L.) Verde.) are discussed by Verdcourt (1968).

Linnaeus' epithet D. trilobus (1753) concerns three elements: a) a plant grow-
ing in Clifford's garden from American seed, not conserved (Hort. Cliff. 360),
b) a specimen in the Linnean herbarium (900.12) labelled ‘trilobus 7’ from China
which is, judging from the microfiche, certainly Pueraria lobata but var. lobata
or thomsoni rather than montana, and c) a drawing of a plant published by Pluk-
enet, which Verdcourt determined as Dolichos falcatus Klein ex Willd. Because
of this confusion it is preferable as Verdcourt also did, to lectotypify Pueraria
lobata by the unmistakable plate of Houttuyn. Willdenow's valid name under
Dolichos, D. lobatus, has perhaps been overlooked because its origin is stated
to be the Cape of Good Hope. The original Houttuyn reference states that the

Agric. Univ. Wageningen Papers 85-1 (1985)
specimen from which the figure was drawn came from Japan, while a similar plant came from the Cape. The German translation of the Dutch work, Natura/like Historie, by PANZER, quoted by WILLDENOW, mentions that Dolichos lobatus looks like plants from the Cape (OHWI 1947, STEWARD 1958).

The epithet hirsuta (Dolichos hirsutus Thunb., 1794) which predates lobata, cannot be used because of the existence of a heterotypic homonym, Pueraria hirsuta Kurz (1873), whereas the combination was not made until 1902 by MATSUMURA, and the later homonym cannot be accepted (Art. 55, 64, of the Code) despite the fact that P. hirsuta Kurz is now referred to Ophrestia (LACKEY, 1977a).

Most of LÉVEILLÉ's segregates (1908) from Pueraria lobata, were described from single accessions, admittedly phenotypically different. These were confined to synonymy quite early by GAGNEPAIN (1916b). Leaflet size, presence or absence of lobes, flower colour (blue vs. purple), length of inflorescence and density of pubescence were the characters on which Leveille based his species. They are, however, all Pueraria lobata. Peculiarly enough LÉVEILLÉ placed his species into two distinct sections. See also LAUENER (1970).

The ethnobotanist BARRAU (1965), describing the confusions with ethnological consequences in Kudzu, erroneously lists Dolichos tuberosus Lamarck (= Pachyrhizus tuberosus (Lam.) Spreng.), and Pachyrhizus trifolius DC. as synonyms for Kudzu. If his paper is read superficially, also Pachyrhizus angulatus Rich. ex DC. would seem a synonym for Kudzu, but BARRAU quoted this latter name as an error in UPHOF (1965), where Kudzu, the Fijian wa-yake, is named Pachyrhizus angulatus Rich. Pachyrhizus montanus Rich. should be (Rich.) DC. refers to Pueraria montana (Lour.) Merr., not, as earlier quoted by Merrill to Pueraria phaseoloides (MERRILL 1935, resp. 1910, 1918, 1923), but now referred to P. lobata var. montana (Lour.) VAN DER MAESEN comb. et stat. nov.

The different varieties of Kudzu are recognized in the markets and folklore botany, although vernaculars (q.v.) overlap. In 1977, KUBO et al. and TAKI et al. obtained three kinds of accessions of 'Gehua' the Chinese crude drug made from Kudzu flowers. Using flower size and morphology, the Chinese accession from Hong Kong was determined to be Pueraria chinensis (Benth.) OHWI (= var. thomsoni), the Taiwanese appeared to be P. montana (Lour.) MERRILL (= var. montana) and those obtained from Korea and Japan were P. lobata (Willd.) OHWI (= var. lobata). The pollen grains of the three forms differ by dimension, lumina number per unit area and shape of exterior configurations. OHWI (1936), KUBO et al. and TAKI et al. (1977) therefore distinguished three species in the lobata complex.

In conclusion, after having studied a large range of geographically widely scattered accessions of Kudzu and Taiwan Kudzu, it appears most convenient and probably closest in line to their natural alliances, to distinguish one species (Pueraria lobata) with three varieties. The varieties are: var. lobata (the typical Kudzu) from China and Japan, spread to Oceania and the USA, probably the only variety introduced elsewhere; var. montana from Indo-China, S. China, Taiwan and the Philippines (= Pueraria montana (Lour.) Merr., and var. thom-
soni (= Pueraria thomsoni Benth.) from NE India, Indo-China and some Malay- sian locations.

For some detailed notes see under varieties.

Uses: Pueraria lobata, the kudzu, produces tubers with starch, stem fibers, silage and hay, is useful as an erosion-controlling soil cover and shade plant, and has medicinal properties. Shurtleff and Aoyagi (1977) presented a vivid description of the uses of kudzu. Their references include ancient Japanese
sources, such as poems dating back to 600 AD, when kudzu first appeared in literature. Other sources of reference are the USDA Bulletins (e.g. Bailey, 1939, 1958), Heyne (1927), Burkhill (1938), Burkart (1950), Wealth of India (1969), Kay (1973) and Duke (1981).

Esteemed for its fine starch in Japan and China, the kudzu has become less important because harvest and extraction are laborious, but its unique properties still make it a speciality food and medicine. In Japan production is still ca 338 tons annually (1977). Inhabiting fences, roadsides and warm places, it needs hardly any attention and is one of Japan's most honoured wild plants and its finest cooking starch and jelling agent. Kudzu starch is used for sauces, soups, jelled salads, deep-fried preparations, noodles, porridges, jelly puddings, confectionary, and beverages. Burkhill (1938) mentioned that the starch was freely marketed all over eastern Asia. Kudzu leaves, shoots, and flowers can be steamed or pickled and eaten as a vegetable.

In Chinatown markets in the USA, the tubers were sold (Porterfield, 1951) and perhaps still are. Before World War I kudzu starch was in little demand in SW China except in times of scarcity and no medicinal uses were quoted (Wilson, 1929). Elsewhere in SE Asia, kudzu is used in times of famine, but in the highlands of New Guinea and New Caledonia the kudzu is still cultivated. In these and surrounding areas kudzu is of ancient introduction and was probably a staple before yams, taro and more recently sweet potatoes became increasingly important. As a food for rituals or special persons, or as an emergency food source, its role is considerable in some highland areas (Barrau, 1958, 1961, 1965). A search was made for vernacular names and data on usage in different highland tribes of Papua and erstwhile Dutch New Guinea, where remnant cultivation still persists (Watson, 1968). Strathern (1969) further elucidated the linguistic-ethnological relations between sweet potatoes (Ipomoea batatas L.) and kudzu in the Central New Guinea highlands. ‘Oka’ is the term for sweet potato, kudzu and related vines, but not a generic term for tuber, edible tuber or tuberous vines. There is a wild ‘Oka’, ‘Oka kweka’, with a small tuber, but neither Watson nor Strathern (i.e.) identify this vine botanically. Montrouzier (1860) distinguished the cultivated ‘bat’ and wild ‘jalé’ in New Caledonia as two varieties of ‘Dolichos tuberosus’ where he meant Pueraria lobata. Both varieties were eaten boiled or grilled, and provided good stem and root fibres for ropes.

Medicinal uses of kudzu starch in Japan include the restoration of health by alkalinizing the bloodstream and fighting intestinal and digestive disorders. The starch is then mainly taken in soups or teas. As a diet food it is soothing, nutritious and easy to digest. Root teas in China are said to be effective in colds, fevers, influenza, diarrhea, dysentery and hangovers. The Chinese use the flower buds as a diaphoretic (agent inducing sweating) and febrifuge (antipyretic, removing fever) medicine, and e.g. in Malaysia they are found among drugs in local pharmacies (Burkhill, 1938). The buds are called ‘Gehua’ and also used for treatment of hangovers (Kubo et al., 1977).

Another role of kudzu is the supply of stem fibers, woven into durable and supple cloth (‘kappu’ in Japanese, fashioned into the ‘katsui’ or kudzu kimono)
as well as coarser uses as fishing lines or head baskets, or for paper (China, New Guinea).

As green fodder or as an erosion-controlling agent kudzu is a successful species. Introduced into America from Japan in 1876, kudzu (var. lobata) was popular as a decorative and shade plant, with fragrant flowers, that grew well on any soil. From ca 1910 its use as pasturage, fodder and hay was popular, until around 1935 when emphasis shifted to its main use in soil erosion control. A vigorous Soil Conservation Service (USDA) campaign led to a coverage of over 3 million ha in 1950. This somewhat overenthusiastic approach overlooked the kudzu's negative aspects, the agressive growth when uncontrolled leading to the coverage of entire forests, uncultivated areas, killing trees and smothering electricity poles. The cultivated area, therefore, declined and by 1970 only ca 30,000 ha was covered by kudzu in the USA. In 1954 kudzu was removed from the list of acceptable cover crops and eradication became the focus of research. In 1981, the plant was about to be declared a pest, constituting a $10 million problem in Georgia where it affected 22,000 ha of commercial forest (Anon., 1982). In Zanzibar kudzu suppressed Imperata grass (PADWICK, 1951).

DUKE (1981) lists pests and diseases, which include nematodes, leaf caterpillars, fungal leaf spots and stem rot, and bacterial blights, mostly non-specific, except Mycosphaerella puericola, angular leaf spot. Bees act as pollinators and kudzu is said to be cross-pollinated, although seed set is often poor outside its native area.

Key to the varieties:

1a. Flowers large, corolla (18-)20 mm or longer, calyx (15-)17 mm or longer, appressed grey-pubescent, lobes 2-4 mm wide, overlapping; leaflets often trilobed, fruits large, 8-13 cm long, 9-13 mm wide ....... var. thomsoni

1b. Flowers smaller ................................................. 2

2a. Flowers small, corolla up to 12(-15) mm long, calyx 8-11 mm long, lobes 1-2 mm wide, short brown pubescent or almost glabrous, leaflets mostly entire, often narrower than long, more or less hairy, coriaceous fruits small, 4-10 cm long, 6-9 mm wide. ................................ var. montana

2b. Flowers medium, corolla 12-20 mm long, calyx 10-18 mm long, hairs spreading, brown, lobes 2-3.5 mm, lower one narrow-elongate, conspicuously longer than the others, leaflets trilobed, occasionally entire, about as wide as long, membranaceous, fruits medium to large, 5-13 cm long, 7-12 mm wide ............... var. lobata


Lectotype: Illustration in Houttuyn, Natuurlijke Historie 2 Plate 64 Fig. l(1779) text p. 153, and Pantzer's edition of the same (1782) text 8 p. 560 (see OHWI, 1947; STEWARD, 1958; VERDCOURT, 1968).


Type: Japan, the 'Kudsu', Thunberg 16757 (UPS, holo; microfiche seen). Illustration in Kaempfer's Iconogr. Select. table 41 (1791).


Neustanthus chinensis Benth., Fl. Hongk. 86(1861).

Type: Hong Kong, Harland (K, holo, not seen).


Agric. Univ. Wageningen Papers 85-1 (1985)


_Type_: New Guinea, Warburg? (not seen).

Paratype: NEW GUINEA, Hollrung 231 (not seen).


_Type_: New Caledonia, N. area, Mts nr Oubatche, 800 m, Schlechter 15484(B, holo? not seen; iso: BM, G, K, W).


_Type_: China, Kiangsu/Jiangsu, d'Argy 51 (E, holo; iso: E, d'Argy 52).

Type: China, Kouy-tcheou (Kweichow prov.), environs of Kouy-yang (Kweiyang), College Hill, Bodinier 2489 (E, holo; iso: P).


Type: Hong Kong, Chay-Ouan (Wanchai?) bay, Bodinier 1358 (E, holo; iso: P).


Type: China, Shantung prov., Tche-fou, Bodinier 239 (E, holo).


Type: Samoa Islands, Upolu Island, nr. Motootua, Rechinger 78(W, holo).

Paratype: Samoa Islands, Apolima Island, Rechinger 180(W, holo).


_Pueraria triloba_ Backer in Heyne, Nuttige Pl. Nederl. Indië 829(1927), based on _Pachyrhizus trilobus_ (Lour.) DC. and _Pueraria thunbergiana_ Benth. (should have been (Lour.) Backer).


Type: Yap, at Datyakal, Hosokawa 8885 (TAI, holo, not seen).


_Pueraria pseudo-hirsuta_ Tang & Wang, nom. nud.

Hu & Hsun, Native Forage Plants (1955).

_Agric. Univ. Wageningen Papers_ 85-1 (1985) 47
Distribution: Australia, (N. Queensland), Carolina Islands, China, Fiji, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Caledonia, New Hebrides, Papua-New Guinea, Philippines, Samoa, Solomon Islands, Taiwan, Thailand, Tonga Islands, USA, Vietnam. Introduced to many other subtropical areas. BECHERER (1934) quoted *P. lobata* as naturalized in Switzerland, near Ascona and Brissago, on Lago Maggiore. The kudzu did not become established in Africa, as far as is known, but was more successful in S. America and extreme-

Ecology: Climber in scrub, forests.

Altitude: 0-1500(-2000) m, more frequent at lower altitudes.
Flowering and fruiting: see Table 1.

Vernacular names: *Pueraria lobata*, in particular var. *lobata*, is most widely known as kudzu, its most common Japanese name. The other varieties, vars. *montana* and *thomsoni*, could be popularly named kudzu too, but Taiwan kudzu and Thomson's kudzu respectively is more specific. Area or language are listed alphabetically together:

*Agric. Univ. Wageningen Papers 85-1 (1985)*
Chinese: Ko, Ko t'eng (Hupeh, Szechwan), Koten, Gue, Fen ge teng.
Dutch: Driekwabbige vingerboon (HOUTTUYN, 1779).
Fiji: Aka, Yaka, Wa-yake.
French: Koudzou, Koudsou.
German: Kopou-bohne.
Indonesia: Bitok (Madurese), Tobi (Sundanese), Tebi (Kangean), Ngu lok (Buang).
Japanese: Kudzu, Kuzu, Saitzu mame, Fusi maki kadsura, Katsi maki, In ken maki, Daisumame.
Korea: Chik, Chuk, Cheulk.
New Caledonia: Magnana Rkerku, Quechoc.
New Guinea: Wowitu, Owitu (Asaro area), Op, Muntamagana (Banz) Sifu (Bena), Goruma (Chimbu), Gosima (Chuave), Korono (Enga-Mendi), So'onea (Gahaku), Kohena (nr Goroka), Ko'pitu, Ngko-ko, Ngko'ahi (Kainantu), Hgedafo, Sifu, Mudja (Kamano), Nggonduma, Nggondumu (Kundiawa), Nggoka (Medipa-Kakoli), Oka mapumb, Oka moi (Medlpa), Mapumb (Mt. Hagen), Kenangia, Kagomba (Watabung).
Philippines: Baai (Igorot), Tahaunon (Manubo).
Solomon Islands: Lebu.
Thailand: Tum yaa krau.
Tonga: Aka, Fue'aepuaka, Fuealpuaka.
Spanish: Kudzu, Kudzucomun, Kudzuordinario.
Vietnam: Cu Nang (Annamese), Cu San day (Tonkin).

Specimens examined (a representation):
AUSTRALIA: Queensland, Thursday Isl., Podenza s.n. (BM).
THING, Courtois 33073 (NAN). Kirin/Gilin prov.: Tang Ho, Pei Nin Ting ml, Clemens 6200 (E).
Kwangsi/Guangxi prov.: Tong Shan, nr Sapuk Po village, Waitsap dist., WT Tsang 22743 (W); Hai Chang village, Chifeu Shan, Kweilin distr., id. 28402 (US). Kwangtung/Guangdong prov.: Nan-kun hill, Yonghan, Lungmim county, S.C. Lee 200071 (WKA). Hainan, White Sand/Bai Sha, Yan-mendong, Bei Kwang, S.K. Lau 26038 (KWA). Kwetchoi/Guizhou prov.: nr Kweiyang, Bodinier 2489 (E, P); Pinfa, Cavalerie 206 (W); Liang Feng Yah, Tsunyi hsien, Steward et al. 287 (NY, US); Lungli, Y. Tsiang 4461; (NAN). Liaoning prov.: Vanfangoo, nr temple, Liaotung peninsula, Lithwinov 1802 (NY); Aushan, Qiao hill nr Zuye temple; Y.L. Chou et al. 2738 (NAN); Peking/Beijing: E. Mei Ssu, W. Tomb, J.C. Liu s.n. (K); Nankow Pass, Wawra 991 (W). Shanghai: Fangwang

Agric. Univ. Wageningen Papers 85-1 (1985) 51

**Fiji:** Viti Levu: Tholo north, *Degener* 14942 (NY, US); Naitasiri, Nasinu, *Togavu, Kraoivelhan* s.r. (K, US); Kambara, *Smith* 1268 (NY, US); Viti Levu: Serua, hills betw. Waininggere & Waiaese creek, Ngaloa to Wainingyamba, id. 9668 (K, US).

**Hong Kong:** Chay-wan bay, *Bodinier* 1338 (E, P); Jubilee reservoir, New Territory, *S.Y. Hu* 8399 (US); Ping Chow Isl., id. 9244 (US).

**Indonesia:** Kangean Isl., Ardjasia, *Backer* 26777 (P); ibid. id. 27213 (L); Taninterm Is, Timor Laut, Jamdena Isl, Saumlaki to Oili, *Buwalda* 4037 (K, L, NY); Roga, Endehe, Flores, *Elbert* 4344 (L); Tual, Key Isls, *Jensen* 31 (C); Ambon, *Jensen* 31 (C, NY, P, U, US); Awa Isl., *Konta* 5354 (C, E, U); Yokohama, hina, SE of Kyoto, id. 151 pref., Ohashi et al. 77 (US); ibid., Himi-komoda, id. 151 (US); Yamadera, Yusenkyo, Yamagata pref., *Ohashi et al.* 101 (WAG); Nagasaki, pref., *Ohashi et al.* 101 (WAG); *Kawamura et al.* 5793 (E, G, W); Quelpaert-Cheju Do Isl., id. 5793 (E, G, W); Umidong, *Faurie* 442 (1707,3095); Sorai Beach, Whanghai prov., id. Kangwha ntp., id. ibid., Himi mt, Shirataka, Shimoaiga-gen, Tsushima Isl., Nagasaki pref., *Ohashi et al.* 77 (US); Hima, *Sonohara et al.* 6328 (US); ibid, Walker et al., 5793 (US); Nakagami, Shuri Castle Hill, id. 5930a (US); Iriomote Isl., Yaeyama Gunto, id. 6166 (US).

**Korea (S):** Tokyon, Tonguei-up, S. Kyongsang, *Chandler* 77 (BM); Kwangnun, *Cheng-In-Cho* 3095 (F); Hoang-hui-to mts, *Faurie* 442 (E, G, W); Quelpaert-Cheju Do Isl., id. 1707 (E); Umido, *Kangwon prov., Lee & Lee* 518 (US); Kumwha, *McClatchie* 664 (US); Ponkhan-San nr Seoul, Kyongjong-do (Nat. Forest Exp. Stn. 5807 (F); Sorai Beach, Whanghai prov., *R.B. Smith s.n.* (US); Kangwha Isl., *R. K. Smith s.n.* (US).

**Korea (N):** S of Heijo, Chosen, in Botandi section, *Dorsett & Morse* 6213 (US).

**Malaysia:** Malaya: Perak, Ipoh, towards Taujing Rambutan, *Huellia?* 1603 (K); Selangor, Teluk Baru, *Franck* 1097 (C); Sarawak: *Anon. 204* (BM).

**New Caledonia:** Tchiar, *Balansa* 3330 (BM, FI, K, US); nr. Noumea, *Franc* 734 (G); Kone, *McKee* 4249 (E, K, L); nr Ubatache, *Schlechter* 15848 (BM, G, K, W).


**Papua-New Guinea:** Rona, *Carr* 12406 (BM, K, NY); Sattelberg, Morobe distr., *Clements* 1729 (L); Busu, nr Lae, Morobe distr., *Coode* 968 (E); 8 km from Sialium to Kalasa, Finschhafen distr., *Hents & Katik* 4116 (C); Matupi Isl., nr Simpsonshafen, New Britain, *Rechinger* 4124 (W).


**Samoa:** Savai Isl., nr Samalaua, *Christophersen* 862 (K, NY); Tau, nr Luma on plateau, *Garbir* 653 (K, NY); Upolu Isl., *Rechinger* 78 (W); Apolima Isl., id. 180 (W); Savai Isl., Sassina to Aopo, id. 9392 (W); Safotu (Savari), *Vosper* 169 (US, W); Tutuila, *Whister* 1288 (US).

**Solomon Islands:** Belona, *Djova, Brown* W/288 (BM); Belona, *Christophersen* 3236, 3238, 3239, 3336, 3439 (C). Guadalcanal: Kokumbona, *Brown* 1671 (BM); Vavaea ridge nr Honiara, *Leach* 52
8b. Pueraria lobata (Willd.) Ohwi var. montana (Lour.) van der Maesen comb. et stat. nov.

Basionym: Dolichos montanus Loureiro, Fl. cochinchin. 440(1790); Fl. cochinchin. ed. Willd. 536(1793).

Type: Vietnam, Cochinchina, habitat in sylvis montanis Cochinchinae, Loureiro s.n. (P, holo, photograph seen).


Type: Linn. Herb. 901.8 (LINN, photograph seen).

Pachyrhizus montanus (Lour.) DC., Prodr. 2: 402 (1825), based on Dolichos montanus Lour.

Stizolobium montanum (Lour.) Spreng., Syst. 3: 352(1826), based on Dolichos montanus Lour.


Type: not seen.


Paratypes: ibid., id. 314(P), id. 318 bis(P); Vietnam, Tonkin, Cha Pa, Hau-tefeuille 183(P); Vietnam, Hanoi prov., But Son, Elephant Mt, Bon 2737(P); China, Yunnan, nr Lou-lan, Duceloux 3771(P); China, Hainan, Katsumata 7813(P); China, Kouang-tcheou (Kwangchow, Canton, Guangdong), Decker 113(P); Hong Kong, ravine forest of Fort Victoria, Bodinier 871(E, P).

Pueraria montana (Lour.) Merrill, Trans. Am. Philos. Soc. n.s. 24-2: 210(1935); Tanaka, Tanaka’s Cyclop. Edible Pl. World 602(1976); Ohashi, Fl. Taiwan 3: 367(1977); Lackey, Synops. Phaseol. 72,74(1977); Thuan, Fl. Cam-

Agric. Univ. Wageningen Papers 85-1 (1985)
PLATE 10. *Pueraria lobata* (Willd.) Ohwi var. *montana* (Lour.) van der Maesen (Shiu Ying Hu 8035)


*Agric. Univ. Wageningen Papers 85-1* (1985)
PLATE 11. *Pueraria lobata* (Willd.) Ohwi var. *montana* (Lour.) van der Maesen (Ford s.n.)


*Agric. Univ. Wageningen Papers 85-1* (1985)
Type: Taiwan, Urai, pref. Taihoku, Suzuki 3297 (TAI, not seen).
Paratypes: see protologue.


Type: not traced. Chinese Pueraria material of the lobata complex on Mount Omei include both var. lobata and var. montana. Judging from the illustration in the Iconographia, P. omeiensis is very similar to var. montana. Both varieties from Mt. Omei have been determined as P. omeiensis in Chinese Herbaria.

Distribution: Burma, China (Chekiang/Zhejiang, Kwangsi/Guangxi incl. Hainan, Hupeh/Hubei, Kweichow/Guizhou, Kiangsi/Jiangxi, Kwangtung/Guandong, Szechwan/Sichuan, Yunnan), Hong Kong, Japan, (Riukiu Isls), Laos, Philippines, Taiwan, Thailand, Vietnam.

Ecology: Climber in thickets, forests, on dry slopes or in moist places, in sandy or loamy soils, valleys, roadsides, open pastures, hedges, river sides, swamps.

Altitude: 100-1500 (-2000) m.

Flowering and fruiting: see table 1.

Vernacular names: China: Kot ma mo, Kot ma t'ang, Kot t'ang fa, Ye wang kot tang, Ye wong kok (Hainan).

Laos: Chua tan cung, (Khua) Khao Piet (Houa Phan); Ma sum (Lai Chan, Hmong).

Taiwan: Taiwan kudzu.

Vietnam: (Day) Cae Lan (Quang Nam), Day dan, San rung (Annamese), San day (Ha Nam Ninh), Surum.

Specimens examined:

BURMA: Mausam Falls, N. Shan State, *Lace 5463* (K); Maymyo Plateau, id. *5960* (K); Keng Tung, Shan State, *MacGregor 937* (CAL); Kachin Hills, *Shaik Mokim s.n.* (CAL).


**JAPAN**: *Yoronjima Isl., Uyehara s.n.* (US).


**THAILAND**: Ban Mae La Noi, 25 km N of Mae Suriang, *Larsen et al. 2284* (E); Nang Rong Falls at Nakhon Nayok, *id. 3347* (E); Phu Miang, *S. P. et al. 51* (P).


**COCHINCHINA**: Soureiro s.n. (P, holo); Botao, *Schmidt s.n.* (P).

**Note**: *Pachyrhizus montanus* Blanco is a synonym of *Pueraria phaseoloides* (Roxb.) Benth. (MERRILL, 1918).

GAGNEPAIN refers in the Flore Générale de l'Indo-Chine to the protologue of its *Pueraria tonkinensis* in Notulæ Systematicæ, which happened to be published a few months later than the fascicule of the Flore. GAGNEPAIN noted the

Agric. Univ. Wageningen Papers 85-1 (1985)
close relation of this *Pueraria tonkinensis* to *P. lobata*, as he mentioned *Neustanthus chinensis* Benth.? in synonymy, with a question mark. Lackey (1977) remarked that *Pueraria montana* is very close to *P. lobata* but seemingly distinct by its smaller habit. In fact, leaflet size sometimes approaches the upper limits of the other varieties, but flowers of var. b. *montana* are smaller. I did not find enough consistency in relative length of petals and auricle presence in the alae, characters used by Bentham (1867), Ohwi (1936) and Ohashi (1977) to accept *P. montana* as specifically distinct from *P. lobata*. Differences are decidedly more of a varietal level, hence the reduction of this taxon to *P. lobata* var. *montana*. Moreover, the geographic distribution of the varieties overlaps. Var. *montana* is not only confined to mountains.

Merrill (1935) did not state whether a Loureiro specimen of *Dolichos montanus* is still extant, but a Loureiro sheet in P (photograph in F) fits the population characteristics. Description and Annamese name of *Dolichos montanus* Loureiro fit the modern specimens received by Merrill under that name. Thuan, however, in his *Phaseoleae* volume of the Flora of Laos, Cambodia and Vietnam (1979) states that the type is not conserved.

I have not been able to obtain more information about *Zeydora agrestis* Lour. ex Gomes and its type, a name reduced by Merrill (1935) to *Pueraria montana*.

8c. *Pueraria lobata* (Willd.) Ohwi var. thomsoni (Benth.) van der Miesen comb.
et stat. nov.


Type: cultus in Cochinchina and China, Loureiro (P? not seen).

*Pachyrhizus trilobus* (Lour.) DC., Prodr. 2: 402(1825), based on *Dolichos trilobus* Lour.

*Dolichos grandifolius* Grah. ex Wall. nom. nud., Wallich Cat. no 5556(1831), based on *Neustanthus chinensis* Benth., Fl. Hongk. 86(1861).

Type: Hong Kong, Harland (K, holo; not seen).

*Pueraria chinensis* non Benth., sensu Ohwi non *Neustanthus chinensis* Benth.,

Basionym: Neustanthus chinensis Benth. Fl. Hongk. 86(1861), which is actually var. lobata.

Lectotype: China, Kwangtung/Guangdong prov., Hainan, Wong Kam

Agric. Univ. Wageningen Papers 85-1 (1985)


_Basionym:_ *Neustanthus chinensis* Benth., Fl. Hongk. 86 (1861) actually var. _lobata._ Typification under *Pueraria chinensis* (non Benth.) Ohwi.

_Distribution:_ Bhutan, Burma, China (Kiangsi/Jiangxi, Kwangsi/Guangxi, Kwangtung/Guangdong incl. Hainan, Yunnan), Hong Kong, India (Meghalaya, Nagaland, Sikkim), Laos, Philippines, USA (Hawaii), Vietnam.

_Ecology:_ Tall climber in thickets, forest fringes, secondary growth, along rivers, on level or sloping terrain, moist or dry, in sun or shade, can form a thick cover.

_Altitude:_ 100-2300 m (in India and Burma above 1000 m).

_Flowering and fruiting:_ see Table 1.

_Vernacular names:_ China: Da jiezi ting (big jiezi vine), Ge tang, Ye San Kot (wild pink-coloured vine).

_India:_ Kaikangru (Assam), Suting, Suting-rit (Khasi).

_Vietnam:_ San day (deai) cu, Cay day, Cat can (Annam), Sa ma nia (Nha Trang), San day (Tonkin), (Day) cat can (Minh Hai), (Day) San (Ninh Binh), San dai (Nam Ha), Tonk gia (Moi, Lam Dong).

_Specimens examined:_

**BHUTAN:** Nyitadi, R.F. 1913 (E).

**BURMA:** U yawm Uka, Kaulback 384 (BM), valley of Nam Tamai, Kingdom-Ward 13079 (BM), N. Triangle, Hibinham, id. 21246 (BM), Maymyo plateau, Lace 5887 (K).

**CHINA:** Kiangsi/Jiangxi prov: Wugong hill, Zhen Shan Kwan, Acad. Sci. 904 (PE). Hangaodsu mt betw. Ningdu & Tjijang (Kian), W.T. Hui 485 (C, W), Kwangsi/Guangxi prov: Me-kon, Schel-Feng Dar Shan, S. Nanning, R.C. Ching 8403 (KWA, NY, US); Daxing shan hill 20 km S of Lungzhou, H.Y. Liang 65849(KWA); Li village, Yong county, T.M. Rei 40165 (KWA), Kwangtung/Guangdong prov: Da cheng, Renhua county, L. Tang 7658 (KWA), Tung Koo Shan, Tapu county, W.T. Tsang 21720 (KWA, NY), Chik Sha village, Hainan, McClure 13533 (NAN); Hainan Isl.: Wong Kam Shan, Ngai county, S.K. Lau 552 (KWA, NY, W, US); middle slope of Nanning hill, Dingan county, S.K. Lau 28415 (KWA); Yaichow, H.Y. Liang 63107 (NY); in forest, C. Wang 34049 (NY, US); ibid., id. 34095 (NY). Kiangsi/Jiangxi prov.: Hangaodsu mt between Ningdu and Tjijang (Ki-an), Wang-te-Hui 485 (C, W). Yunnan prov.: Man Hao region, d’Alleizette s.n. (L); W flank of Shweli-Salween divide, 2520N, Forrest 8917 (E, K); ibid., id. 9117 (E, K); Mengtze, on way up to By river, Hsinku rd, Henry 9248 (CAL, NY); Mengtze, SE mts, Henry 11041 (CAL, NY, US); Xishuangbonna forest, S. Ru Shan Exp. Stn, P.I. Mao 7098 (KWA).

**HONG KONG:** Lantao, Ford 10 (US).

**INDIA:** Arunachal Pradesh: behind Wakroo Inspection Bungalow, Lohit distr., Joseph 48434 (CAL); Khumi Pahad to Peopol, Subansiri Frontier Div. Panigrahi 19631 (CAL); Old Hayulangs, Assam Rifles, A.S. Rao 48168 (CAL). Manipur: Arunchal Pradesh: behind Wakroo Inspection Bungalow, Lohit distr., Joseph 48434 (CAL); Ukhrul, Kingdom Ward 17918 (BM); Karong, Koels 26376.
Table 1. Flowering and fruiting of *P. lobata*

<table>
<thead>
<tr>
<th><strong>Var. lobata</strong></th>
<th><strong>Flowering</strong></th>
<th><strong>Fruiting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Feb</td>
<td>*</td>
</tr>
<tr>
<td>Caroline Islands</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>China</td>
<td>(May)Jun-Sep(Oct)</td>
<td>(Jul)Sep-Nov(Dec)</td>
</tr>
<tr>
<td>China, Hainan</td>
<td>Mar</td>
<td>*</td>
</tr>
<tr>
<td>Fiji</td>
<td>Dec, Mar-Apr, Aug</td>
<td>*</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Oct</td>
<td>Oct-Dec</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Feb-Mar</td>
<td>*</td>
</tr>
<tr>
<td>Japan</td>
<td>Jul-Oct</td>
<td>Sep-Nov</td>
</tr>
<tr>
<td>Korea</td>
<td>Jul-Oct</td>
<td>Aug-Oct</td>
</tr>
<tr>
<td>Malaya</td>
<td>Jul</td>
<td>*</td>
</tr>
<tr>
<td>New Hebrides</td>
<td>Jan, Mar, Oct</td>
<td>*</td>
</tr>
<tr>
<td>Papua-New Guinea</td>
<td>Feb, Apr, May, Dec</td>
<td>*</td>
</tr>
<tr>
<td>Philippines</td>
<td>May-Aug, Oct</td>
<td>*</td>
</tr>
<tr>
<td>Samoa</td>
<td>Nov-Jan</td>
<td>*</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>Feb, Mar, May, Nov, Dec</td>
<td>*</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Aug, Sep</td>
<td>*</td>
</tr>
<tr>
<td>Thailand</td>
<td>Jul, Nov</td>
<td>*</td>
</tr>
<tr>
<td>Tonga Islands</td>
<td>Dec-Jan, Mar</td>
<td>Mar</td>
</tr>
<tr>
<td>USA</td>
<td>Jul-Oct</td>
<td>Sep-Oct</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Apr</td>
<td>*</td>
</tr>
</tbody>
</table>

**Var. montana**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Burma</td>
<td>Sep-Oct</td>
<td>*</td>
</tr>
<tr>
<td>China</td>
<td>Jul-Oct</td>
<td>Aug-Nov</td>
</tr>
<tr>
<td>China, Hainan</td>
<td>Mar-May, *</td>
<td>Apr-May, Nov-Dec</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Sep-Oct</td>
<td>Dec</td>
</tr>
<tr>
<td>Japan</td>
<td>Aug</td>
<td>*</td>
</tr>
<tr>
<td>Laos</td>
<td>May, Sep</td>
<td>Sep, Oct</td>
</tr>
<tr>
<td>Philippines</td>
<td>Jun-Aug</td>
<td>*</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Aug, Oct, Jan</td>
<td>Aug</td>
</tr>
<tr>
<td>Thailand</td>
<td>Jul-Aug</td>
<td>*</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Mar, Jun-Oct</td>
<td>Sep-Nov, Jan</td>
</tr>
</tbody>
</table>

**Var. thomsoni**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhutan</td>
<td>Aug, Sep</td>
<td>*</td>
</tr>
<tr>
<td>Burma</td>
<td>Aug, Sep</td>
<td>*</td>
</tr>
<tr>
<td>China</td>
<td>Jun, Sep-Oct</td>
<td>Oct-Nov</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Jul</td>
<td>*</td>
</tr>
<tr>
<td>India</td>
<td>Aug-Oct</td>
<td>Sep-Jan</td>
</tr>
<tr>
<td>Laos</td>
<td>Oct</td>
<td>*</td>
</tr>
<tr>
<td>Philippines</td>
<td>Jun-Sep</td>
<td>*</td>
</tr>
<tr>
<td>Thailand</td>
<td>Aug</td>
<td>Dec</td>
</tr>
<tr>
<td>USA, Hawaii</td>
<td>Oct</td>
<td>*</td>
</tr>
<tr>
<td>Vietnam</td>
<td>May, Aug-Oct</td>
<td>Nov-Dec</td>
</tr>
</tbody>
</table>

* not reported on herbarium labels.
(L). Meghalaya: Shillong, Clarke 38251 (CAL); ibid., Bishop’s Falls, id. 42508 (CAL); Khasi mts, Normal (Nyrmia), id. 40100 (CAL, F, G); Khasi mts, Griffith s.n. (BM, P); Khasia regio temp. Hooker & Thomson s.n. (K, holo: iso: C, CAL, FL, G, K, L, NY, OXF, P, U, US, W); Assam (probably Meghalaya hills), Jenkins s.n. (BM, CAL, K); Mawryngkneng, Khasi hills, Koelz 28341 (L); Mokokchung, Hutton s.n. (CAL); Suting, Beadon Falls, Kanjilal 2381 (CAL); Khasi mts, Griffith s.n. (BM, P); Khasia regio temp. Hooker & Thomson s.n. (K, holo: iso: C, CAL, F, G, K, L, NY, OXF, P, U, US, W); Assam (probably Meghalaya hills), Jenkins s.n. (BM, CAL, K); Mawryngkneng, Khasi hills, Koelz 28341 (L); Mokokchung, Hutton s.n. (CAL); Suting, Beadon Falls, Kanjilal 2381 (CAL); Khasi mts, Kurz 325 (W?); Way to Sonapur, Panigrahi 4463 (CAL). Nagaland: Jotsoma, Naga hills, Bor 6249 (BM?); Ghukiya, Assam, Bor 16313 (L); Kohima, Clarke 40933 (CAL, FI, G), Munghoo, Kari s.n. (CAL).

Sikkim: L. Munghoo Reshap, Anon. 26, 28 (K); Tista, Cave s.n. (BM, E); Sikkim Himalaya, Treutler 786 (K). West Bengal: Kalimpong, Darjeeling distr., Clarke 9172 (K); id. 9206 (CAL).

LAOS: Savannakhet, Pollane 28036 (P).

PHILIPPINES: Negros Isl., Curran 17339 (US); Biliran Isl., McGregor 18522 (US); ibid., id. 18773 (US); Masanganbahi, Catanduanes Isl., Ramos & Edano 75206 (CAL, NY); Mt Yagaw E slope, Mindoro, Sulit & Conklin 17621 (BM, E, L).

THAILAND: Sriracha, Collins 490 (K); Muak Lek, Saraburi, Kerr 9088 (BM, E, K); Nong Bon 25 km E of Makham, Larsen et al. 32267 (K).

VIETNAM: Tonkin: Ouonbi, Balansa 1183 (P); Tu-Phap, in hedges, Balansa 2277 (P); Phu Nhae, Bon 38 (P); Huong-thung, Thua-thien prov., Eberhardt 2276 (P); Seven Pagodas, Mouret 54 (P); Phu Ho, Petelot 1515 (NY, P, US); Se Phue Yen, Pagoda of Soc Son, Petelot 5568 (P, US); Phu Lu nr Laokang, right bank of Red River, Pollane 24982 (P); Long-tehou, Simond 306 (P); Kan Nga Shan & vicinity, Tien-yen, W.T. Tsang 30537 (C, G, K, KWA, L). Annam: Thoi binh, N of Camau, Baelieu prov., Pollane 508 (P); Ta Bai, Kontum prov., id. 18212 (P); Tran, Haut Donai prov., id. 30190 (P); Cho-quan nr Saigon Ho Chi Minh City, Lefèvre 46 (P).

Notes: Bentham (1867) quoted his Neustanthus chinensis as a synonym of P. thunbergiana (Sieb. & Zucc.) Benth. OHWI (1936) made the combination P. chinensis (Benth.) OHWI with Bentham’s species as basionym. However, neither Ohwi nor I saw the type (Harland, from Hong Kong, K?) and he quotes material which is definitely var. thomsoni. Var. thomsoni also occurs in Hong Kong, but Bentham would have quoted his N. chinensis as synonym under his P. thomsoni if the type belonged there. Kubo et al. (1977) and Taki et al. (1977) use P. chinensis in the sense of Ohwi, that is var. thomsoni.

Baker (1876) listed Dolichos spicatus Wall. Cat. 5557 C (nom. nud.) as synonymous to P. thomsoni. However, the material at G and NY is P. phaseoloides var. subspicata, just as Wall. Cat. 5557A and B, except for a loose var. thomsoni inflorescence on the NY sheet, which apparently got mixed up. This may also be the case in the original Wallich Herbarium in Kew.

Pain (1897) put P. thomsoni Benth. into synonymy with P. thunbergiana (Sieb. & Zucc.) Benth., now P. lobata (Willd.) Ohwi. With the material then available, more abundant than in Bentham’s time, he could not separate Bentham’s species even as varieties. However, despite the difficulty of distinguishing some of the largest flowering, most vigorous specimens of var. lobata from those which I consider to be var. thomsoni, varietal rank is appropriate in my opinion. Wealth of India (1969) and Chinese Floras kept P. thomsoni as a separate species.

Thuan (1979) states that var. thomsoni appears to be cultivated or escaped from cultivation in its area of distribution. So far it appears mainly var. lobata, rather than var. thomsoni, which is the widespread introduction in areas outside SE Asia.


**Lectotype:** Thailand, Doi Sutep nr Chiangmai, 300-800 m, 21 March 1949, *Suvatabandhu s.n.* (K, hololecto, sheet 2, inflorescence & leaf; isolecto: K, sheet 5, flowers).

**Paratypes:** ibid., 28 May 1947, *Suvatabandhu s.n.* (not seen); ibid., 2 March 1949, *id. s.n.* (K, with tuberous roots).

**Description:** Woody climber, perennial, with tubers up to 15 cm long, 6 cm wide. **Branches** strong, to ca 7 mm in diameter, 5 m or longer, terete, striate, clad with adpressed grey hairs, more or less glabrous with age. **Stipules** peltate, elliptic, both ends obtuse, up to 5 mm long, 2 mm wide, caducous, leaving a round scar. **Leaves** pinnately trifoliolate; petiole canaliculately striate, almost glabrous, up to 12(-?) cm long, rachis 2-7.5 cm long. **Leaflets** broadly ovate, side leaflets obliquely so, 12-20 cm long, 8-14 cm wide, apex long- acuminate base truncate or broadly cuneate, green and thinly grey-pubescent above, grey-green and adpressed grey pubescent below, ribs prominent, in 6-7 unequal pairs; petiolules thickened, pubescent, 5-8 mm long; **stipellae** subulate, pubescent, striate, ca 3-5 mm long, 1 mm wide. **Inflorescence** narrow-branched, mainly at the base, short, up to 30 cm long, **branches** many, ridged, at the tip almost winged, clearly nodose, covered with adpressed short greyish hairs, bracts at the base small perules; pedicels short, ca 1 mm; flowers (2-)3 per node; bracts linear-lanceolate, ca 5 mm long, 1 mm wide, striate, dorsally long-pubescent, ventrally short-pubescent, very caducous; **bracteoles** 2 per flower, triangular, tip obtuse, brown-pubescent, ca 1 mm long and wide. **Calyx** with short brown adpressed hairs, inside only where calyx teeth join at end of tube, tube ca 2.5 mm long, teeth short, triangular, obtuse, upper ones connate, ca 2 mm long, side teeth ca 1 mm long, lowest tooth ca 1.5 mm long. **Vexillum** orbicular-ovate, apex emarginate, base clawed, auricles inflexed, with two callosities near base, bluish purple, ca 9-10 mm long, ca 8 mm wide, margins inflexed. **Alae** lanceolate, ca 8-9 mm long, 2.5 mm wide, claw 2 mm long, auricle hooked, 1 mm. **Keel** petals rather sharply curved along the base, ventrally adnate ca 8-9 mm long. **Ovary** elongate, grey silky, adpressed pubescent, ca 5 mm long, ca 7 ovules; style almost glabrous, ca 1.5-2 mm flattened extension of ovule, ca 2 mm perpendicularly upcurved; stigma terminal, globular, penicillate at base. **Stamens** monadelphous, vexillary stamen attached at the middle with a knee, ca 9 mm long, free part 1-2 mm long, upcurved; anthers uniform, dorsiflex below the middle, alternatively on long and short filaments. **Pods** (teste protologue) flattened-oblong, to 3 cm long, 7 mm wide, constricted where ovules fail, sutures thickened, short adpressed-pubescent. **Seeds** (teste protologue) suborbicular, flattened, base intruded, 2-5 mm diameter, brown purple.
Distribution: Thailand.

Ecology: deciduous forest, hill slopes.

Altitude: 300-800 m.

Flowering: February-March. Fruiting: April.

Vernacular names: Thailand: Kwaokeur, Kwao Kua.

Specimens examined:

THAILAND: type material (vide supra); Kok Charoen, 13.5 km N of Chaibadan, Lopburi prov., Loofs 1 (L); N. Lampang, Thou, Mae Hawk, Samaphuddi BKF23028 (C).

Uses: The tubers have a reputation of rejuvenating effects (KERR, 1932; PHYA WINIT, 1933). Estrogenic substances have been found (VANIJVATAMA, 1938). Its use has remained localized until renewed interest by Thai and British workers (CAIN, 1960). Upon further investigation the name 'miroestrol' was given to the estrogen and its chemical and physical properties determined. Preliminary clinical trials showed that miroestrol produced marked estrogenic effects but the doses tried caused rather disagreeable toxic effects (CAIN, 1960). In Thailand preparations are much less purified and the dried root is taken with honey. The plant has earlier been referred to as Butea superba Roxb., because only old plants flower and the leaves do superficially resemble Butea leaves. Butea does not produce tubers which facilitate identification of sterile plants. Pueraria mirifica and B. superba are both common near Chiengmai (LAKSHNAKARA KASHEMSANTA et al., 1952).

This species is closely related to P. candollei, if not just a variety. Differences are slight: flower size smaller, lower surface of leaves greyish, both of which can be accounted for by a small genetic diversity; a similar variation is found e.g. in Cajanus cajan (L.) Millsp. Study of live material may solve this problem.

Vernacular names in Thailand for P. candollei and P. mirifica are similar, if not exactly the same, while the name is also applied to several other tuberous plant species (CAIN, 1960).

10. Pueraria peduncularis (Grah. ex Bentham) Benth.

*(Map 8, p.69; Plates 13, 14, p.94,98)*

PLATE 13. *Pueraria peduncularis* (Grah. ex Benth.) Benth. (McLaren's collectors 162C)

PLATE 14. *Pueraria peduncularis* (Grah. ex Benth.) Benth. (*Ludlow et al. 1754*)

**Basionym:** *Neustanthus peduncularis* Grah. ex Benth. in Miquel, Pl. Jungh. 2: 235(1852); Miquel, Fl. Ind. Bat. 1-1: 219(1855).

**Type:** Nepal, Graham, Wallich Cat. No. 5354 (K, holo; iso: BM, CAL, G, K), (*Pueraria? peduncularis* Grah. ex Wall. nom nud).

*Agric. Univ. Wageningen Papers 85-1 (1985)*

**Type**: China, Yunnan, woods nr Tapintze, *Delavay* 506(P, holo; iso: P).

*Pueraria peduncularis* (Grah. ex Benth.) Benth. var. *violacea* Franchet, Pl. Delav. 182(1890).


*Lectotype*: China, Yunnan-sen, source of the Pe-long-tan river, 8 May 1904, *Ducloux* 377 (FI, holo, not seen).

*Paratype*: China, without location, *Maire* 210 (FI, not seen).

**Description**: Woody climber, perennial. Branches strong, to ca 4(-10) mm diameter, up to 5-10 m long, rooting on the nodes, striate, grooved and pubescent when young, terete and glabrous when full grown; stipules peltate, basal part very short, fringed, ovate to lanceolate, (2-)4-10 mm long, 1-3 mm wide, striate, adpressed pubescent, leaving an elevated irregular scar when fallen, leaves pinnately trifoliolate, petiole canaliculately striate, pubescent or glabrous, 10-20 cm long, rachis 3-5 cm long. Leaflets ovate to rhomboid, side leaflets (very) obliquely so, (5-)9-12(-23) cm long, (3-)5-14 cm wide, apex long-acuminate, base rounded-cuneate, green and thinly short pubescent above, grey green and short pubescent below, ribs prominent, pubescent, in 6-7 unequal pairs, basal pair opposite; petiolules not thickened, more pubescent than the petiole, 3-7 mm long. *Stipellae* setaceous, short, 2-5 mm long, quite persistent. Inflorescence axillary, occasionally paired, axis (5-)10-40(-68) cm long, mostly flowering well below the middle, striate, pubescent, very slightly nodose, or with 1-20 mm long slender pubescent laterals; flowers (2-) 4-7 per node, purple or mauve, purplish blue, pink, violet, blue, lilac or white with purple tipped keel, or pure white (China); bracts lineate- setaceous, pubescent, 4-8 mm long, caducous; pedicels very slender, sturdier in fruit, up to 13 mm, pubescent or glabrescent; bracteoles 2 per flower, setaceous-hairy, less than 1 mm long, caducous. Calyx thinly and shortly adpressed-pubescent, glabrous inside, tube 3-5 mm, gibbous above the base, rimmed at the base, folding slightly over top of pedicel, teeth shorter than the tube, (broad) acute, upper ones connate or almost connate, 1-3 mm, side teeth triangular, 1-2 mm long, lower tooth narrow triangular, 1-1.5 mm long. Vexillum obovate, 11-15 mm long, 7.5-9 mm wide, apex emarginate, base clawed, not auriculate but reinforced and inflexed, no callosities. *Alae* lanceo-
late, 10-14 mm long, 3-4 mm wide, claw ca 3 mm, upper margin with a triangular lobe, not hooked, base straight. Keel petals triangular, ca 12-14 mm long, 5 mm wide, ventrally adnate. Ovary elongate, ca 5-8 mm long, very thinly pubescent, mainly along the ventral suture, ca 7 ovules; style glabrous, ca 2-4 mm as extension of ovary, ca 2-3 mm upcurved; stigma terminal, globular, densely penicillate at the base. Stamens diadelphous, vexillary stamen quite free, but adherent at first, ca 10-14 mm long, free part ca 2-3 mm, upcurved; anthers basidorsifix, alternatively on long and short filaments. Pods flattened-oblong, glabrous, papery, outline of seeds visible, (3-)5-7 cm long, 0.5-0.7(-1) cm wide, black, purple-brown or pale brown, (1-3)4-6(-7) seeded, cuneate at base, acuminate at apex, tipped with rest of style, sutures strong, somewhat sinuate. Seeds flattened-ovoid, ca 4 mm long, 2 mm wide, 1.5 mm thick, minutely punctate, strophiole irregular-rimmed, round, diameter ca 1 mm.

**Distribution:** Bhutan, Burma, China (Yunnan, Szechuan), India (E. Himalaya, Khasi Hills), Pakistan.

**Ecology:** Scandent or pendulous on shrubs and trees, in open or shady situations, on hill slopes or ravines, medium wet forest, near streams, waterfalls, and jungle edges or clearings, bamboo forests, hill tops, on well-drained or sandy soils, scree and rocks.

**Altitude:** (1200-)1700-3000(-3600) m.

**Flowering:** April-October (China), July-October (India). **Fruiting:** April-May, July, September-November (China), September-November (India).

**Vernacular names:** Ko ken (Chinese), Ting Khla (Khasi).

**Uses:** *Pueraria peduncularis* is used as an insecticide in China (PERRY, 1980, listed as *P. yunnanensis*) named Chung kuo t'u nung yao chih, no. 75. Its roots can be used as fish poison (HENRY 12483 A, specimen from the Szemao Mountains in China).

**Specimens examined (selected specimens):**

**Bhutan:** Thaisa Kha, Tang Chu, Bowes Lyon 15011 (BM); Lamakka, Thimpu, Cooper 1332 (E); Tilazong Punakha (Thimpu), id. 2674 (BM); Sawang Kurted, id. 4339 (BM); Kole La Kurted, id. 4662 (BM); Chendebi, Gould 707 (K); Gamri Chu, Trashigong, Ludlow & Sheriff 1097 (BM); Yuto La, bew. Bumthang & Trongsa (Tongsa?), id. 17007 (BM, E); Trashi-cho Dzong, Thimbu Chu, id. 17541 (BM); Shabjetang, Bumthang Chu, id. 19290 (BM); Trongsa Dzong, Yuto La, id. 19554 (BM, E); Denchung, Khoma Chu, id. 20897 (BM).

**Burma:** Bhamodir, Sinlum, Cubitt 293 (CAL); The Triangle, Kachin state, Hbinhum, Kingdom Ward 21355 (BM); Esakan, Mt. Victoria, id. 22658 (BM); Kabai to Kyatpyin, Ruby Mines distr., Lace 5993 (E, K).

**China:** Szechwan/Szechuan: nr Tatsienlu/Kangting, Cunningham 173 (E); nr Ningyuen, Lushan, Sichang, Handel-Mazzetti 1307 (E, P); Yalung to Yenyuen above Lumper, id. 2059 (W); mt S

*Agric. Univ. Wageningen Papers* 85-1 (1985)
of Muli, Mt Gibboh, Rock 16936 (NY, US); W of Yalung riv., betwn Mutirong & Wandzanron Pass, Muli-Chiulung hsien border, in Yatsa Kong, nr. 17425 (US, W); S of Muli Gomba, mt Gibboh, id. 24177 (E). TIBET: Salween-Kui Cheang divide, Tsarong, Forrest 19259 (BM, E); Rima/Chayu, Kingdon-Ward 20168 (BM). Yunnan: above Choang Che Teu, nr Tapintze, Delaway 3588 (P, US); nr Pien-kio, id. s.n. (K, P); nr Yunnan-sen/Kunming, Ducloix 2301 (BM, F, K, P) and many other collectors; Tong Tshuan, id. 5599 (F); Tengyueh-Talipe rd, S end of Yung Chang Fu valley, Paoshan, Forrest 1058 (E); E flank of Tali range, id. 4259 (BM, CAL, E, K); W of Tengyueh/Tengchung, id. 7564 (E); Yangpi valley, id. 5933 (BM, E, K); Shweli valley, id. 11995 (BM, E); Mengtze & mts around, Hancock 275 (K) and many other collectors; rd from Yunnan fu to Dali/Tali/Tali betw. Gwangdung, Maojing & Schedse, Handel-Mazzetti 1629 (US, W); Feng Cien Lin mt, Henry

Because of the long filiform pedicels and small glabrescent membranous calyx, but these are only minimal differences, and fall completely within the range of P. peduncularis. However, also present in P. candolleana, P. collettii, and P. edulis, and are perhaps Consider this material as a separate taxon. Nevertheless, P. peduncularis fits the generic descriptions of De Candolle, Ben-
THAM, HUTCHINSON and LACKEY himself. LACKEY did not indicate any genus to accommodate *P. peduncularis*, although he considered each of the groups within *Pueraria* sufficiently distinct to represent a genus. LACKEY wrote that tradition and stability of nomenclature are better served by maintaining one genus, and I consider *P. peduncularis* to belong in *Pueraria*. Even if biosystematic research would establish more distance from the other species, or even an anomalous position in the genus, it is not at all uncommon to admit within a genus a more or less anomalous species.

Specimens from India, Nepal and Bhutan tend to be more luscious than those from China.


*(Maps 9-11, p.74,77,82; Plates 15-18, p.72,79,80,84)*

*Pueraria phaseoloides* (Roxburgh) Bentham. For typification, literature and synonymy see under varieties.

Description: Perennial herbaceous creeper or climber. Stems strong, fibrous, up to 5 mm diameter, up to 10 m long, rooting on the nodes, striate, thinly pubescent hairs spreading, 1 mm long, on a small bulbous base, somewhat deciduous. Roots tuberous. Stipules triangular to ovate, 4-11 mm long, 2-3 mm wide, apex, acuminate, striate, pubescent. Leaves pinnately trifoliolate; petiole ribbed canaliculate above, 3-11 cm long, more or less pubescent, hairs adpressed and spreading, bulbous-based; rachis 1-4 cm long. Top leaflets symmetrical, (broad-) ovate to rhomboid, entire or more or less lobed, 3.5-17.5 cm long, 2.5-16 cm wide, sometimes wider than long, margin entire or sinuate, side leaflets obliquely so, 4-14 cm long, 3-12 cm wide, always longer than wide, apices acuminate, acute or sometimes obtuse, mucronate, bases cuneate to rounded, sometimes truncate, green and adpressed pubescent above, dull green and quite densely adpressed-pubescent below, hairs grey, bulbous based; ribs prominent below, pubescent, three at the base, another 5 major primary laterals, in pairs or not; petiolules as thick as or thinner than petiole, 2-5 mm long, pubescence spreading; stipellae lanceolate to setaceous, 3-7 mm long. Inflorescences axillary, flowering above the middle, (10-)15-36(-46) cm long, unbranched, more or less thinly adpressed-pubescent, appearing densely pubescent in late flowering, bracts 2-5 mm long, 1-2 mm wide, striate, pubescent, ventrally glabrous, caducous; pedicels 2-6 mm, pubescent; bracteoles 2 per flower, ovate-lanceolate, 3-5 mm long, 1-2 mm wide, striate, thinly pubescent both sides, calyx pubescent outside, tube 3-5 mm, upper teeth acute to acuminate, halfway connate or only split at apex (var. javanica) 2-4 mm long, side teeth obtuse (var. javanica) to acute (vars. phaseoloides and subspicata), 1.5-2.5 mm long, lower tooth acute (var. javanica) to lanceolate-acuminate or subulate, 3-6 mm long. Vexillum obovate, 10-23 mm long, 8-18 mm wide, purplish or blue with green or yellow patches, blue-green, blue, pale pink, white with purple tinge, veins sometimes marked purple, or white with blue at base, rose red or mauve, apex emarginate, base shortly clawed,
PLATE 15. *Pueraria phaseoloides* (Roxb.) Benth. var. javanica (Benth.) Baker (Faulkner 3282)

auricles short but broadly inflexed, no callosities. *Alae* long-ovate, almost reniform, 9-20 mm long, 3-6 mm wide, purplish blue or white with blue or purple tip, claw ca 3-4 mm, auricle 0.5 mm, (more pronounced in var. *javanica*), basal margin lobed. *Keel* petals triangular-clawed, ventrally adnate, 10-21 mm long, claw 4-6 mm long, purplish blue or white with blue, green, or purple tip. *Ovary*
elongate, grey silky adpressed pubescent, ca 10-15 mm long, ca 20 ovules; style glabrous, 4-9 mm, upcurved, basal part as broadened pubescent extension of ovary (var. javanica); stigma terminal, globular, penicillate at base. Stamens dia-delphous, vexillary stamen free, earlier attached in bud, 11-21 mm long, free part alternatively on long and short filaments. Pods cylindric, round or somewhat flattened, grey to blackish, (5.5-)7-12.5 cm long, 3-5 mm wide, (10-)14-20 seeded, thinly adpressed-pubescent, apex acute, base cuneate, valves curling when ripe, showing papery partitions between seeds, sutures thickened, especially the dorsal one. Seeds barrel-shaped or rounded, brown or grey, 2.5-4.5 mm long, 2-3.5 mm wide, 1.5-2 mm thick, seed coat minutely tubercled or pitted, strophiole white- or red-brown, very thin, round to elliptic, 1 mm diameter. Seedling epigeal, first 2 leaves simple and opposite, ovate, 15-18 mm long, 15-16 mm wide, apex obtuse, base cordate.

Distribution: South, Southeast and East Asia, now widely spread into other tropical areas.

Uses: Pueraria phaseoloides, tropical kudzu, is quite successful as a fodder, green manure or cover crop in tropical tree plantations such as rubber, coconut or citrus (Wealth of India, 1969; Heyne, 1927; Burkart 1950; Duke 1981, where more references can also be found). Propagation of tropical kudzu is by cuttings or seeds. Seeds are produced if the plants are allowed to climb or grow in areas with a distinct dry period, in some other areas seed set may be poor. It is more suited to tropical lowlands than P. lobata, the kudzu. Especially var. javanica is widespread in the tropics, it is in general more vigorous than var. phaseoloides. Var. subspicata is probably (Pain 1897) the common variety in NE India, as is also confirmed by the distribution of its specimens. The edible roots are rarely consumed, where the plant is abundant (Crevost & Lemarie, 1917; Burkill, 1938; Wealth of India, 1969; Tanaka, 1976; Duke, 1981). No herbarium specimen that I saw made mention of the tubers. The fibers can be used for twines or ropes (Kanjilal et al., 1938; Crevost & Lemarie, 1917), sometimes as rough-and-ready string (Burkhill, 1938). In Malaya P. phaseoloides was used as a remedy for boils and foul-smelling ulcers, taken as a decoction or as a poultice for children (Burkhill, 1935). Powell (1976) lists a medicinal use of the crushed bark: an extract to aid birth in New Britain.

Tropical kudzu can be grazed; but cattle, goats and poultry have to get used to it. As for kudzu, care has to be taken not to overgraze the canopy. Tropical kudzu (mainly var. javanica) was apparently introduced into South and Central America in the (late) nineteen thirties. I have not seen specimens collected earlier than 1934 (var. phaseoloides in Surinam). Telford s.n. from Puerto Rico (collected 13-12-1945) has a statement on the label that seed was brought to Puerto Rico in 1940 by Dr. W. F. Stewart of the Boyce Thompson Institute, New York, from the Rubber Research Institute of Malaya at Kuala Lumpur. Similarly, specimens from Africa are rather recent. On Zanzibar P. phaseoloides has established itself in the wild.
Key to the varieties:

1a. Flowers small, corolla 7-13(-15) mm long; bracts and calyx more or less pubescent, hairs not very long; lateral calyx lobes acute-acuminate, lower calyx lobe acuminate-lanceolate; leaflets entire, lobed or sinuate; fruit 5-9 cm long, 3-4 mm wide .................. var. phaseoloides

1b. Flowers large, corolla 15-23 mm long ....... var. phaseoloides

2a. Bracts and calyx pubescent, lateral calyx lobes obtuse, lower calyx lobe acute; leaflets mostly entire, rarely somewhat lobed; fruit 7-11 cm long, 4-5 mm wide .................. var. javanica

2b. Bracts and calyx densely long-pubescent, lateral calyx lobes acute-acuminate, lower calyx lobe lanceolate-subulate; leaflets large, entire to deeply lobed; fruits 7-12.5 cm long, 4.5 mm wide .................. var. subspicata


Agric. Univ. Wageningen Papers 85-1 (1985)

Type: Java, Merapi, R. Kuning, Junghuhn s.n. (K, holo; not seen, teste Verd-court, 1971). There is a 19th century sheet communicated by Herb. Lugd. Batav. from Java, without collector, which may be this type (NY, W, U).


Type: Java, not seen, probably at BOG.

*Neustanthus sericans* Miquel Fl. Ind. Bot. 1-1: 218(1855). (Non *Pueraria seri-
cans* K. Schum., a synonym of *P. pulcherrima* (Kds.) Merr.).

Type: Java, nr Surakarta, Horsfield L 121 (K, holo, iso: U).

Distribution: Brunei, Indonesia (Java, Sulawesi), Malaysia (Malaya, N. Borneo), Philippines (Luzon), Sri Lanka, New Guinea, Solomon Islands, further introduced into Africa, South and Central America.

Ecology: Along rice fields, rivers, roads, on bushes, in evergreen forest or cleared patches, in grass vegetations, as a cover crop in plantations, occasionally an escape, on sandy (black) soil, sandy loams and heavy clays.

Altitude: 0-1100 m.

Flowering and fruiting: See table 2.

Vernacular names: English: Tropical kudzu, Puero (Australia).

Indonesia: Kachang uchi(s), Kachang monyet (Sundanese), Kachang ruji; Krandang (Javanese); Otok buwa, Otok ghangan (Madurese); Kachang pan-jang (Ambon, usually for cowpea); Fuo banga (Ternate).

Malaysia: Kachang-kachang; Kachang hijan hutan; Tampong urat, Ulan susu, Suloh.

New Caledonia: Quéchot.

Spanish: Kudzu tropical.

Vietnam: Dan ma (Dong Nai), Bu cho a tau (Thuan Hai); Xuat (Dong Nai); Rōta tokvih (Jorai).
MAP 10. *Pueraria phaseoloides* var. *javanica* in Oceania.

*Agric. Univ. Wageningen Papers 85-1 (1985)*
Specimens examined:

BRUNEI: nr Kampong Sungei Liang, Tutong distr., *van Niel 4283* (L).
CAMBODIA: Cam Chai forest nr Kampot, *Poilane 23225* (P); Kompong Smach, *id. 22920* (P).


PAPUA NEW GUINEA: above Everill junction, Fly river, *Jeswiet 121* (WAG); Beyond Subitana, *Womersley & van Royen 4217* (K).

PHILIPPINES: Luzon: Lamao river, Mt. Mariveles, Bataan prov., *Borden 2340* (CAL, E, K, NY, US); Mt. Makiling, Laguna Prov., *Sulit 34073* (BM, US); Pandacan, Manila, *Vera Santos 6322* (US);


VIETNAM: Tourane, *Poilane 28092* (P). Some of the specimens seen and quoted by Thuan (1979) are really var. *phaseoloides*.

Other specimens seen were collected in ANGOLA, BRAZIL, CAMEROON, DOMINICAN REPUBLIC, GHANA, HONDURAS, JAMAICA, LIBERIA, MARTINIQUE, MEXICO, NIGERIA, PERU, PUERTO RICO, SURINAM, TANZANIA, TRINIDAD.


Agric. Univ. Wageningen Papers 85-1 (1983)
PLATE 16. *Pueraria phaseoloides* (Roxb.) Benth. var. *phaseoloides* (Pierre 1017)

282(1917); Merrill, Sp. Blancoanae 189(1918); Ridley, Fl. Malay Penins. 1: 571(1922); Haines, Bot. Bihar Orissa 3: 304(1922); repr 2: 295(1961); Merrill, Enum. Philipp. Fl. Pl. 2: 311(1923); Heyne, Nuttige Pl. Nederl. Indië 829(1927);

*Agric. Univ. Wageningen Papers* 85-1 (1985) 79
PLATE 17. Pueraria phaseoloides (Roxb.) Benth. var. phaseoloides (van der Maesen 4871 in situ, West Bengal, India)

Surv. India 7: 144(1963); Biswas, Pl. Darjeeling, Sikkim Himalayas 1: 291(1966);
seeol. 72, 75(1977); Ohashi, Fl. Taiwan 3: 370(1977); Thuan, Fl. Cambodia, Laos,
Viet-nam 17: 83, 83(1979); Verdcourt, Manual New Guinea Legum. 485(1979);
2: 503(1980); Perry, Medicinal Pl. E & SE Asia, Cambridge Mass. 224-225(1980); 

**Basionym:** *Dolichosphaseoloides* Roxb., Fl. Indica 3: 316(1832).

**Type:** India, Calcutta Bot. Garden, grown from seeds received from Kerr
at Canton, China (CAL? not seen). **VERDCOURT** (1971) included as syntype
Roxburgh's drawing no. 1890 (K, not seen).

**Synonyms:** *Dioscorea bolofonica* Blanco, Fl. Filip. 800 (1837); ed. 2:
551(1845); Llanos & Fernandez-Villar, Fl. Filip. ed. 3, 3: 208(1879); Merrill,

**Neotype:** Philippines, Pasay, Rizal prov., Luzon, Merrill Sp. Blanco. 195
(US, holo; iso: F, NY, W).

**Dolichos viridis** Hamilton ex Wallich nom. nud., based on Wallich Cat. No.
5559 (K, also at BM); Bentham. in Miq. Pl. Jungh. 2: 235(1852); id., J. Linn. Soc.

**Phaseolus barbatus** Graham ex Wallich nom. nud., based on Wallich Cat.
No. 5559 B(1831); Bangladesh, Sylhet (K, also at BM).

**Phaseolus decurrens** Graham ex Wallich nom. nud., Wallich Cat. No.
5612(1831), ( teste Prain). In the E. I. Herbarium actually written as *P. decurrens*.
India 2: 199(1876); Ind. Kew. (1895); Prain, J. Asiatic Soc. Bengal 66-2:
420(1897), based on Wallich 5612 (K, not seen) from Penang, coll. G. Porter.
Not misquoted as stated by Prain (l.c.), but intended to be *Pueraria decurrens*.

**Neustanthus phaseoloides** (Roxb.) Benth. in Miquel, Pl. Jungh. 2: 234(1852);
Miquel, Fl. Ind. Bat. 1-1: 219(1855); Bentham, Fl. Hong Kong 88(1861); id.,
J. Linn. Soc. Bot. 9: 125(1867), based on *Dolichos phaseoloides* Roxb.

**Pachyrhizus montanus** Blanco (non(Lour.)DC.), Fl. Filip. ed. 2: 406(1845);
Legum., Philipp. J. Sci. Bot. 5: 123(1910); id., Sp. Blancoanae 189(1918); id.,
Enum. Philipp. Fl. Pl. 2: 311(1923). Merrill reduced this name since description
and Tagalog vernacular fully agree with *Pueraria phaseoloides*, commonly avail­
able on Luzon. Blanco's herbarium was lost.

**Pachyrhizus teres** Blanco, Fl. Filip. 580(1837); Merrill, Enum. Philipp. Le­

*Agric. Univ. Wageningen Papers* 85-1 (1985) 81

**Distribution:** China, Vietnam, India, Bangladesh, Nepal, Philippines, Indonesia, Thailand, Burma, Sri Lanka, Taiwan, Malaya, New Guinea, occasionally introduced, e.g. Liberia, Cameroon, Nigeria, Suriname.

**Ecology:** Trailing in savannah grasses, open grounds in scrub, roadsides, in mixed forests in shade, bamboo forests, on trees and shrubs in open jungle, near paddy fields, stream margins, sandy or clayey soils, low hills, widely cultivated in plantations.

**Altitude:** 0-1600 m.

**Flowering and fruiting:** see table 2.

**Vernacular names:**

**China:** Yie g(u)e teng, Ye sha kot.

**Burma:** Pe ying pin.

**Vietnam:** Dau dai, Dan ma, Ci rung, Dau rung (Tonkin).

**Philippines:** Bahay (Tagalog); Bahai, Bajai (Cebu Bisaya); Sinkamas aso (Tagalog); Vai (Ivatan).

**Japan:** Kuzu-ingen.

**Germany:** Knollengrische (Gerth van Wijk, 1911).

**Specimens examined** (majority of sheets seen):

**Bangladesh:** Bholagange, Sylhet, Clarke 17430 (BM, CAL); Rangpur, id. 26830 (CAL, K); Jaintiapur, Sylhet, id. 42438 (US); Sylhet, Wallich 5559 B (BM).

**Burma:** Rangoon, Dickason 6597 (CAL, E, L); Moumlein, Kuntze 6288 (NY); Pegu, Kurz 1726 (W); Maymyo, Lacey 4329 (CAL, E); Mingalardon nr Rangoon, Vogt BU-52 (US).

**Cambodia:** Kampot, Geoffray 253 (P); between Benteai Chmai and Ton Choum, Battambang and Siem Reap prov., Pollane 14427 (P); Cam Chai nr Kampot, id. 22847 (P).

**China:** Kwangtung/Guangdong prov.: Wu Pua, Hainan, Anon. 68189 (NAS); Canton vicinity, Levine 1837 (BM, C, E, US); Tingwu Shan, Ting & Shih 992 (L); Tung Koo Shan, Tapu distr., W.T. Tsang 21600 (NY); Ba Wan Tang, Haifeng county, Z.F. Wei 121340 (NAS); Wusban to Color Metal Factory Yard, Guangzhou city, H.G. Yip 196 (KWA). Kwangsi/Guangxi prov.: Longtcheou/Lungcing, Beaufort s.n. (P); ibid., Simond s.n. (P); Bako Shan, W. Poseh, R.C. Ching 7609 (NAN).

**India:** Kerala, Quilon, Wight 755 (CAL, K). Manipur: Kanglatongbi, Bullock 627; 655 (K). Meghalaya: Theria, Clark 44995 (US); Jowai, King's collector s.n. (BM); 27 km from Ralong to Garampani, Remananand 4696 (ICRISAT); Dawki market & vicinity, Panigrahi 4678 (L). Uttar Pradesh: Dehra Dun & vicinity, Umarao Singh 410 (NY). West Bengal: near Calcutta, Helfer 116 (BM, C, F, NY, US, W); nr Teesta river suspension bridge, van der Maesen 4854 (ICRISAT); 9 km S of Sevoke, id. 4871 (ICRISAT).

**Hong Kong:** Tai-O, New Territory, W.Y. Chun 3101 (F, NY); Peak to Taitam Tuk, id. 7322 (NY); above Happy Valley, id 7459 (NY, W); Chung Chi College, Shiu Ying Hu 5589 (US); Ma...

*Agric. Univ. Wageningen Papers 85-1 (1985)*
On Shan, *id.* 6479 (US); Lantao Isl., *Y. W. Taam* 1753 (F, NY, US).

**Indonesia:** Sula Mangoli, Sula Isls, Moluccas, *Bloemenbergen* 4679 (NY); nr Menado, Sulawesi, *Nielson 778* (C); Amboina, *Robinson 365* (US); ibid., *id.* 607 (NY); Tapianuli, Padang Sidempuan Div., *Rahmat Si Toroës* 4905 (NY); Mopa Airstrip near Merauke, N. Guinea, *van Royen 4541* (K).

**Laos:** Thakhet, Cummon prov., *Poliane 28173* (P).

**Malaysia:** Malaya, *Gordon Spane F 692* (K); Perak, *King's Collector 5117* or *5717* (BM, P, US); Segalitud, Elopura Sandakan, North Borneo, *Cuadra 1083* (US).

**Nepal:** Tilhar, Stainton et al. *id.* 28173 (P).

**Papua New Guinea:** Daru Isls., W. Div., *Brass 6037* (US?); Mapamoiwa, Fergusson Isls., *Nielsen 778* (C); Amboina, *Robinson 565* (US); ibid., *id.* 607 (NY); Tapianuli, Padang Sidempuan Div., *Rahmat Si Toroes 4905* (NY); Mopa Airstrip near Merauke, N. Guinea, *van Royen 4541* (K).

**Taiwan:** Bankensing Mts., *Henry 1503* (K, NY).

**Thailand:** Ban Si Racha, *Collins, 646* (US); Doi Suep, *Kerr s.n.* (BM); Chiangmai, *id.* 1468 (C, CAL, K); Surat, *id.* 11294 (BM); Chumphon, *id.* 11641 (BM); Aranya Praket, *Put 2006* (K); between Trang & Krabi, *Sorensen et al. 767* (C, E); 25 km N of Nan, W of Nan River, *Walker 7965* (US).


**Sri Lanka:** Deraniyagala, *Douglas Simpson 9144* (BM).

11c. **Pueraria phaseoloides** (Roxb.) Benth. var. **subspicata** (Benth.) van der Maesen stat. nov.

**Basionym:** *Neustanthus subspicatus* Bentham in Miq., Pl. Jungh. 2: 234(1852); Miquel, Fl. Ind. Bat. 1-1: 219(1855).


**Paratypes:** India: Goalpara, Hamilton, *Wallich 5557B* (not seen); Bangladesh: Sylhet; *Wallich 5557C* (K, G, NY).


**Dolichos ficifolius** Grah. nom. nud., *Wallich Cat. No. 5563*, based on *Wallich 5563a*: Burma, Prome 1826(K, BM, G) and 5563b: Burma, Tavoy W.G. 447(K, G).

PLATE 18. *Pueraria phaseoloides* (Roxb.) Benth. var. *subspicata* (Benth.) van der Maesen (Yandell 331)

Based on *Neustanthus subspicatus* Benth.


Based on *Neustanthus subspicatus* Benth.
Distribution: Bangladesh, Burma, India (Assam, Meghalaya, Sikkim, Bengal), Thailand.

Ecology: Mixed deciduous forest, scrub vegetation, along roads, tanks.

Altitude: 0-1300 m.

Flowering and fruiting: See table 2.


Specimens examined:

BANGLADESH: Bholagunj, Sylhet, Clarke 14341 (CAL, K); Thavia, Sylhet, id. 18502 (BM, CAL); East Bengal, Griffith 1713 (C); Sylhet, Hooker s.n. (K, W); Teknaf, M.S. Khan 621 (CAL); Chittagong Hill Tracts, King's collector 586 (CAL, K); Signal Hill, Cox's Bazar, Sinclair 328 (CAL, E); Sylhet & mountains nearby, Wallich 5557a (K, hololecto; iso: BM, E, G, K, W).

BHUTAN: Sarbhang div., Kalikhola forests, Gaylegphug, Sen Gupta 816 (CAL).

BURMA: Tenasserim, Heifer 1713 (P); Maymyo, Lace 4247 (E); Tana, Upper Chindwin, Meebold 7523 (E); Kachin hills, Shaik Mokim s.n. (CAL, E, US); ibid., Myitkyina, id. 95 (CAL, W); Pegu, Scott 350 (BM); Thechaung, Akyab Isl., Arakan coast, Vogt BU 242 (US); Prome, Wallich 5563A (BM, G, K); Tavoy, Wallich 5563B (G, K).

INDIA: ? Gowhatty Ghat, Anon. 395 (CAL, US); sine loc., Anon. 1506 (NY); E. Himalaya, Farseng, Cave s.n. (E). Arunachal Pradesh: Lohitpur, A.S. Rao 47945 (CAL, Front Div.); West of Tuting, R.S. Rao 17036 (CAL); Tirap Frontier Div., Nampong to Pangsu Pass, id. 20009 (CAL); ibid., Namsang to Soha, id. 20339 (CAL). Assam: Singra, Chatterjee s.n. (P); Assam plains, Hooker s.n. (P); sine loc., Jenkins s.n. (G); Guwahati, Sibsagar distr., Kanjilal 1819 (CAL); Sonari, ibid., id. 2023 (CAL); Nowgong, Simons 168,169 (K); Mangaldai, nr Bhutan border, Yandell 33 (K). Manipur: Barak, Meebold 6295 (CAL, K); Ukhrul, Mukerjee 3122 (CAL). Meghalaya: Khasi hills, Sharla, Clarke 14919 (K); Sohra, id. 15610 (BM, K); regio trop., Hooker & Thompson (K); Isamati, Kanjilal 6244 (CAL). Nagaland: Dimapur, Clarke 40819 (BM, CAL, K). Sikkim: Terai, Dulkajhar, Clarke 36916 (BM); Sehim, id. 36867 (CAL); lower hills, Hooker s.n. (K); Terai, id. s.n. (K); regio trop., id. s.n. (K); Rungbee, W.W. Smith 268 (CAL). West Bengal: Jaldakar, Darjeeling distr., Cave 37 (CAL); Siliguri, Clarke 27027 (K); West Duars, Haines 513 (K). Alipur Duars, Howwood 116 (CAL); 1 km S. of Sevoke, 16 km N. of Siliguri, van der Maesen 4870 (ICRISAT); Namurhat to Cooch Behar, Mukerjee 4657 (CAL); Sukna, id. 6218 (CAL); Bankura, Joypur forest, Sanyal 812 (CAL).

NEPAL: Pursona betw. Birganj & Hettoura, Burkhill 19381 (CAL).

THAILAND: Pak Thong Chai, Sakarad Forest Res. along Nui Krae stream, van Beusekom & Charoenpol 1986 (E); Hui Taleng, Korat, Put 2253 (K).

Notes: Some authors (BAKER, 1876; Index Kewensis, 1895; and in herb.) considered P. subspicata as conspecific with P. phaseoloides, but PRAIN (1897) strongly opposed this: the leaflets are almost always more deeply lobed, the flowers much larger, the pods usually longer, with dorsal sutures thickened, while he found no intermediate forms in the Calcutta Herbarium. KANJILAL et al. (1938) described P. subspicata as very similar to P. phaseoloides, CRAIB (1928), THOTHATHRI (1973) and LACKEY (1977, quoting PRAIN, 1897) kept the species apart. BENTHAM remarked that the habitus and leaves conformed with his P. javanica. This is precisely the point, all three taxa differ, and can be keyed
Table 2. Flowering and fruiting of *P. phaseoloides*

<table>
<thead>
<tr>
<th><strong>Var. phaseoloides</strong></th>
<th><strong>Flowering</strong></th>
<th><strong>Fruiting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>Oct, Nov</td>
<td>Oct-Dec</td>
</tr>
<tr>
<td>Burma</td>
<td>Oct-Nov</td>
<td>Oct-Nov</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Jan</td>
<td>Feb?</td>
</tr>
<tr>
<td>China</td>
<td>(Aug) Sept-Nov</td>
<td>Sept-Jan, Mar</td>
</tr>
<tr>
<td>India</td>
<td>Oct, Nov</td>
<td>Oct-Dec</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Jul</td>
<td>Aug?</td>
</tr>
<tr>
<td>Liberia</td>
<td>Dec</td>
<td>Jan</td>
</tr>
<tr>
<td>Malaya</td>
<td>Jan, Nov</td>
<td>Nov, Feb?</td>
</tr>
<tr>
<td>Nepal</td>
<td>Sept</td>
<td>Oct</td>
</tr>
<tr>
<td>New Guinea</td>
<td>Mar-Apr, Aug-Nov</td>
<td>Mar, Nov</td>
</tr>
<tr>
<td>Philippines</td>
<td>Jul, Nov-Dec</td>
<td>Aug? Nov-Jan</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Jan</td>
<td>Jan</td>
</tr>
<tr>
<td>Suriname</td>
<td>Jun, Nov-Jan</td>
<td>Jul, Nov-Jan</td>
</tr>
<tr>
<td>Thailand</td>
<td>Oct-Jan</td>
<td>Nov-Jan</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Sept-Dec</td>
<td>Sept-Dec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Var. javanica</strong></th>
<th><strong>Flowering</strong></th>
<th><strong>Fruiting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>Sept</td>
<td>Oct</td>
</tr>
<tr>
<td>Brazil</td>
<td>May</td>
<td>May</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Jan</td>
<td>Feb</td>
</tr>
<tr>
<td>Caribbean Islands</td>
<td>Dec-Feb</td>
<td>Dec-Feb</td>
</tr>
<tr>
<td>China, Hainan</td>
<td>Oct</td>
<td>Oct</td>
</tr>
<tr>
<td>Ghana</td>
<td>Dec</td>
<td>Jan</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Jun-Sept</td>
<td>Jun-Sept</td>
</tr>
<tr>
<td>Kenya</td>
<td>Jul-Sept</td>
<td>Aug, Oct</td>
</tr>
<tr>
<td>Liberia</td>
<td>May</td>
<td>May, Jun</td>
</tr>
<tr>
<td>Malaya</td>
<td>Mar, Aug</td>
<td>Mar, Aug</td>
</tr>
<tr>
<td>Mexico</td>
<td>Dec</td>
<td>Dec</td>
</tr>
<tr>
<td>New Guinea</td>
<td>Jun</td>
<td>Jul</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Mar</td>
<td>Mar</td>
</tr>
<tr>
<td>N. Borneo</td>
<td>Dec</td>
<td>Jan</td>
</tr>
<tr>
<td>Philippines</td>
<td>Dec</td>
<td>Dec, Jan</td>
</tr>
<tr>
<td>Peru</td>
<td>Jul</td>
<td>Jul</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>May-Aug, Oct</td>
<td>Jul-Aug, Oct</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Feb-Mar, Oct</td>
<td>Feb, Oct</td>
</tr>
<tr>
<td>Suriname</td>
<td>Nov, Jan</td>
<td>Nov, Jan</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Jul-Sept</td>
<td>Aug, Oct</td>
</tr>
<tr>
<td>Thailand, S.</td>
<td>Mar, Aug</td>
<td>Mar, Aug</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Var. subspicata</strong></th>
<th><strong>Flowering</strong></th>
<th><strong>Fruiting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>Oct-Dec</td>
<td>Oct-Dec</td>
</tr>
<tr>
<td>Burma</td>
<td>Aug</td>
<td>Aug, Dec</td>
</tr>
<tr>
<td>India</td>
<td>Sept-Nov, Feb</td>
<td>Oct-Dec, Feb</td>
</tr>
<tr>
<td>Thailand</td>
<td>Nov</td>
<td>Dec</td>
</tr>
</tbody>
</table>

out easily if not too many parts are missing, but approach each other either sizewise or they have overlapping morphological characters. Now that many more specimens are available for inspection, the sharp boundaries PRAIN saw at CAL in 1897 have disappeared. The three taxa are much more conveniently
placed as varieties and biosystematic research may confirm conspecificity e.g. by producing viable hybrids. It appears plausible that var. *phaseoloides* originated or developed in SE China, var. *javanica* in Java and Malaya, var. *subspicata* in NE India. It could be argued that the varieties, or at least var. *subspicata* can better be ranked as subspecies, but their geographical distribution is now overlapping. The ecology of all three varieties of *P. phaseoloides* is virtually the same.

12. *Pueraria pulcherrima* (Kds.) Merr. *(Map 12, p. 91)*


Basionym: *Mucuna pulcherrima* Koorders, Meded. Lands Plantentuin 19: 440/630(1908);

Type: Indonesia, Sulawesi (Celebes); Minahasa, Menado along Ranoyapo River nr Amurang, *Koorders 17699* (BOG, holo, not seen; iso: L).


Type: Philippines, Mindanao Isl., Taumo, *Warburg 14664* (B, holo, not seen).


Type: Indonesia, W. New Guinea, Canoe Camp 150 ft (BM, holo? see notes).

*Pueraria sericans* K. SCHUMANN (non BENTHAM, non *Neustanthus sericans* Miquel), Fl. Kaiser Wilhelmsland 99(1889); Karnbach, Beibl. 37, 15, Engler Bot. Jahrb. 16(1892).

Type: New Guinea, Kuliku-mana nr Constantinhafen, *Hollrung 566* (K, lectotypus novus, ex B).


*Agric. Univ. Wageningen Papers 85-1* (1985)
Paratypes: New Guinea, Finschhafen, Uassa nr Bonga river, Hollrung 231 (B7 not seen); Oertzen mts, in tall forest and on rocks in Nowulja river, Lauterbach 2072, 2100 (B7 not seen); Bismarck-Archipelago, New Britain, Gazelle peninsula, Warburg s.n. (B7 not seen).
Description: Woody climber, perennial. Branches woody, to ca 2.5 cm diameter, up to 10 m long, terete when young, covered with many short grey hairs and fewer or no brown-tinged spreading long hairs up to 3-4 mm, vaguely striate, glabrous with age, older stems with yellowish or grey-brown bark, irregularly ribbed when dried, with many horizontal lenticels of 1-2 mm. Stipules amplexicaul, peltate, bract-like, containing the vegetative and inflorescence buds (5-)25-60 mm long above insertion, ca 5 mm below insertion, 3-7 mm wide, dorsally adnate, ventrally oblong, top obtuse, lower end acute or bifid, long and short grey-pubescent outside, brown striate puberulous inside, early caducous, leaving a linear scar; axillary buds supported by filiform stipules, ca 5-15 mm long, pubescent. Leaves pinnately trifoliolate; petiole striate, densely short grey and long brown hairs, 6-10 cm long, rachis similar, 3-4 cm long. Leaflets rhomboid to lanceolate, side leaflets obliquely so, 10-23 cm long, 4-14 cm wide, apex long-acuminate, base cuneate to rounded-truncate or cordiate, green and thinly grey-pubescent above, hairs long and short, glabrous with age, grey-green and densely silvery grey-pubescent below, ribs prominent, in ca 6-8 irregular pairs, with long and short hairs. Stipellae linear to filiform, up to 25 mm long, 0.5-1 mm wide, very caducous, petiolules thickened, densely pubescent, ca 7-10 mm long, slightly winged. Inflorescences few-branched, axillary or terminal, 10-25 cm long, flowering axis grey-pubescent, peduncles striate, nodose, sometimes supported by stipules; pedicels 0.5-2 mm, densely grey-pubescent, flowers 3 per node, usually crowded; bracts linear, 2-17 mm, long, 0.5-2 mm wide, long-pubescent, caducous before anthesis; pedicels 0-2.5 mm bracteoles 2 per flower, ovate-lanceolate, tip obtuse, densely grey-pubescent, up to 1 mm long, 0.5 mm wide. Calyx shortly grey-pubescent; tube 1.5-2.5 mm long; teeth short, obtuse, upper ones connate, apex truncate, slightly emarginate or incised, 1-2 mm long, side teeth acute to obtuse, 1-1.5 mm long, lower tooth acute, 1.5-2.5 mm long. Vexillum orbicular blue, purple, violet with yellow, green or cream spot, or white, ca 6-10 mm long, 6-10 mm wide, apex emarginate, base hardly clawed, auricles slightly inflexed or not, callosities near base hardly pronounced; alae long-obovate, purple or white, ca 6-10 mm long, 2-5 mm wide, claw ca 2 mm, auricle ca 1 mm, lower margin wavy or straight; keel petals rhomboid, ventrally adnate, purple or white, ca 6-10(-12) mm long, 2.5-4 mm wide. Ovary elongate, silky pubescent, ca 6 mm long, (4?)-8(-11) ovules; style almost glabrous, ca 3-4 mm long, upcurved; stigma terminal, globular, not penicillate. Stamens monadelphous, vexillary stamen attached from the middle downwards, ca 6-10 mm long, free part 1-2 mm, upcurved; anthers uniform, dorsifix to almost basifix, alternately on long and short filaments. Pods flattened-oblong, 1.5-4 cm long, 0.5-0.6 cm wide, 8-11 seeded, rounded at both ends, tipped with rest of style, dark brown to black, short pubescent or spreading long-pubescent, sutures thickened, straight, long-pubescent, hair light brown, valves reticulate, sometimes hairs short. Seeds flattened-ovoid, 2-3 mm long, ca 1.5 mm wide, 1 mm thick, brown or black, strophiole slightly protruding, circular, ca 0.6 mm diameter.

**Distribution:** E. Indonesia, Philippines, Papua New Guinea, Kei Islands, Solomon Islands.

**Ecology:** Climbing in shrubs or trees, open rain forest, primary or secondary, *Imperata* grassland, flatlands or on rocks near rivers, on muddy or well-drained soil, coral.

**Altitude:** 0-1300 m.

**Flowering:** Throughout the year (New Guinea); Jan-Oct (Philippines, Indonesia); May-Oct (Solomon Islands). Fruiting: Jan, Jun-Aug (New Guinea); Apr-Dec (Philippines, Indonesia); Jun-Jul, Nov? (Solomon Islands).

*Agric. Univ. Wageningen Papers 85-1 (1985)*
Vernacular names: Indonesia: Bage (Sangi & Taland Isl.). New Guinea: Muno (Orne language, Walwali), Oomay (Ossima, Sepik distr.), Bungweb (Buan dialect, Morobe distr.). Solomon Islands: Sa’a, Fai Sa’a, Kewalo Sa’a (Kwara’e language).

Uses: In Papua New Guinea P. pulcherrima is used for binding material and as one of the climbers employed to make carrying bags or nets. The fiber is called 'seleng' and the carrying bags 'bilum' (Karnbach, 1892; Schumann & Lauterbach, 1901; Hoogland 1901 in herb.).

Species examined:

Indonesia: Sulawesi: Peana? Kaudern 280(h); Manado, Minahasa, Koorders 17699(L, iso!); betw. Palu & Parigi 35 km from Palu, Meyer 9382(L); Seram: Wai Kaba (SE, Seram), Kornassi 867(L, U); Wae Matakabo, Ruten 329(L, U); Sangi & Taland isl, Korakelang, S slope of Gunung Duata, Taland, Lam 2718(K, L); Irian Jaya: New Guinea: Utakwa riv. to Mt Carstenz, Boden Kloss s.n.(BM); Beri Creek nr Andai, Koster 11966(L); Andai, Teysmann 17476(h); Hawai’i, Kaua’i, Hanalei, Kimball 913, U; Hanalei, Sattelburg, Clemens 587(h, iso!); Waimea, id. 112442(K, L, US); Kauai, id. 913(K, L, US). PAPUA-NEW GUINEA: Fergusson Isl., Iamele no. 1., Brass 25934(K, h); Rakua riv., Opaigwani, Milne Bay distr., id. 24244(K, L, US); Sattelburg, Clemens 587(L, iso!); nr Kajabit Mission, Morobe distr., id. 20625(L); Constantinhafen, Hollrung 566(K); along Kua riv., N of Zalimpa, Huon peninsula, Morobe distr., Hoogland 9010(h); Finschhafen, on Bumi riv., Lauterbach 636 (type of P. textilis, L, iso!); rd to Amele, Madang distr., Millar 22651(G, h); Ossima village, Sepik distr., Sayers 13281(h, US); Leitu village, Sepik distr., id. 18948(h); Torricelli mts, Schlechter 14406(BM, K, P); forest nr Wengi, id. 16107(P); Alexishafen, Admosin Isl, Vandenberg 42175(h); Mambump village, Buang region, Herzog range, Morobe distr., Womersley 177507(K, L, US); Tagan river valley, id. & Miller 8509(BM, L);

PHILIPPINES: Luzon: Albay-Sorsogon, Curran 12392(K, NY, US); Irosin, Mt. Bulusan, Sorsogon prov., Elmer 16724(BM, C, CAL, F, G, L, NY, U, US). Leyte Isl: Wenzel 427(BM, F, G); ibid., id. 210(F, G, US); ibid., Dagami, Ramos 15208(BM, K, US); Bilaran, McGregor 18699(F, US). Mindanao: Mt. Apo, Davao prov., Clemens 15577(E, KWA, NY); ibid., DeVore & Hooger 368(US); ibid., Todaya, Elmer 10655(BM, CAL, E, F, FI, G, K, L, NY, U, W); Cabadbaran, Mt. Urdaneta, Agusan prov., Elmer 13336(BM, E, F, FI, G, L, NY, P, U, US, W); Davao distr., Penix 15850(E); Baganga, Surigao prov., Merrill 5430(K, L, NY, P, US); Camahalan riv., Agusan prov., Rams & Convogor 483(NY); Maluko & vicinity, Bukidnon subprov., Rams & Edano 38454(BM, L, P, US); Mati, Davao prov., id. 49244(BM, NY); Placer, Surigao prov., Wenzel 1864(K, US); Surigao, id. 2605(G, NY); Todaya, Mt. Apo, Williams 2592(NY); Santa Cruz, Davao prov., id. 2933(K, NY, US);

SOLOMON ISLANDS: Santa Isabel: Molofu Bay, Beer’s collectors 7379(L); San Cristobal: Kirakira, E. S. Brown W/271(BM); San Cristobal riv., Hunt 2253(K, L); Guadalcanal: Makina area, Marau, Gafui et al. 9492(K); Dudui riv., W. coast, id. 10038(L); Kombito, Mt. Austen rd, Leach 15528(K, L); Wanderer bay area, Mauriisi et al. 12293(L); Honiara, valley N of Vavaya ridge, Morrison 237(L); Honiara, from along Skyline rd, id. 295(K, L); headwaters of Tenaru riv., path from Bettlonga to Tenaru Mission, Whitmore & Corner 4394(K, L).

Notes: If the type of Pueraria warburgii Perkins was burnt at the Berlin Herbarium during the Second World War, and if no isotypes are extant (which, as yet, I could not verify) a neotype can be chosen from the material cited by Merrill (1908).
The type material of *Pueraria pilosissima* Bak. f. is from the Wollaston Expedition to W. New Guinea in 1912-1913. The sheet in BM collected by C. Boden Kloss during the expedition does not bear the location ‘Canoe Camp’ but ‘Utakwa river to Mt Carstensz’, and may be accepted as the intended type.

Diversity in *P. pulcherrima* includes the length of the bracts and stipellae, the indumentum of branches and pods and the leaf colours which are difficult to judge from dried specimens. Subtle variation exists in the auricles of the vexillum and base margin of the alae: e.g. inflexed and straight in *Williams 2453* (Philippines) and flat and wavy in *Leach 15528* (N. Guinea) respectively. Verdier (1979) suggests distinct subspecies may be involved, there would be a typical form from the Philippines and the more hairy material from New Guinea with longer bracts, stipellae and larger flowers ('*P. textilis*', '*P. pilosissima*'). However, the caducous nature of bracts, stipules, stipellae and hairs points to the need to study live material to see if these characters are consistently limited with geography. The material does corroborate this view to some extent, but there are long-pubescent pods in New Guinea material (*Brass 24244*) while pods are usually short-pubescent, just the opposite of the stems and leaves. The specimens from Indonesia are similar to those from the Philippines.

13. *Pueraria rigens* Craib. *(Map 13, p.95; Plate 20, p.94)*


Type: Thailand, Sukotai, Kao Luang, ca 1100 m, on rocks, *Kerr 5924* (K, holo; iso: BM).

Description: Stiff woody climber, perennial. Stems up to 3(-?) mm diameter, ribbed, later terete, adpressed greyish pubescent. Stipules deltoid-acute, up to ca 3 mm long, base thickened, 2 mm wide, hairy as the stem. Leaves pinnately trifoliolate, petiole ribbed, pubescent, 2-7 cm long, rachis 0.5-1.5 cm long. Top leaflets ovate-rhomboid, 6-10 cm long, 3.5-6.5 cm wide, apex acute to acuminate, base cuneate-attenuate to rounded, margin entire, side leaflets somewhat obliquely ovate, 5-10 cm long, 3-5 cm wide, (dark?) green and thinly puberulous above, veins conspicuous, hairy, densely greyish adpressed pubescent below, ribs prominent, in ca 7(sub)opposite pairs. Stipellae setaceous, 0.5-1.5 mm long, hairy, petiolules thickened, 4-7 mm long, pubescent. Inflorescences axillary or terminal, unbranched but with short 7 mm nodose laterals, to ca 15 cm long, ribbed, rusty brown pubescent, flowering close to the base, flowers on short nodose laterals, ca 5-10 together, bracts very caducous, ovate-lanceolate, ca 2-3 mm long, pubescent, pedicels short, ca 2 mm, bracteoles 2 per flower, lanceolate, ca 1 mm long, caducous. Calyx adpressed pubescent, tube ca 4 mm long, upper teeth connate, obtuse-emarginate, ca 2.5 mm side teeth acute, ca 2 mm long, lower tooth lanceolate, ca 3 mm. Vexillum orbicular, purple, ca 8.5 mm long, 7 mm wide, apex emarginate, base, not clawed, margin near the base inflexed, no auricles or callosities; alae elliptic-clawed, purple, ca 8.5 mm long, 3 mm

*Agric. Univ. Wageningen Papers* 85-1 (1985)
wide, one auricle near the base, short, 0.3 mm, claw 2 mm, keel petals boat-shaped, ca 9 mm long, 3.5 mm wide, ventrally adnate, purple. Ovary elongate, densely silvery pubescent, ca 7 mm long, 6 ovules, base stipitate, style ca 2 mm, not expanded, straight, glabrous above; stigma terminal, globular-papillate, short-paniculate at the base. Stamens diadelphous, vexillary stamen entirely free,
ca 8.5 mm, free part 1-2 mm, not yet upcurved, anthers uniform, basidorsiflex, alternately on long and short filaments. *Pods* not known.

**Distribution:** Thailand.

**Ecology:** On rocks.

*Agric. Univ. Wageningen Papers 85-1 (1985)*
Altitude: ca 1100 m.

Flowering: May.

Specimens examined: Only the type material extant.

Note: Lackey (1977a) reduced *Pueraria rigens* Craib to the synonymy of *P. wallichii* DC. Although only a single gathering exists, the differences are too great to abandon *P. rigens*. The leaflets are narrower, darker green above and more dense grey-pubescent below, the side leaflets are very much less oblique, venation is more conspicuous, and more symmetrical in the side leaflets. The inflorescence has reduced laterals, which is an approach to *P. wallichii*. Although *P. rigens* flowers are not fully expanded, they are very much smaller. The calyx is much more hairy, has acute side teeth, and a lanceolate lower tooth, not a short-obtuse one as in *P. wallichii*. Corolla parts are of different shape, the 6-ovular ovary is stipitate and the vexillar stamen is completely free while it is attached in *P. wallichii*. Despite the scarcity of material *P. rigens* appears a good species.

14. *Pueraria sikkimensis* Prain *(Map 14, p. 99; Plate 21, p. 97)*


Lectotype: India, Sikkim, Rangeet, 1000 feet, 11 March 1876, Clarke 27263(K, holo, iso: BM, CAL, K) chosen from Prain’s syntypes.

Paratypes: India, W. Bengal, Sistra, Darjeeling Terai, Gamble 2227A(K); Sikkim Terai, Anderson (CAL), ibid., Gamble s.n. and Gammie s.n. (CAL), Teesta Valley, King s.n. (CAL).

Description: Woody climber, perennial. Branches sparsely clad with adpressed glabrescent hairs, young branches rusty-puberulous (*teste* Prain). Stipules peltate, ovate-obtuse, striate, at least up to 5 mm long and wide. Leaves trifoliolate. Leaflets broadly rhomboid, up to 15 cm long, 17.5 cm wide (*teste* Prain), glabrous above, adpressed-pubescent below. Inflorescences branched at the base, 15-30 cm long, branches foxtail-like, few, ridged, nodose, densely covered with rusty brown hairs, supported by ovate stipules, barely peltate, ca 3-4 mm long, 3-4 mm wide, tip obtuse; pedicels short, up to 3 mm; flowers 3 per node, nodes crowded; bracts lanceolate, 4-8 mm long, 1-2 mm wide, dorsally long-pubescent, ventrally glabrous, striate, very caducous; bracteoles 2 per flower, lanceolate, inconspicuous in pubescence of calyx, 1-1.5 mm long and wide. Calyx rusty brown, densely long-pubescent, inside also pubescent, tube ca 4-5 mm long, teeth short, triangular, subobtuse, upper teeth connate, ca 3-4 mm long, side teeth ca 2 mm long, lowest tooth ca 3 mm. Vexillum orbicular-ovate, purplish blue, apex emarginate, base long-clawed, callosities not conspicuous, auricles inflexed, reinforced, ca 13-18 mm long, 10-12 mm wide, margins...
PLATE 21. Pueraria sikkimensis Prain, lectotype (Clarke 27263 A)

inflexed. Alae lanceolate, purplish, ca 10-14 mm long, ca 5 mm wide, base auriculate, claw 3-4 mm, auricle 1 mm long. Keel petals rounded along base, ventrally adnate, 12-14 mm long. Ovary elongate, rusty brown-adpressed pubescent, 6-7 mm long, ca 10 ovules; style almost glabrous, ca 2 mm as flattened extension.
of ovary, ca 4 mm perpendicularly upcurved; stigma terminal, globular, penicillate at base or not. Stamens monadelphous, vexillary stamen attached in the middle with a knee, 11-13 mm long, free part 2-3 mm, upcurved; anthers uniform, dorsifix below the middle, alternatively on long and short filaments. Pods not known, but likely to be similar to those of P. tuberosa.

**Distribution:** Bhutan, India (Sikkim, adjacent W. Bengal, NW Himalayas).

**Ecology:** Climber in deciduous forest or shrubs, on plains, river valleys.

**Altitude:** 330-1600 m.

**Flowering:** March. **Fruiting:** April-May.

**Vernacular names:** not recorded.

**Specimens examined:**

**BHUTAN:** Tista, Beleri Cave P? Cave s.n. (E).

**INDIA:** Himachal Pradesh: Sutlej Valley, 5000 ft., Anon. s.n. (BM); W. Himalaya: Patrick Gerard s.n. (BM). Sikkim: Rangeet, Clarke 27263(K, holoelect; isoelecto: BM, K); Mongpu, Ribu & Rhomoo 4058 (CAL); Baninpokri, Gamble 667C (CAL); Terai, Hooker s.n. (CAL, K). W. Bengal: Darjeeling Terai, Tista, Gamble 2227A(K); Kurseong, Medde 128 (CAL); Jaldaka, Sikkim Terai, Ribu 3654 (CAL). Uttar Pradesh: Ambori? Dehra Dun distr., Gamble 22980(K); Siwaliks, Stewart 154/BS(K).

**Notes:** PRAIN (1897) mentioned the rusty pubescence, larger bracts, (6 mm), much longer flowers as features distinguishing P. sikkimensis from its nearest ally, P. tuberosa DC. In the protologue the length of the dense clustered racemes and panicles (foxtail-like pseudoracemes cf. LACKEY, 1977) is given as usually only 10-15 cm. Even in the type material longer branches exist. The specimens from the NW Himalayan foothills appear to be P. sikkimensis despite the larger number of branches, and the slightly longer inflorescences. P. tuberosa specimens from this area have less densely clustered flowers, of smaller size but larger than the Central Indian ones; their pubescence is light brown.

In Kala Middi? (Ritchie s.n., E) a specimen with long bracts was found but otherwise it entirely agrees with P. tuberosa.

According to LACKEY (1977), in the first case the free stamen is often slightly adherent to the other and has to be peeled off. It has no knee, as far as could be ascertained, as in P. sikkimensis. In P. sikkimensis I saw penicillate stigmas, LACKEY’S drawing shows a stigma without hairs around the base.

Although many flowers are available in herbarium specimens, dissection has to be kept to a minimum. Regarding these subtle differences preferably a comparison of live material should indicate whether the above mentioned differences warrant specific status or not. A decision whether to reduce P. sikkimensis to varietal status has to be deferred until the time that live material can be studied.

*Agric. Univ. Wageningen Papers 85-1 (1985)*
At the moment I am inclined to say that the available *P. sikkimensis* specimens represent a limit of variability in one extreme of the diversity of *P. tuberosa*. The dearth of material also makes conclusions for geographical reasons uncertain.

*Agric. Univ. Wageningen Papers 85-1 (1985)*
15. Pueraria stricta Kurz *(Map 15, p. 103; Plate 22, p. 101)*


Lectotype: Burma, Pegu (Yomah), *Kurz 2557* (CAL, holo, not seen; iso: K) *lectotypus novus.*

Paratype: Burma, Martaban hills 300-1000 m, *Kurz* (CAL).


Lectotype: Burma, Pegu (Yomah), *Kurz 1720* (CAL, holo).

Paratype: Burma, Pegu (Yomah), *Kurz 2554* (CAL).


Lectotype: Burma, Shan hills at Yawnggyen, 1300 m, *Collett 654* (CAL, holo; iso: K).

Paratypes: Burma, Fort Stedman (Mong Hsawk), *Abdul Huk s.n.*(CAL, K); Taunggyi, *Abdul Khalil s.n.*(CAL, L); Maymyo, *Badal Khan 104* (CAL, G, K); Indine, Saga, King’s collectors; unspecified specimens from King’s collectors.


Type: Thailand, Chiangmai, Doi Sutep at 420 m, *Kerr 831* (K, holo; iso: BM, CAL, E, K).


Type: Laos, Pak Leun 1500 m, nr Xieng Khouang, *Poilane 16897* (P, holo).
Description: Shrub, occasionally straggling, perennial. Stems up to 6 mm diameter, 1-2.5 m tall, striate and short grey-pubescent, terete and glabrous with age. Stipules triangular-ovate, up to 7 mm long, 3 mm wide, apex acuminate, quite persistent, leaving a narrow scar when lost, densely grey-pubescent. Leaves pinnately trifoliolate, petiole canaliculate above, short grey-pubescent, 3-9 cm long, rachis 1.2-3.5 cm long. Top leaflets rhomboid to ovate, 11-24 cm long.
4-12 cm wide, side leaflets obliquely ovate, apices short to long-acuminate, rarely obtuse (Henry 13431), bases rounded to cuneate, green and thinly short grey-pubescent above, greyish and densely velvety grey-pubescent below, ribs prominent, not in pairs, ca 5 laterals each side; petiolules 2-6 mm long, pubescent; stipellae lanceolate-setaceous, 2-6 mm long, pubescent. Inflorescence axillary, usually single, many-flowered, with one main branch, if terminal sometimes further branched; nodes being thickened condensed racemuli up to 2 mm in fruit, bearing 4-6(-8) flowers, supported by soft lanceolate bracts, 2-3 mm long, spreading and hooked, pubescent, ventrally glabrous, usually falling, sometimes hard and quite persistent when in fruit; pedicels slender, up to 3 mm long, sturdier and up to 5 mm in fruit, supported by lanceolate adpressed-pubescent bracts, ca 1 mm long, ventrally glabrous; bracteoles 2 per flower, ca 1 mm long, pubescent, ventrally glabrous. Calyx pubescent, with adpressed grey hairs, tube glabrous inside, 1.5-2.5 mm long, teeth pubescent both sides, upper ones connate, obtuse, more or less dilated at the tip, 0.5-1.5 mm long, side and lower teeth acute, 0.5-1.5 mm long. Vexillum obovate, 5-8 mm long, 4.5-7 mm wide, white, pinkish to purple or blue, once reported yellow, apex emarginate, base clawed, auricles inflexed, no callosities. Alae obovate, 5-8 mm long, 2.3-2.6 mm wide, white to pinkish or purple, base curved-clawed, auriculate, claw ca 1.5-2.5 mm long, auricle ca 0.5 mm, base margin lobed. Keel petals oblique, white to pinkish or purple, clawed, ventrally adnate, 5-7 mm long, 1.5-2.5 mm wide. Ovary elongate, grey silky pubescent along the sutures only, ca 3-5 mm long, ca 10 ovules; style glabrous, ca 2.5 mm, upcurved; stigma terminal, globular, penicillate at base. Stamens monadelphous, vexillary stamen connate in the middle, ca 6 mm long, free part 1-2 mm long, upcurved; anthers uniform, basi-dorsifix, alternately on long and short filaments. Pods flattened-oblong, apex long-acuminate, base cuneate, 3.5-6 cm long, ca 0.5-0.7 cm wide, rarely constricted where ovules failed, light brown, glabrous to slightly pubescent, diagonally striate, sutures thickened, delinate between seeds, (5-)7-10 seeded; valves curling when ripe, interior lined with thin papery layer. Seeds flattened-ovoid, ca 4 mm long, 3 mm wide, 1.5 mm thick, dark brown to black, seed coat finely tuberculate, strophiole thin, circular, ca 0.5 mm diameter. Seedling epigeal, first 2 leaves simple and opposite, ovate, 10-15 mm long, 8-15 mm wide, apex obtuse, base cordate.

**Distribution:** Burma, China (Yunnan), Thailand.

**Ecology:** Open grassy Pinus-Helicia jungle, deciduous or dry evergreen forest with bamboo or oak, on sandstone or calcareous soil, on hillsides, dry ridges.

**Altitude:** 400-1700 m.

**Flowering:** May, July, October-November(-January). **Fruiting:** (September) November-January.

**Vernacular names:** Burma: Maik chi ya (Shan).
MAP 15. *Pueraria stricta* (= *P. colletti*) in south Asia.

*Agric. Univ. Wageningen Papers 85-1 (1985)*

103
Specimens examined:

BURMA: Maymyo, Badal Khan 104 (G, K, para); Ywanguen, Shan hills, Collett 654 (CAL, holo; iso: K); nr. Malow, S. Shan, Gilbert Rogers 696 (CAL); Fort Stedman (Mong Hsawk), Abdul Huk (K, para); Shan state, Abdul Khalil s.s. (CAL, G); Taunggyi id. s.n. (CAL, L, para); Shan state, King's collector J95 (BM, CAL); Mindat, W Central Burma, Kingdon Ward 22514 (BM); Pegu Yomah, Kurz 2557 (K, iselecto); Magyigon to Tindaw, Thayetmyo distr., Lace 2719 (E, K); Popa hill, Myingyan distr., id. 4903 (E, K); One-Tree hill, Maymyo plateau, id. 5938 (CAL, E, K); Keng Tung, S Shan state, MacGregor 947 (CAL, E); Taunggyi hillside, McKee 5891 (K, P); Sillotia roadside, Minbu distr., Shaik Mokim 294 (CAL, G); sine, loc., Parkinson 3642 (K); Loilem, S. Shan state, Robertson 8 (K); nr Yegyano, Maymyo, Rodger 615 (E); Singu Ravy, Lower Madaya reserve, Mandalay distr., Saw Maung Mya 3642 (K); Taunggyi crags, Vogt BU-445 (US).

CHINA: Yunnan: Yuanchiang, Henry 11579 (CAL, NY, US); ibid., id. 13254 (CAL, E, K, US); Szemao, id. 13431 (BM, K, NY); betw. Keng Hung (Cheli) & Muang Hing, Pang Khun forest, Rock 2604 (E, US).


THAILAND: Phu Krading, Loie, Native collectors DE 10 (W); Chiangmai, Doi Sutep, Fioato 931 (C); ibid., id. 4924 (C); Payap, Doi Chiangdao mt, Henniman 3224 (K, L); Chiangmai, Doi Sutep 720 m, Kerr 831 (K, holo; iso: BM, E, K); ibid., id. 1386 (BM, CAL, K); Doi Chiangdao mt, Murata et al. T14980 (C); ibid., Put 4534 (BM); Doi Chiangmai, Doi Sutep, Smitinand 3985 (h); ibid., Sorensen et al. 4061 (E, P); ibid., Sorensen et al. 5105 (C); ibid., id. et al. 5106 (C, E, L); ibid., id. 5472 (C).

Notes: PRAIN (1897) noted that KURZ had described Pueraria stricta, P. hirsuta, and P. brachycarpa from rather inadequate fruiting material without flowers, and that the Calcutta collectors never found the species again. Since material from CAL, where PRAIN worked, was not available, BAKER (1876) had not seen it. Pueraria collettii, which was found much more often, is extremely close both to P. stricta and P. brachycarpa. PRAIN concluded, that it might appear necessary to reduce the latter two and unite P. collettii with them.

Although no flowering specimens are known of for P. stricta or P. brachycarpa, it appears warranted to unite the species. The types of P. stricta and P. brachycarpa are less pubescent specimens with more persistent bracts, and shorter pods respectively, of the typical P. collettii. It is my opinion that the soft bracts in the more hairy specimens turn harder with age, and appear as the conspicuous hooked, more or less persistent bracts in fruiting specimens which is the case in several 'P. stricta' accessions. The short length of a few inflorescences and indeed less pubescence of the typical P. stricta are not sufficient to keep the species apart, unless comparison of live materials proves the opposite. Another reason why P. stricta was never found again, whereas KURZ (1876) described it as rather frequent in the 'hill-eng' (dry deciduous forests on hills) and upper dry forests of the Pegu Yomah and Martaban hills (rare in the drier upper mixed forests), is that it apparently constitutes an extreme in the range of the species.

P. hirsuta Kurz is a hairy form of P. stricta, and contrary to PRAIN (1897) I notice but little difference with ordinary 'P. collettii'. It is not an Ophrestia, as LACKEY (1977) suggested. The specimens Kerr 3246, 3276 and 5475 (from Thailand, BM), determined earlier as P. hirsuta (CRAIB, 1928) fit Thuan's description of Ophrestia laotica (Gagnep.) Verdc. (THUAN, 1979), but are not P.
stricta. I have not compared the Thai specimens with material of O. laotica (type: Harmand, P).

CRAIB (1928) reduced his Pueraria siamica of 1912 and P. collettii Prain var. siamica Gagn. (really (CRAIB) Gagn.) of 1916 to the synonymy of P. collettii.

LACKEY (1977a, b) reported the presence of canavanine, a free amino acid, in P. collettii, a compound generally absent in most Glycininae. LACKEY (1977c, 1980) suggested that P. collettii could be a Neonotonia, which seems chemically correct but morphologically the species fits better in Pueraria, as differences in habit, inflorescence size, calyx shape, flower size and shape, pod size and shape separate it from Neonotonia wightii (ARNOTT) LACKEY.

LARSEN (1971) reported a chromosome number of 2n = 20, but NEWELL (1982, pers. commun.) found a tetraploid with 2n = 44 in root tips of Floto 931, which I was also able to inspect.

16. Pueraria tuberosa (Roxb. ex Willd.) DC. *(Map 14, p.99)


Type: India, Bengal, Roxburgh s.n.(B, Herb. Willdenow, holo; iso: G, K, received via Puerari from the Calcutta Botanical Garden and via Lambert from Roxburgh).

Description: Woody climber, perennial, with large tubers up to 0.75 m circumference or up to 35 kg, often in strings connected to the main roots by thin
roots. Branches strong, up to 12 mm diameter, many m long, ribbed, sparsely clad with caducous adpressed greyish hairs, glabrous with age. Stipules peltate, bifid or 3-split to bearded below the point of insertion, ovate-obtuse above, striate, 5-10 mm long, 4-7 mm wide, caducous, leaving an oval scar. Leaves pinnately trifoliolate, petiole canaliculately striate, grey-tomentose, 10-23 cm long, rachis 1-6 cm long. Leaflets orbicular-ovate, side leaflets obliquely so, 8-32 cm long, 6-25 cm wide, apex long-acuminate, base narrow to wide-acuminate or rounded, occasionally cordate, green and adpressed grey-puberulous above, glabrous with age, light or grey-green and densely adpressed grey pubescent below, ribs prominent, in 6-9 unequal pairs, petiolules barely thickened, densely pubescent, to 8 mm long, stipellae lanceolate, more or less striate, 2-8 mm long, 1-2 mm wide. Inflorescences wide-branched, at the base, up to 20-50 cm long, branches many, ridged, slightly nodose, upright, densely covered with short grey hairs, bracts at the base ovate, not produced below insertion or barely fringed, ca 2 mm long and wide, obtuse, flowers (2-3) per node, pedicels short, up to 5 mm at maturity, bracts lanceolate, ca 3, rarely 7 mm long, 1, rarely 2 mm wide, dorsally pubescent, ventrally glabrous, striate, very caducous, bracteoles 2 per flower, ovate to deltoid, tip obtuse, long-pubescent, ventrally glabrous, 1-2 mm long, fairly persistent. Calyx grey to light brown pubescent, hairs longer along margin of teeth and center of upper connate teeth, puberulous inside, tube ca 4 mm long, teeth short, triangular, almost obtuse, upper teeth connate, 3-4 mm long, side teeth 3-4 mm, lowest tooth 4-5 mm long. Vexillum orbicular-ovate, apex emarginate, base clawed, auricles inrolled, reinforced, callosities not conspicuous, purplish, (9-)10-16 mm long, 9-13 mm wide, margins inrolled. Alae lanceolate-ovate, 10-14 mm long, ca 4 mm wide, base auriculate, claw 3-4 mm, auricle 1.5-2 mm long. Keel petals rounded along base, ventrally adnate, 9-13 mm long. Ovary elongate, grey silky adpressed pubescent, 6-12 mm long, ca 10 ovules, style almost glabrous, 2-4 mm as flattened extension of ovary, ca 3 mm perpendicularly upcurved, stigma terminal, globular, penicillate at base. Stamens diadelphous, vexillary stamen free, or slightly adherent, 10-14 mm long, free part 3-4 mm, upcurved, anthers uniform, dorsifex below the middle, alternatively on long and short filaments. Pods flattened oblong, up to 7 cm long, 1.1 cm wide, (1-2-)3-8-seeded, acuminate at base and apex, tipped with rest of style, constricted where ovules fail, sutures indented slightly between seeds, outline visible, hairs golden brown, bulbous-based, rather dense, somewhat caducous, rarely absent. Seeds flattened reniform, reddish brown, ca 5 mm long, 4 mm wide, 2 mm thick, hilum small, white, 1 mm long.

Distribution: India, Nepal, Pakistan.

Ecology: Hill forests, deciduous vegetation, slopes, sides of rocky streams, growing in exposed and eroded areas, covering the ground, bushes and even trees.

Altitude: 0-1300 m
Flowering: February-April after the leaves have shed from December to February, new leaves arrive around May. Fruiting: April-June.

Vernacular names:


Nepal: (Nepali) Biralikund.

Pakistan: Badar, Sarar, Sarwala, Siali, Surur (Urdu).

Uses: The tubers sometimes attain an enormous size (up to 30 seers, Ahuja 1965; or even 35 kg, Wealth of India 1969; or 60 cm long and 75 cm in circumference, Campbell cf. Haines 1922), and are sometimes eaten boiled (Haines, 1922) or raw (Kanjilal, 1938) but this use seems far from general. The tubers taste like liquorice. As is the case with kudzu, P. tuberosa is mainly a scarcity food. Starch can be extracted. The tubers are also fed to horses and tonga-ponies (Collett, 1902; Wealth of India, 1969).

In Punjab, western Uttar Pradesh and Central India P. tuberosa was found suitable for soil erosion control, where kudzu and tropical kudzu failed. Its leaves afford good cattle fodder. In most districts (Haines, 1922), the tubers are used medicinally e.g. for renal complaints, for certain bowel conditions. Tubers of certain genotypes are reported to be employed as fish poison in Manbhum, Bihar (Watt 19251) as compared with those used for food (Watt 8444). Campbell cf. Haines (1922) also refers to the use as fish poison in Manbhum.

Other medicinal uses of the tubers include application as a demulcent and refrigerant in fevers, as a cataplasm to cure swellings of joints, and as a lactagogue (Watt, 1892; Wealth of India, 1969; Ahuja, 1965; Kirtikar & Basu, 1933). The ayurvedic preparation is called chyavanprash. An estimated amount of 1500 maunds (ca 60,000 kg) is collected annually in the Saharanpur area. The dried decorticated flat thin white or dirty-white slices with a peculiar sweet taste and characteristic odor are sold in markets.

Chemical contents (Wealth of India, 1969) of the tubers are 85.1% dry matter,

Agric. Univ. Wageningen Papers 85-1 (1985)
64.6% carbohydrates, 28.4% crude fiber, 10.9% crude protein, 0.5% aether extracts. P. S. Rao (1958) obtained similar results for the tubers, which compare well with the composition of P. lobata. He also analyzed the leaves: with 23.8% crude protein these constitute a good fodder for cattle. Sucrose, glucose, fructose, and beta-sitosterol have been identified. Watt (1892) reports an inulin-related compound, a resin and a resin acid as analyzed for the Pharmacographia India. The tuber exudes a bitter acrid gum of opalescent color when wounded (Dymock cf. Watt 1892).

Haines (1922) claims that the stems reach 60 cm (2 feet) girth. The bark is brown and fibrous, peeling off in strips, sometimes twisted. No mention is made of any use of bark or stem fibers. Perry (1980) did not cover P. tuberosa in her work on Medicinal Plants of East and Southern Asia.

Specimens examined:

India: Andhra Pradesh: Horsleykonda, Chittoor distr., Fischer 4332 (CAL); Palkonda hills, Vishakhapatnam hills, Srikakulam distr., Gamble 13912 (K); Bainuti, Kurnool distr., id. 18709 (K); Rampal hill, E. Godavari distr., Ramaswami 1578 (CAL); Assam: Dhemsin (Lakhningam), Nowong distr., Kanjilal 3661 (CAL). Bihar: Paras Nath, Chota Nagpur, Clarke 14010 (CAL, K); SE of Gibraltar hill, Hazaribagh, Chota Nagpur, Kerr 2580 (BM); Paras Nath Hill, Van der Muesen (ICRISAT, WAG); Moodh, Chota Nagpur, W. J. Nuthu? s.n.(K); Biswadi, Manbhum, Watt 8444 (E); Suren Pani, Manbhum, id. 9251 (E); Gujarat: Malangdev, Songudi, Surat distr., A.S.B. 64.6% carbohydrates, 28.4% crude fiber, 10.9% crude protein, 0.5% aether exstrose, and beta-sitosterol have been identified. (1892) reports an inulin-Watt (DYMOCK 1892). No mention is made of any use of bark or stem fibers. Perry (1980) did not cover P. tuberosa in her work on Medicinal Plants of East and Southern Asia.

Notes: The specimens from NW India approach the typical P. sikkimensis in size of flowers, more crowded inflorescences, and brown colouration of the flower.
pubescence (see note under *P. sikkimensis*).

In January and February the large senescent yellowing leaves are conspicuous in the Indian forests.

17. **Pueraria wallichii** DC.


**Type:** Nepal, *Wallich* (1821) (G, holo, microfiche seen; iso: BM, C, K: *Wallich 5353* a/c).

**Synonyms:** *Pueraria composita* Graham ex Wallich nom. nud., *Cat. Herb. Ind.* no. 5570, based on Burma, Taong Dong, *Wallich 5570* (BM, G, K).


**Type:** Burma, Taong Dong, *Wallich 5570* (K, holo; iso: BM, G, K).


**Type:** Nepal, Hamilton (CAL, holo).

**Description:** *Shrub* with woody stems and branches, sometimes straggling, perennial. *Stems* up to 7 mm diameter, 1.5-4(-7) m tall, striate, sparsely pubescent, hairs adpressed, vertical, disappearing with age. *Bark* brown. *Stipules* very caducous, linear-acuminate, not produced below the base, to ca 8 mm long, 2 mm wide, striate, finely pubescent, leaving a narrow-oval scar, sometimes folded downwards; buds protected by similar, smaller stipules. *Leaves* pinnately trifoliolate; petiole striate, glabrescent, 7-18 cm long; rachis 2-5.5 cm long. Top leaflets rhomboid-elliptic, ovate or sometimes obovate, 8-28 cm long, 5-19 cm wide, side leaflets obliquely so, 8-23 cm long, 5-15 cm wide, apex long-acuminate, sometimes obtuse, base cuneate, margins rarely shallowly lobed, green and gla-
brous above, grey-green and very short-adpressed-pubescent below, very thinly if leaflet is large sized, ribs prominent, in ca 7 (sub-) opposite pairs. Stipellae linear-setaceous, 2-3 mm long, ca 0.5 mm wide, finely pubescent, caducous with time, petiolules thickened, 4-11 mm long, pubescent. Inflorescences axillary or terminal, sometimes branched, 8-30(-52) cm long, 1 or 2, sometimes more per axil (Nepal), axes finely ribbed, finely pubescent, flowering close to the base, flower buds crowded on short laterals, which expand with age, up to 3.5 cm long, ca 5-8 flowers per node or lateral, leaving top flowers close together, rarely remaining short-nodose; bracts very caducous, linear, ca 5 mm long, pubescent; pedicels slender, 2-5 mm, sturdy in fruit; bracteoles 2 per flower, ovate, ca 0.5 mm, caducous. Calyx short-pubescent, interior glabrous, tube 3.5-5 mm, teeth short, obtuse, 0.5-1 mm long, upper ones connate or slightly dilated. Vexillum obovate, ca 16-19 mm long, 6-8 mm wide, white or pale yellow to (rarely) violet red, apex rounded, base narrowed, not clawed, no auricles or callosities; alae narrow-elongate, ca 15-17 mm long, ca 2 mm wide, white or pink, darker than vexillum and keel, claw ca 4 mm long, auricle short, 0.5 mm; keel petals boat-shaped, ventrally and basally adnate, white to pinkish or violet red, ca 14-17 mm long, 3 mm wide, auricle near claw ca 1 mm, claw 5 mm. Ovary elongate, finely pubescent, ca 10 mm long, ca 8 ovules; style ca 4.5 mm, 2.5 mm upcurved, glabrous, stigma terminal, globular, penicillate at the base. Stamens monadelphous, vexillary stamen attached in the middle, ca 15 mm long, free part 1-2 mm, upcurved; anthers uniform, dorsifix, alternately on long and short filaments. Pods flattened-oblone, somewhat S-shaped, ca 6-7 seeded, 6-10 cm long, 0.7-1.1 cm wide, acuminate at both ends, tipped with rest of style, pale to medium brown, glabrous, valves faintly reticulate, curling when ripe. Seeds reniform, ca 5.5 mm long, 3.5 mm wide, 2.5 mm thick, brown with black mosaic, seed coat minutely reticulate, strophiole oval, ca 1.2 mm longest diameter, yellowish.

Distribution: Bangladesh, Burma, China (Yunnan), India (E Himalayas, Meghalaya), Nepal, Thailand.

Ecology: In or near dry evergreen forests, associated with sal (Shorea robusta Gaertn.), pines, dipterocarps, Quercus; in open grassy vegetation, on slopes, along rivers, erect or scandent in shrubs and trees.

Altitude: 180-1900(-2300) m.

Flowering: (August-September) October-January (February). Fruiting: (August) October-February.

Vernacular names: India: Mei-soh-ktaw (Khasi).

Uses: Hooper 34722 (CAL) refers to the use of Pueraria wallichii as a hedge near the villages of Therria ghat in the Khasi hills of Meghalaya, India.
Specimens examined:

BANGLADESH: Sylhet, Walllich 5353B (BM, G, K);

BURMA: Pandyang, Toungoo distr., Chin 4446 (CAL); Taunggyi, Collett 90 (K); Khyrban, Dangmii, Gamble 313B/C (CAL, K); Chenga distr., id. 2423 (CAL, K); Fort Stedman (Mong Hsawk), Inle Lake, Abdul Huk s.n. (CAL); Heho, Shan, Abdul Khallit s.n. (CAL); Esakan, Victoria, Kingdon Ward 22871 (BM); Martaban, Kurz 1724(FI, US); Palwe reserve, Gamethin distr., Lace 4534(K);

Thailand: Phu Kradung, Loei distr., id. 4973 (CEL, E); Ani Sakam nr Maymyo Plateau, id. 5510(CEL, E, K); Keng Tung, S. Shan State, MacGregor 950 (CEL, E); Byinban, Upper Chindwin, Meebold 7737 (CAL, K); betw. Numpandet and Wetpyaye, Melville 10 (BM); Shindy, Chhihia hill, Minbu, Shaik Mokim 1173 (G); Upper Burma, Prager 32(CAL, G, US); ibid., id. 45(G); Polamy Mohye, S. Shan State, Robertson A(K); Thangthagon, Tandia forest, id. 44(K); Taunggyi backyard, Vogt 417(US); Tuang Dong or Taong Dong, Walllich 5570(BM, G, K).

CHINA: Yunnan: sine loc., Bons d'Arty s.n. (P); hills NE of Tengyueh, Forrest 8276 (K); Talang, Henry 11568 (CAL, K); Talang, Tatien river, Sheo Dai, id. 13233 (CAL, E, K, NY, US); on the Babien-ho betw Talang and Puori, von Wissmann 543 (W).

INDIA: Assam: Pynursla, Biswas 4035 (CAL); Jowai, King's collector s.n. (BM); Khasi & Jaintia hills, Dawki market, Panigrahi 4678 (CAL, L). Meghalaya: Khasi hills: Mausmai, Clarke 5338 (BM, CAL, K); Puriang (Puriang) id. 5793 (BM, K); Mingot or Muongot nr river, id. 14829 (BM, CAL, K); Shoulia, id. 14884 (BM, CAL, K); Sohra, id. 15599 (BM); Walong, id. 17819 (BM, K); ibid., id. 17825 (CAL, K); sine loc., Griffith 250 (G, K); Chabadi, id. 1733 (K, W); Regio trop. Mahadev, Hooker & Thomson s.n.(BM, C, CAL, FI, G, K, L, NY, OXF, P, US, W); below Pongrang, id. 2488 (K); Syndai, Kanjiyal 2777 (CAL); Cherrapunj to Theria, id. 4579 (CAL); Mahadeo; id. 4621 (K); Mawlynung, Koolz 28421 (L); ibid., Thakur Bap Chand 3085 (L); Dawki Market & surroundings, Panigrahi 4678 (CAL). Mizoram: Shekoi, Lushai hills, Mrs. Parry 446 (CAL).

Sikkim: Himalaya, Gammie 47 (U); betw. Chumthang and Lumtieng, Prain s.n.(BM, CAL, L); West Bengal: Cult. Hort. Bot. Calcut, Anon. s.n(G, L).

NEPAL: Num, Beer 12536 (BM); Lumle Agric. Centre, Dawson 473 (BM); Garhi Daura-Linkim-Tuwa, Hara et al., 6301726 (BM); Ilham-Jog Mai-Ranga Panii, id. 6301727 (BM, NY); E. Dhankuta, id. 6301728 (BM, E); Taplethok-Helok, id. 6301729 (BM); Khebang below Siling Tzokupa, id. 6301730 (BM, E, NY); E. Nepal & Sikkim, Hooker s.n.(K); Lungtung, Tambur river, id. s.n.(K); Khabili river, id. s.n.(K, P); Darondi Khola S of Himal Chuli, Stainton 6030 (BM); Mardi Khola (BM); Khebang-below Siling Tzokupa, id. 6301728 id. 6301729 id. (BM, E); Taplethok-Helok, Tuwa, id. 6301727 Hara et ah, 6301726 (BM, NY); E. Dhankuta, id. 5793 (BM, K); Mingot or Mungot nr river, id. 14829 (BM, E); below Pomrang, id. 14829 (BM, CAL, K); Shinday, Khebang, id. 4579 (K); Syndai, Kanjiyal 2777 (CAL); Cherrapunj to Theria, id. 4579 (CAL); Mahadeo; id. 4621 (K); Mawlynung, Koolz 28421 (L); ibid., Thakur Bap Chand 3085 (L); Dawki Market & surroundings, Panigrahi 4678 (CAL). Mizoram: Shekoi, Lushai hills, Mrs. Parry 446 (CAL).

Sikkim: Himalaya, Gammie 47 (U); betw. Chumthang and Lumtieng, Prain s.n.(BM, CAL, L); West Bengal: Cult. Hort. Bot. Calcut, Anon. s.n(G, L).

THAILAND: Phu Krading, Loei distr., van Beusekom et al. 4620 (L); ibid., Charoenphoi et al. 14850 (K); Doi Sutep, Chiangmai, Mrs Collins 1222 (K, US); Dai-Angka, Me Ka Pak drainage, Garrett 313(E, K, L); Payap, Doi Buak Ha, W of Chiangmai, Henningman 3175(C); Doi Sutep, nr Chiangmai, Hosseus 207 (BM, G, K); Doi Chiang Dao, Kanchhachai 95 (L); Doi Sutep, Chiangmai, Kerr 878 (BM, L); 1556 (BM, E, K, US); Tapoh, Larsen 9144 (L); Chiang Dao, Seno Pengnare 31 (L); Kanchanaburi, Tham Pa, Phennkhai 344 (L); Doi Chiang Dao, Put 368 (BM, C, L); 4436 (BM, E, K); Camp Hoi Chan Kiang, Doi Sutep, Rock 116 (US); Chiangmai to Chiang Rai betw. Pang Kai & Meh Kha Chan, basin of Meh Lao, id. 1620 (US); Phu Krading, Loei, below Sam Khao, Smithinard 2113 (CAL, L); id. 3091 (L); Chiangmai, id. 3936. 3956 (L); Kunm Tan mts, H.M. Smith 454 (US); Phahom Pok, in opium field, Sorensen et al., 1659 (C); Doi Sutep, Chiangmai, id. 585/ (C); 5914 (C, L); & 5972 (E, C); Chiang Dao, Suvarnakoses 976 (K, L); Phrae, vanpruk 478 (CAL, K); Lampun, Mi Li Pi forest, Wint 1521 (K).

Notes: The holotype, sent by WALLICH TO DE CANDOLLE between 1821 and 1825 is conserved in the Heriber de Candolle at G. As isotypes 1 consider the specimens sent later with the Herbarium of the East India Company, Walllich 5353A, and Walllich 5353C, grown in the Calcutta Botanic Garden from seeds brought from Nepal, likely to be from the same source. Walllich 5353B is from
Sylhet, now Bangladesh, and is not a type.

*Pueraria wallichii* contains canavanine, unlike most *Pueraria* spp. and is morphologically so distinct from the other *Pueraria* sp., that Lackey (1977a, b) considered it anomalous in the genus and felt it should be removed, even though it fits nowhere else well.

*Pueraria rigens* Craib was listed as a synonym of *P. wallichii* by Lackey (1977a). I think *P. rigens* is at any rate specifically sufficiently distinct, although as to flower and inflorescence structure it is somewhat like *P. peduncularis*.

### 11. MATERIAL OF UNCERTAIN DISPOSITION

Some specimens could not be placed in other genera and fit the general habit of *Pueraria*.

*Cunningham 105 and 173* (BM) both from Tatsienlu (now Kangting) in Szechwan, China, are erect shrubs with terminal pseudoracemes, flowers (14 mm) similar to those of *P. peduncularis*, also without auricles on the vexillum, but with a somewhat bulgy style base, larger hooked wing auricle, similar calyx, stipellae, ovary, stamens, and bracteoles. The leaflets are ovate-rounded with emarginate-mucronate apex, not long-acuminate, truncate-cordate base and margin sinuate. Its pubescence is thin-woolly, the hairy forms of *P. peduncularis* are semi-adpressed pubescent. The Cunningham specimens are either a variety of *P. peduncularis* or a closely related, erect species of *Pueraria*.

*Simeon Ten 266(E)* from Nanfantchoang, Yungse (Yangtze?) in Yunnan, China, has rounded to obovate leaves, emarginate, nonmucronate apex, rounded base, slightly sinuate thickened-pubescent margin, with thin adpressed pubescence above and woolly pubescence below. Its inflorescence is branched, paniculate with ca 2 flowers at the base of most laterals, thin hairy pedicels and flowers much the same as *P. peduncularis*. With Cunningham 105 and 173 it has flower shape, size (10 mm) and approximate leaf shape and pubescence in common. If this specimen belongs in *Pueraria*, its alliance is with *P. peduncularis*.

*Henry 13626* (BM, NY, US) and 10931 (CAL, K, NY) from Mengtze mts, Yunnan, China, has the facies of a hybrid between *Pueraria lobata* and *P. edulis*. Its leaves are 3-lobed, coarser than the thinner (when dried) leaves of *P. lobata* var. *lobata* and *P. edulis*, with acute rather than acuminate leaflet tips, relatively broad stipellae as in *P. edulis* but in a single pair near the side leaflets. Stipules are peltate. The flowers are ca 12 mm long, smaller than those of the mentioned species, with a quite hairy calyx and vexillary stamens attached at first at least. The ribs on the greyish and grey-pubescent lower leaflet side are quite prominent, more so than in *P. lobata* var. *lobata* and *P. edulis*, the pubescence of the latter disappearing soon. At present I cannot decide upon specific or varietal status. The sheets were identified as *P. phaseoloides*, but that is definitely an error.

*Agric. Univ. Wageningen Papers 85-1* (1985)
haps this material is simply a form of *P. lobata* var. *lobata*, or, indeed, a hybrid of *P. edulis*, or *P. lobata* var. *montana*, of which it has the leaf structure.

*Ducloux* 5805(P) from Liao Fa Ka, Kiao Kia region in Yunnan, China, deter-

*Agric. Univ. Wageningen Papers 85-1* (1985)
mined as *Pueraria bicalcarata* Gagn., seems to be a *P. lobata* var. *lobata* but with short, rather broad calyx lobes, short-grey hairy calyx and thin longer-pubescent lower leaflet sides and more prominent veins.

114

*Agric. Univ. Wageningen Papers 85-1 (1985)*
PLATE 25. Henry 13626, near Pueraria lobata and P. edulis

*Palmer & Bryant* 266(US) from Chiburum, slopes of Gunung Gedeh on Java looks somewhat like *Pueraria pulcherrima*. Leaflets are smaller, not so woolly greyish pubescent below, stipellae are not so caducous, black, short linear, ca

*Agric. Univ. Wageningen Papers 85-1 (1985)*
5 mm long. Stipules are narrower and also more persistent than in *P. pulcherri-
ma*, rather papery. The pubescent inflorescence is not well developed yet, but
flowers are tended by large bracts and arranged ca 3 per node. The flowers are

*Agric. Univ. Wageningen Papers 85-1 (1985)*
as large as those of *P. pulcherrima* (8 mm at least) but the calyx is not greyish canescent while the upper lobe is incised. The stamens are monoecious. If this is a *Pueraria*, it is an undescribed species.

**Pueraria tanaii** Ozaki (fossil species)

Paratypes: Same location, *GYNU-CMP-1028* & 1030 (ibid., photograph seen).
Ecology: Considered to have been warm-temperate to transitional forests during Miocene.

Notes: Fossils of single leaflets, resembling present-day *Pueraria* (of which *P. lobata* is commonly found in Japan), were found in Miocene sediments (OZAKI, 1974). The leaflets, judging from the photograph, do indeed resemble *P. lobata* leaflets, the holotype may be an unlobed asymmetric side leaflet, paratype 1030 looks like a slightly lobed ± symmetric top leaflet. Venation and shape were described in detail (OZAKI, 1974). The leaflet size varied from 5-7 cm long and 4-7 cm wide.

12. EXCLUDED SPECIES AND REJECTED NAMES, WITH NOTES ON TEYLERIA

Some new combinations were necessary; some of LACKEY'S (1977) new names are validated in this chapter.


Type: Thailand, Doi Sutep 3000 ft, *Kerr 2653* (K, holo; iso: BM). Other material seen: Ibid., *id.* 2224(BM, K). See note under *P. tetragona*.

PLATE 27. Teyleria barbata (Craib) Lackey ex van der Maesen, holotype (Kerr 2653)


Lectotype: Ethiopia, betw. Adcita & Cualo Dijot mt, Assaorta, Pappi 5795 (FI, holo? not seen; iso: G, lectotypus nov.).

Paratypes: ibid., Pappi 2998 (FI? not seen); Ethiopia, Pappi 3721, 3728, 3064 bis (FI? not seen).


Type: Transvaal, Selati railway betw. Komati Poort & Letaba riv., Rogers 11806 (BOL, holo, not seen).


Type: India, U.P., Kumaon, Kalimundi 7300 ft, Strachey & Winterbottom s.n. (K, holo).


Type: syntypes are Clarke 13493 from Sikkim and Mann; Collett; and Clarke 40383 from Khasia. A lectotype has to be selected from material in CAL or K.


Note: for the convenience of the users a key to the species of *Teyleria* is given here. The locations of the three species are mapped, the specimens seen...
are listed in the previous sections and after the key respectively. *Teyleria* has more the facies of *Glycine*, with which the type species was formerly associated. *Teyleria* differs from *Glycine* and *Pueraria* by its four-angled stems, bearing retrorse hairs on the angles. The inflorescence is short, the flowers measure 5 mm or less.

*Agric. Univ. Wageningen Papers 85-1 (1985)*

PLATE 28. *Teyleria koordersii* (Backer) Backer (H. Y. Ling 67636)
Key to the species of Teyleria

1a. Leaflets large, ca 9-15 cm long, densely pubescent below, stem angles long-pubescent, strong climber ....................... T. barbata
1b. Leaflets smaller, up to 10 cm long, thinly pubescent or glabrous below, stem angles short-pubescent, weak climber ....................... 2

2a. Fruits ca 4-7 cm long, 0.5 cm wide ....................... T. tetragona
2b. Fruits ca 3 cm long, 0.3 cm wide ....................... T. koordersii
PLATE 30. *Pueraria stracheyi* Baker = *Shuteria sp.?*, holotype (*Strachey & Winterbottom s.n.*).

Lectotype: Java: Kediri Res., Gudangan Pare, Koorders 22997(BOG, holotype, not seen; isotype: L; lectol. nov. typus floriferus).
Paratype: Java: Besuki, Puger, Koorders 21260 (BOG, not seen; L, 2 sheets seen; typus fructiferus).


Type: China, Hainan, Lok Mooi Shan, Changkiang distr., S. K. Lau 1198 (holo: ?; iso: BM).

Specimens examined:

INDONESIA, Java: Banyumas, Melawung Plantation, Anon. s.n.(L); N of Kiara Payung, N of Chemur, Backer 23737 (K, L); Pekalongan, Margasari forestry, Beumee 1799(L); Besuki, Puger, Koorders 21260 (iso. fruct., L); ibid, id. 21283 (L); Kediri, Gudangan-Pare id. 22997 (iso. floriferus, L); Besuki, Rogojimpi, id. 28939 (L). Flores: Endeh, Rensch 1040(L). Backer (1939) quotes more specimens from Indonesia.

CHINA: Kwangtung/Guangdong prov., Hainan: Jianfangle, K. S. Chow 78227 (BM, NY); Lok Mooi Shan, Changkiang distr., S. K. Lau 1198 (iso, BM); Ka Chik Shan, ibid., H. Y. Liang 66441 (KWA, US).

VIETNAM: Annam, region of Nha Trang, d'Alleizette s.n. (L).

13. ACKNOWLEDGEMENTS

I wish to thank Dr. L. D. Swindale, Director General, ICRISAT for according permission to go on study leave to the Crop Evolution Laboratory, the University of Illinois, Urbana, where Dr. J. R. Harlan, Dr. J. M. J. de Wet, and Dr. T. Hymowitz offered me hospitality and guidance. Their staff members and students assisted in creating a good working atmosphere, for which I am grateful. I am also grateful to Mr. Tung Ming Sung for translation of Chinese herbarium labels and Emily Fortenberry for typing the manuscript. I am grateful to Prof. Dr. H. C. D. de Wit, Agriculture University Wageningen, for critically reviewing the manuscript. This research would have been impossible without the support of the Directors and Curators of the following Herbarium Institutes who sent Pueraria material on loan and assisted in various ways:

BM – British Museum (Natural History), London, U.K.
C – Botanical Museum and Herbarium, Copenhagen, Denmark.
CAL – Central National Herbarium, Botanical Survey of India, Calcutta, Howrah, India.
CEL – Crop Evolution Laboratory, University of Illinois, Urbana, Ill, U.S.A.

Agric. Univ. Wageningen Papers 85-1 (1985)
SUMMARY

The taxonomy of the Asian genus *Pueraria* DC. (Leguminosae) has been revised. The study was based on herbarium material. In total 17 species are now recognized, including *P. imbricata* van der Maesen sp. nov. from Laos and Thailand. Some species anomalous in the genus have been retained: *Pueraria peduncularis* (Grah. ex Benth.) Benth., *P. wallichii* DC.

*Pueraria subspicata* (Benth.) Benth. was lowered from species to variety level under *P. phaseoloides* (Roxb.) Benth., as was done for *P. thomsoni* Benth. and *P. montana* (Lour.) Merr., which are better placed as varieties of *P. lobata* (Willd.) Ohwi.

Two *Pueraria* species were placed in a related, earlier monotypic genus, *Teyleria* Backer: *T. barbata* (Craib.) Lackey ex van der Maesen comb. nov. and *T. tetragona* (Merr.) Lackey ex van der Maesen comb. nov.

Lectotypes were designated for *Pueraria alopecuroides* Craib., *P. mirifica* Shaw & Suvatabandhu, *P. sikkimensis* Prain, *P. stricta* Kurz and the synonyms *P. colletti* Prain, *P. peduncularis* (Grah. ex Benth.) var. violacea Franch., *Derris bonatiana* Pamp., *Neustanthus subspicatus* Benth., *Pueraria textilis* Lautb.

*Agric. Univ. Wageningen Papers 85-1 (1985)*
Schum., *P. tonkinensis* Gagnep. and *P. sericans* R. Schum.

Geography, flowering, uses and vernacular names are compiled, occurrence of specimens examined was plotted on maps. Most of the genetic diversity is found in Burma, S. China, Thailand, Indochina, NE India. *P. pulcherrima* (Kds.) Merr. is confined to SE Asia and parts of Oceania.

Biosystematic references, of which there are few, are added. Chromosome counts in the genus are $2n = 22$ and $44$, rarely $2n = 20$ and $24$, the latter almost certainly incorrect.

For further studies it is imperative that live material and, for many species, better herbarium material be collected, to elucidate the taxonomy of the genus. Related to *Glycine*, the soybean and its relatives, *Pueraria* and *Teyleria* may have useful genes to contribute to soybean improvement.

**RESUMÉ**

La taxonomie du genre asiatique *Pueraria* DC. (Leguminosae) a été révisée; ce genre comprend 17 espèces. L'étude était basée sur les collections d'une vingtaine d'herbiers importants. *Pueraria imbricata* van der Maesen est décrite comme une nouvelle espèce du Laos et de la Thailande. Quelques espèces appartenant au genre, mais de morphologie atypique, restant dans *Pueraria: P. peduncularis* (Grah. ex Benth.) Benth. et *P. wallichii* DC. *Pueraria subspiaata* (Benth.) Benth. a été reclassée d'espèce à variété sous *P. phaseoloides* (Roxb.) Benth. ainsi que *P. thomsoni* Benth. et *P. montana* (Lour.) Merr. qui sont mieux placées comme variétés de *P. lobata* (Willd.) Ohwi, le kudzu.

Deux espèces de *Pueraria* ont été reclassées dans un genre voisin: *Teyleria* Backer: *T. barbata* (Craib) Lackey ex van der Maesen et *T. tetragona* (Merr.) Lackey ex van der Maesen.


La géographie, les dates de floraison, les utilisations et les noms vernaculaires sont compilés. Des cartes montrent la répartition des espèces. La plus grande diversité se trouve en Birmanie, au sud de la Chine, en Thaïlande, en Indochine et au nord-est de l'Inde. *Pueraria pulcherrima* (Kds.) Merr. se retrouve uniquement au sud-est asiatique et dans certaines parties de l'Océanie.

Les références biosystématiques, peu nombreuses, sont discutées. Les nombres chromosomiques sont $2n = 22$ et $44$, rarement $2n = 20$ ou $24$, le dernier étant probablement incorrect.

On a besoin de semences de plantes vivantes, ainsi que de meilleurs échantillons d'herbier pour poursuivre l'étude biosystématique.

Agric. Univ. Wageningen Papers 85-1 (1985)
Apparenté à Glycine, la soja et ses espèces, Pueraria et Teyleria, pourront avoir des caractères utiles contribuant à l’amélioration du soja.

SAMENVATTING

Deze taxonomische revisie van het Aziatische genus *Pueraria* DC. (Leguminosae), welke gebaseerd is op de analyse van herbariummateriaal, leidt tot het onderscheiden van 17 soorten binnen het genus. Een van de soorten, *P. imbricata* van der Maesen, is nieuw beschreven. *P. peduncularis* (Grah. ex Benth.) Benth. en *P. wallichii* DC. zijn twee taxonomisch problematische taxa die voorhands in het genus worden gehandhaafd. *P. subspicata* (Benth.) Benth. wordt gereduceerd tot een variëteit van *P. phaseoloides* (Roxb.) Benth., terwijl *P. thomsoni* Benth. en *P. montana* (Lour.) Merr. worden gereduceerd tot twee afzonderlijke variëteiten van *P. lobata* (Willd.) Ohwi. Twee *Pueraria* soorten werden geplaatst in het tot nog toe monotypische genus *Teyleria* Backer. Dit leidt tot het onderscheiden van *T. barbata* (Craib.) Lackey ex van der Maesen comb.nov. en *T. tetragona* (Merr.) Lackey ex van der Maesen comb.nov.


Een overzicht van geografie, bloeitijden, gebruik en volksnamen volgt de beschrijving van iedere soort. De verspreiding van de bestudeerde exemplaren is aangeduid op kaarten. De grootste verscheidenheid vindt men in Burma, Zuid China, Thailand, Indochina en Noordoost India. *Pueraria pulcherrima* (Kds.) Merr. is beperkt tot Zuidoost Azië en delen van Oceanië.

De weinige biosystematische gegevens zijn gecompileerd. Het aantal chromosomen van het genus is 2n = 22 en 44, zelden is 2n 20 of 24 gevonden; het laatste aantal is vrijwel zeker onjuist.

Van diverse taxa is weinig geconserveerd materiaal, dat bovendien dikwijls van matige kwaliteit is, beschikbaar.

Het is te verwachten dat de analyse van levend materiaal tot een juister begrip van de taxonomie zal leiden.

Onderzocht dient te worden of *Pueraria* en *Teyleria* die verwant zijn aan *Glycine*, de sojaboon en zijn verwanten, misschien kunnen bijdragen aan de (genetische) veredeling van de sojaboon.
14. REFERENCES

Only references cited in the text and in the notes have been listed, all other references appear under the names of species and synonyms.

BURKILL, I. H. 1935. A dictionary of the economic products of the Malay peninsula 1838.
LINNAEUS, C. 1753. Species Plantarum 754, 1021.
MERRILL, E. D. 1912. A flora of Manila. 753.
Sakai, B 1951. La Kromosomo 11: 425.
Agric. Univ. Wageningen Papers 85-1 (1985)


VERDCOURT, B. 1968. The identities of *Dolichos trilobus* L. and *Dolichos trilobatus* L. Taxon 17: 170-173.


16. INDEX TO PLANT NAMES

The accepted names pertaining to this study and the page numbers of their main entries are printed in bold face. Plates are indicated with italicized page numbers. Synonyms, nomina nuda and excluded names are in italics, new names or synonyms listed as such.

Amphicarpha Nutt. 6
Breviramulae van der Maesen sect. nov. 13
Butea superba Roxb. 64
Cajanus grandiflorus (Benth. ex Bak.) van der Maesen 119
Clitorieae (Clitorieae) 6
Cologania Kunth. 6
Derris bonatiana Pamp. 67
Desmodium 6
Dioeclea odorata Montr. 45
Dioscorea bolojonica Blanco 81
Diphyllarium Gagnep. 6
Dolichos falcatus Klein ex Willd. 38
Dolichos ficifolius Grah. ex. Wall. nom. nud. 84
Dolichos frutescens Ham. 109
Dolichos grandifolius Grah. ex Wall. nom. nud. 58
Dolichos hirsutus Thunb. 45
Dolichos japonicus Hort. nom. nud. 47
Dolichos lagopus Dunn 119
Dolichos lobatus Wild. 45
Dolichos montanus Lour. 53
Dolichos phaseoloides Roxb. 81
Dolichos spicatus Wall. nom. nud. 62, 84
Dolichos tuberosus Lam. 39
Dolichos trilobus L. 45
Dolichos trifolius Houttuyn non L. 45
Dolichos viridis Ham. ex Wall. nom. nud. 81
Dunasia DC. 6
Dunbaria pulchra Bent. ex Bak. 119
Eminia Taub. 6
Eupueraria (sect.) 11
Glycine Wild. 6
Glycine ferruginea Grach. ex Wall. nom. nud. 117
Glycine hainanensis Merr. & Metcalf 124
Glycine javanica L. 53
Glycine koordersii Backer 124
Glycine maclurei Metcalf 119
Glycine max (L.) Merr. 5
Glycine warburgii (Perk.) Merr. 88
Hedysarum tuberosum Roxb. ex Wild. 105
Impomoea batatas L. 42
Lotée (Lotoeae) 6

Mastersia Benth. 6
Mueuna pulcherrima Kds. 88
Mycocephalelll studioica 43
Neonotonia Lackey 6
Neonotonia wightii (Arnott) Lackey 105
Neorautanenia amboensis Schinz 119
Neorautanenia ficifolius (Benth.) C. A. Smith 119
Neorautanenia mitis (A. Rich.) Verdc. 119
Neustanthus Benth. 9, 11
Neustanthus chinensis Benth. 45, 62
Neustanthus javanicus Benth. 76
Neustanthus peduncularis Grah. ex Benth. 66
Neustanthus phaseoloides (Roxb.) Benth. 9, 81
Neustanthus sericans Miquel 76
Neustanthus subspecificus Benth. 84
Neustanthus wallichii (D.C.) Benth. 109
Nogra Merr. 6
Nonnudiflorae van der Maesen subsect. nov. 12
Ophrestia 104
Ophrestia laotica (Gagnep.) Verdc. 104
Pachyrhizus angulatus Rich. ex DC. 39
Pachyrhizus mollis Hassk. 76
Pachyrhizus montanus Blanco 57, 81
Pachyrhizus montanus (Lour.) DC. 39
Pachyrhizus teres Blanco 81
Pachyrhizus thunbergianus Sieb. & Zucc. 45
Pachyrhizus trilobus (Lour.) DC. 58
Pachyrhizus tuberosus (Lam.) Spreng. 39
Phaseoleae Benth. 6
Phaseolus barbatus Grah. nom. nud. 81
Phaseolus chaneti (Levi.) Levi. 117
Phaseolus decurrens Grah. ex Wall. 81
Phaseolus trilobus (L.) Ait. 45
Pseudeminia Verdc. 6
Pseudovigna Verdc. 6
Pueraria DC. 9
Pueraria (sect.) 12
Pueraria (subsect.) 12
Pueraria alopecuroidea Craib 12, 15, 16
Pueraria anabaptista Kurz. 117
Pueraria argyi Lévl. & Vaniot 46
Pueraria assamica nom. nud. 70
Pueraria barbata Craib 117
Pueraria bella Prain 6, 18, 19
Pueraria bicinculata Gagnep. 29
Pueraria bodinieri Lévl. & Vaniot 46
Pueraria brachycarpa Kurz. 6, 100, 104

Agric. Univ. Wageningen Papers 85-1 (1985)
Pueraria caerulea Lévl. & Vaniot. 47
Pueraria calycina Franchet 12, 20, 21
Pueraria candollei Grah. ex Benth. 12, 23, 24, 70
Pueraria chanetii Lévl. 117
Pueraria chinensis (non Benth.) Ohwi 58
Pueraria colletti Prain 8, 9, 70, 100, 104
var. siamica (Craib.) Gagnep. 100
Pueraria composita Grah. ex Wall. nom. nud. 109
Pueraria decurrens Grah. ex Wall. nom. nud. 81
Pueraria edulis Pamp. 12, 27, 25, 70
Pueraria ferruginea KUTZ 118
Pueraria fenicifolia (Benth.) L. Bolus 119
Pueraria forrestii Evans 20
Pueraria harmsii Rech. 47
Pueraria hirsuta Kurz 100
Pueraria hirsuta (Thunb.) Matsum. non Kurz 46
Pueraria hirsuta (Thunb.) Schneid. 46
Pueraria hochstetteri Chiov. 119
Pueraria imbricata van der Maesen nov. sp. 12, 32, 33
Pueraria javanica (Benth.) Benth. 53, 76
Pueraria koten Lévl. & Vaniot 47
Pueraria lacei Craib 12, 35, 36
Pueraria lobata (Willd.) Ohwi 7, 8, 9, 12, 37
var. chinensis (non Benth.) Ohwi 60
var. lobata 43, 44
var. montana (Lour.) van der Maesen comb. et stat. nov. 53, 54, 55
var. thomsoni (Benth.) van der Maesen comb. et stat. nov. 58, 59
Pueraria longicarpa N. V. Thuan 100
Pueraria maculata (Metcalfe) F. J. Hermann 117
Pueraria mirifica Airy Shaw & Suwatabandhu 9, 12, 63
Pueraria montana (Lour.) Merr. 53
Pueraria neo-caledonia Harms 46
Pueraria novo-guineensis Warb. 46
Pueraria novo-guineensis sensu Pulle non Warb. 88
Pueraria omeiensis Wang & Tang 56
Pueraria peduncularis Grah. ex Benth. 7, 8, 9, 64, 65, 66
var. violacea Franch. 67, 70
Pueraria phaseolioides (Roxb.) Benth. 7, 8, 9, 13, 71, 72
var. javanica (Benth.) Bak. 75
var. phaseolioides 8, 78, 79, 80
var. subspicata (Benth.) van der Maesen comb. et stat. nov. 84, 85
Pueraria pilosisma Bak. f. 88, 93
Pueraria pseudo-hirsuta Tang & Wang 47
Pueraria pulcherrima (Rds) Merr. 9, 12, 88, 89

Pueraria quadristipellata Clarke ex W. W. Smith 29
Pueraria rigidissima Craib 8, 13, 93, 94, 112
Pueraria rogersii L. Bolus 119
Pueraria seguini Lévl. & Vaniot 119
Pueraria sericosia K. Schum. 88
Pueraria siamica Craib 100
Pueraria sikkinensis Prain 12, 96, 97, 108
Pueraria stracheyi Backer 119, 123
Pueraria stricta Kurz 6, 13, 100, 101, 104
Pueraria strobilifera Kurz ex Prain 119
Pueraria subspicata (Benth.) Benth. 84
Pueraria tanali Ozaki (fossil) 117
Pueraria tetragona Merr. 119
Pueraria thomsonii Benth. 58
Pueraria thunbergiana (Sieb. & Zucc.) Benth. 45
var. formosana Hosokawa 55
Pueraria tonkinensis Gagnep. 53
Pueraria triloba (Houtt.) Makino 47
Pueraria triloba (Lour.) Backer 47
Pueraria triloba (Lour.) Makino ex Backer 47
Pueraria tuberosa (Roxb. ex Willd.) DC. 8, 9, 12, 98, 105
Pueraria volkensii Hosokawa 47
Pueraria wallichii DC. 9, 13, 109
Pueraria warburgii Perk. 88, 92
Pueraria yunnanensis Franch. 67
Pulcherrima van der Maesen subsect. nov. 12
Quercus 110
Shorea robusta Gaertn. 110
Schizophyllon Bak. 11
Shuteria W. & A. 6
Shuteria anabaptista (Kurz) Wu 117
Shuteria ferruginea (Kurz.) Bak. 118
Shuteria hirsuta Bak. 117, 119
Sindolichos Verde. 6
Sindolichos lagopus (Dunn) Verdc. 119
Stizolobium montanum (Lour.) Spreng. 53
Teramnus P. Br. 6
Teyleria Backer 6
Teyleria barbata (Craib) Lackey ex van der Maesen comb. nov. 117, 122
Teyleria koordersii (Backer) Backer 121, 122, 124
Teyleria tetragona (Merr.) Lackey ex van der Maesen comb. nov. 119, 122, 122
Vigna radiata (L.) Wilczek 118
Vigna trilobata (L.) Verdc. 38
Zeydora Lour. ex Gomes 9
Zeydora agrestis Lour. ex Gomes 9, 53

Agric. Univ. Wageningen Papers 85-1 (1985)