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CAJANUS DC.  
AND  
ATYLOSIA W. & A.  
(LEGUMINOSAE)

A revision of all taxa closely related to the  
pigeonpea, with notes on other related genera  
within the subtribe Cajaninae

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## SUMMARY

The taxonomy of the genera *Cajanus* and *Atylosia* (Leguminosae, Papilionoideae, tribe Phaseoloideae, subtribe Cajaninae) is revised. Morphological, cytological and chemo-taxonomical data prove the genera to be congeneric and consequently *Atylosia* has been sunk in *Cajanus*, which contains the important tropical legume crop pigeonpea, and has priority. Data are gathered from field, herbarium and literature studies conducted since 1975 at ICRISAT Center near Hyderabad, India, and throughout India, and at Wageningen, the Netherlands.

*Cajanus* now numbers 32 species (Table 1), including three newly described species from Australia. The Indian subcontinent contains 17 species. Australia harbours 13 endemic species, one of which occurs in New Guinea as well. *C. scarabaeoides* is common to all areas where species do occur, is the most widespread species, and has an endemic variety in Australia. West Africa also harbours one endemic species. Keys are written for the species from Asia and Africa and those of the Australian region. The sectional arrangements are reviewed and revised. Similarities with other related genera, *Rhynchosia* and *Dunbaria*, are discussed. The genus *Endomallus* is also congeneric with *Cajanus*.

Eleven genera are now recognized in the subtribe Cajaninae: in alphabetical order these are *Adenodolichos* Harms, *Baukea* Vatke, *Bolusafr*a Kuntze (*Fagelia* DC.), *Cajanus* DC., *Carissoa* E.G. Baker, *Chryso*scias E. Meyer, *Dunbaria* W. & A., *Eriosema* (DC.) Reichenb., *Flemingia* Roxb. ex W. & W.T. Aiton, *Paracalyx* Ali (*Cylista* Ait.) and *Rhynchosia* Lour.

The detailed botanical description of each species is accompanied by a full-page drawing, lists of literature and synonyms, and notes on taxonomic problems, distribution, ecology and uses. Each species is mapped to illustrate its distribution. Vernacular names are compiled.

## SAMENVATTING

De taxonomie van de genera *Cajanus* en *Atylosia* (Leguminosae-Papilionoideae, tribus Phaseoloideae, subtribus Cajaninae) is herzien. Gebaseerd op morfologische, cytologische en chemotaxonomische gegevens worden de soorten beschouwd als behorende tot één genus en derhalve is *Atylosia* samengevoegd met *Cajanus*, dat de prioriteit heeft, en waarin de belangrijke tropische peulvrucht pigeonpea is geklassificeerd. De studie omvat gegevens verkregen uit veldonderzoek, voornamelijk in India, en herbarium- en literatuuronderzoek in het ICRISAT Centrum bij Hyderabad, India, en te Wageningen, in het Laboratorium voor Plantensystematiek en -Geografie, sinds 1975.

TABLE 1. Species recognized in the genus *Cajanus* and their basionyms or most widely known synonyms.

Species of <i>Cajanus</i>	Basionym or most common synonym
1. <i>Cajanus acutifolius</i> (F. von Muell.) van der Maesen <i>comb. nov.</i>	<i>Rhynchosia acutifolia</i> F. v. Muell. ex Benth.
2. <i>Cajanus albicans</i> (W. & A.) van der Maesen <i>comb. nov.</i>	<i>Atylosia albicans</i> (W. & A.) Benth.
3. <i>Cajanus aromaticus</i> van der Maesen <i>sp. nov.</i>	–
4. <i>Cajanus cajan</i> (L.) Millsp.	<i>Cajanus indicus</i> Spreng.
5. <i>Cajanus cajanifolius</i> (Haines) van der Maesen <i>comb. nov.</i>	<i>Atylosia cajanifolia</i> Haines
6. <i>Cajanus cinereus</i> (F. von Muell.) F. von Muell.	<i>Atylosia cinerea</i> F. v. Muell. ex Benth.
7. <i>Cajanus confertiflorus</i> F. von Muell.	<i>Atylosia pluriflora</i> F. v. Muell. ex Benth.
8. <i>Cajanus crassicaulis</i> van der Maesen <i>sp. nov.</i>	–
9. <i>Cajanus crassus</i> (Prain ex King) van der Maesen var. <i>burmanicus</i> (Collett & Hemsley) van der Maesen <i>var. et stat. nov.</i> var. <i>crassus</i>	<i>Atylosia crassa</i> Prain ex King  <i>Atylosia burmanica</i> Collett & Hemsley  <i>Atylosia crassa</i> Prain ex King
10. <i>Cajanus elongatus</i> (Benth.) van der Maesen <i>comb. nov.</i>	<i>Atylosia elongata</i> Benth.
11. <i>Cajanus goensis</i> Dalz.	<i>Atylosia barbata</i> (Benth.) Bak.
12. <i>Cajanus grandiflorus</i> (Benth. ex Bak.) van der Maesen <i>comb. nov.</i>	<i>Atylosia grandiflora</i> Benth. ex Bak.
13. <i>Cajanus heynei</i> (W. & A.) van der Maesen <i>comb. nov.</i>	<i>Dunbaria heynei</i> W. & A.
14. <i>Cajanus kerstingii</i> Harms	–
15. <i>Cajanus lanceolatus</i> (W. V. Fitzg.) van der Maesen <i>comb. nov.</i>	<i>Atylosia lanceolata</i> W. V. Fitzg.
16. <i>Cajanus lanuginosus</i> van der Maesen <i>sp. nov.</i>	–
17. <i>Cajanus latisepalus</i> (Reynolds & Pedley) van der Maesen <i>comb. nov.</i>	<i>Atylosia latisepala</i> Reynolds & Pedley
18. <i>Cajanus lineatus</i> (W. & A.) van der Maesen <i>comb. nov.</i>	<i>Atylosia lineata</i> W. & A.
19. <i>Cajanus mareebensis</i> (Reynolds & Pedley) van der Maesen <i>comb. nov.</i>	<i>Atylosia mareebensis</i> Reynolds & Pedley
20. <i>Cajanus marmoratus</i> (R. Br. ex Benth.) F. von Muell.	<i>Atylosia marmorata</i> R. Br. ex Benth.
21. <i>Cajanus mollis</i> (Benth.) van der Maesen <i>comb. nov.</i>	<i>Atylosia mollis</i> Benth.
22. <i>Cajanus niveus</i> (Benth.) van der Maesen <i>comb. nov.</i>	<i>Atylosia nivea</i> Benth.
23. <i>Cajanus platycarpus</i> (Benth.) van der Maesen <i>comb. nov.</i>	<i>Atylosia platycarpa</i> Benth.
24. <i>Cajanus pubescens</i> (Ewart & Morrison) van der Maesen <i>comb. nov.</i> var. <i>mollis</i> (Reynolds & Pedley) van der Maesen <i>comb. nov.</i> var. <i>pubescens</i>	<i>Atylosia pubescens</i> (Ewart & Morrison) Reynolds & Pedley var. <i>mollis</i> Reynolds & Pedley –

TABLE 1. (continued)

Species of <i>Cajanus</i>	Basionym or most common synonym
25. <i>Cajanus reticulatus</i> (Dryander) F. von Muell. var. <i>grandifolius</i> (F. von Muell.) van der Maesen <i>comb. et stat. nov.</i> var. <i>reticulatus</i> var. <i>maritimus</i> (Reynolds & Pedley) van der Maesen <i>comb. et stat. nov.</i>	<i>Atylosia grandifolia</i> (F. v. Muell.) Benth. <i>Atylosia reticulata</i> (Dryander) Benth. –
26. <i>Cajanus rugosus</i> (W. & A.) van der Maesen <i>comb. nov.</i>	<i>Atylosia rugosa</i> W. & A.
27. <i>Cajanus scarabaeoides</i> (L.) Thou. var. <i>pedunculatus</i> (Reynolds & Pedley) van der Maesen <i>comb. nov.</i> var. <i>scarabaeoides</i>	<i>Atylosia scarabaeoides</i> (L.) Benth. var. <i>pedunculata</i> Reynolds & Pedley <i>Atylosia scarabaeoides</i> (L.) Benth.
28. <i>Cajanus sericeus</i> (Benth. ex Bak.) van der Maesen <i>comb. nov.</i>	<i>Atylosia sericea</i> Benth. ex Bak.
29. <i>Cajanus trinervius</i> (DC.) van der Maesen <i>comb. nov.</i>	<i>Atylosia candollei</i> W. & A.
30. <i>Cajanus villosus</i> (Benth. ex Bak.) van der Maesen <i>comb. nov.</i>	<i>Atylosia villosa</i> Benth. ex Bak.
31. <i>Cajanus viscidus</i> van der Maesen <i>sp. nov.</i>	–
32. <i>Cajanus volubilis</i> (Blanco) Blanco	–

*Cajanus* omvat nu 32 soorten (Table 1), met inbegrip van drie nieuw beschreven soorten uit Australië. In het Voor-Indische subcontinent komen zeventien soorten voor, in Australië zijn in totaal dertien endemische soorten gevonden, één daarvan komt ook op Nieuw Guinea voor. *Cajanus scarabaeoides* komt voor in alle gebieden van het areaal van het genus, is het meest algemeen, en telt een endemische variëteit in Australië. In West Afrika komt ook een endemische soort voor. De sectie-indeling is herzien. Overeenkomsten met andere, verwante, genera: *Rhynchosia* en *Dunbaria* zijn besproken. Het genus *Endomallus* is eveneens synoniem verklaard met *Cajanus*.

In totaal worden nu elf genera gerekend tot de subtribus *Cajaninae*: *Adenodolichos* Harms, *Baukea* Vatke, *Bolusafra* Kuntze (= *Fagelia* DC.), *Cajanus* DC., *Carissoa* E.G. Baker, *Chrysoeias* E. Meyer, *Dunbaria* W. & A., *Eriosema* (DC.) Reichenb., *Flemingia* Roxb. ex W. & W.T. Aiton, *Paracalyx* Ali (= *Cylista* Ait.) en *Rhynchosia* Lour.

De gedetailleerde botanische beschrijving van iedere soort wordt vergezeld van een illustratie, literatuurgegevens en synoniemen, evenals aantekeningen betreffende taxonomische problemen, het voorkomen, de ecologie en het gebruik. Geografische kaarten geven de verspreiding aan van elke soort. Indien bekend zijn de volksnamen vermeld.

## RESUMÉ

La taxonomie des genres *Cajanus* et *Atylosia* (Leguminosae-Papilionoideae, tribu Phaseoloideae, sous-tribu Cajaninae) est révisée. Des données morphologiques, cytologiques et chimio-taxonomiques indiquent que les espèces appartiennent à un seul genre et par conséquent *Atylosia* a été réuni avec *Cajanus*, contenant le pois d'Angole et genre ayant la priorité. La révision a commencé en 1975, grâce à des collections faites en Inde et dans d'autres pays, l'étude sur le terrain et l'herbier du Centre ICRISAT chez Hyderabad, Inde, et du Laboratoire de Taxonomie et Phytogéographie de Wageningen, Pays Bas.

Maintenant *Cajanus* compte 32 espèces (Tableau 1), dont trois nouvellement décrites provenant d'Australie. On trouve dix-sept espèces sur le sous-continent indien. Il y a treize espèces endémiques en Australie dont une se trouve également en Nouvelle Guinée. *Cajanus scarabaeoides* se trouve dans toutes les régions où l'on trouve les espèces et c'est celle qui est la plus répandue, en sus il y a une variété endémique en Australie. En Afrique de l'Ouest se trouve aussi une espèce endémique. Des clefs sont préparées pour la détermination des espèces et variétés en Asie, Afrique, et dans la région australienne. Le genre *Endomallus* a été également réuni avec *Cajanus*.

Le sous-tribu des Cajaninae contient onze genres: *Adenodolichos* Harms, *Baukea* Vatke, *Bolusafr*a Kuntze (= *Fagelia* DC.), *Cajanus* DC., *Carissoa* E.G. Baker, *Chrysoscias* E. Meyer, *Dunbaria* W. & A., *Eriosema* (DC.) Reichenb., *Flemingia* Roxb. ex W. & W.T. Aiton, *Paracalyx* Ali (= *Cylista* Ait.) et *Rhynchosia* Lour.

L'arrangement des sections est révisé. Des ressemblances avec d'autres genres apparentés, comme *Rhynchosia* et *Dunbaria*, sont discutées. La description botanique détaillée de chaque espèce est accompagnée d'une illustration, d'une revue de la littérature et des synonymes, ainsi que de notes concernant les problèmes taxonomiques, la géographie, l'écologie et l'utilisation. Des cartes géographiques montrent la répartition de chaque espèce. Les noms vernaculaires sont complétés.



## 1 INTRODUCTION

Pigeonpea, one of the important grain legumes adapted to the semi-arid tropics, is a mandate crop for improvement at the International Crops Research Institute for the Semi-Arid Tropics. Significant research results were reviewed recently at the International Workshop on Pigeonpeas held from 15-19 December, 1980 (ICRISAT, 1981).

For present and future crop improvement programs a germplasm collection with as wide a diversity as possible is required to provide a solid base. Such a collection of pigeonpea, available at ICRISAT, also includes wild relatives. The quest for wild pigeonpeas which could contribute valuable genes continues. This monograph is an outcome of studies on pigeonpeas since 1975, and is warranted by the need for an up-to-date nomenclature and delimitation of the species related to *Cajanus*.

The assemblage of a world-wide germplasm collection of the pigeonpea, *Cajanus cajan* (L.) Millsp. (VAN DER MAESEN, 1976), led to a closer study of the genus *Atylosia*. This latter genus appears closely related to *Cajanus*, and contains several species which have been successfully crossed with pigeonpea; fertile hybrids were obtained by several workers. The floristic treatments by BAKER (Flora of British India vol. 2, 1876) and by GAMBLE (Flora of the Presidency of Madras vol. 1, 1918) and to some extent the notes of PRAIN (J. Asiatic Soc. Bengal 66-2, 1897) are the main publications dealing with Indian *Atylosia*. All other Indian, Malaysian and Australian floras only include a few species. Several unsolved questions of nomenclature existed. Several species or supposed species are represented by a few accessions and only one species of *Atylosia* is more than locally frequent or widely distributed.

*Cajanus* could only be handled after its relations to *Atylosia* had been studied. In order to collect *Atylosia* species for eventual use and conservation of wild germplasm, it was necessary to trace the exact position of the localities. A screening of the herbarium collections was therefore needed, also because a taxonomic revision had to be carried out. *Atylosia* species had to be delineated properly and nomenclatural problems needed attention.

Apart from the species described more than forty years ago, it soon became apparent from the examination of herbarium specimens that several new taxa existed among the Australian representatives of *Atylosia*. Several of these were published in a revision for the Flora of Queensland (REYNOLDS & PEDLEY, 1981).

Applied scientists often pointed to the congenericity of *Atylosia* and *Cajanus*, as is discussed in Chapter 4. In this monograph the conclusion is reached, that a merger of *Atylosia* with *Cajanus* (the latter has priority) is warranted, and both genera are consequently united.

## 2 MATERIALS AND METHODS

This revision is based on a thorough morphological study of fresh and conserved material of the plants belonging to the genera *Cajanus*, *Atylosia*, and some other Cajaninae. The material was compared with published descriptions, and the information carried on herbarium labels served to compile data on distribution and phenology. The typification was verified. A detailed literature search accompanied the treatment of each species.

The herbarium work has been mainly carried out at the Herbarium Vadense in the Laboratory for Plant Taxonomy and Plant Geography of the Agricultural University at Wageningen, the Netherlands, where the majority of the material and the loans were placed. The Indian Herbaria, being located near to the author's place of research (ICRISAT, Hyderabad), were visited several times to study the material conserved there in the course of several years' field trips. These trips conducted since early 1975 yielded field observations and live material as well as herbarium specimens of several Indian species. Living seeds from Africa, Australia and Papua New Guinea were obtained by correspondence.

As far as possible the species were cultivated in the Botanical Garden at ICRISAT Center near Hyderabad, India. The plants were grown either in the open, or in a shaded or cooled (temporary) greenhouse. All species were used for intergeneric hybridization immediately upon flowering. The Pigeonpea Breeders of ICRISAT took care of the crosses with the pigeonpea, the Genetic Resources Unit devoted time and labour to interspecific crosses between '*Atylosia*' species.

Except when marked 'not seen', all specimens cited have been examined for the taxonomic revision. The lectotypes have been chosen from syntypes or isosyntypes. Those designated by other authors are referred to as such. The specimens seen have all been cited, except for the cultivated pigeonpea, and the common and widely spread wild species *Cajanus scarabaeoides*, where only representative locations are cited. The distribution of *C. cajan* has been the subject of another publication (VAN DER MAESEN, 1983), so only the maps are reproduced here.

The labelling of the specimens has been done in accordance with the decisions taken in this monograph, except for those materials which had to be returned early to the owners. Since the study had to be carried out over a long period of time, not all specimens returned to various herbaria could be labelled with the latest name. The recent revision of Australian *Atylosia* REYNOLDS & PEDLEY, 1981) also caused further alterations, which could not in all cases be included on the labels attached to the material seen and returned.

Material was studied from the following herbaria, either while visiting the institutions, or from sheets obtained on loan:

- A – Arnold Arboretum, Cambridge, Mass., U.S.A.
- AD – State Herbarium of South Australia, Adelaide, Australia
- ASSAM – Botanical Survey of India, Eastern Circle, Shillong, India
- B – Botanischer Garten und Botanisches Museum Berlin-Dahlem, Federal Republic of Germany
- BLAT – Blatter Herbarium, St. Xavier's College, Bombay, India
- BM – British Museum (Natural History), London, U.K.
- BR – National Botanic Garden, Bruxelles, Belgium
- BRI – Queensland Herbarium, Indooroopilly, Brisbane, Australia
- BSD – Botanical Survey of India, Northern Circle, Dehra Dun, India
- BSI – Botanical Survey of India, Western Circle, Poona, India
- C – Botanical Museum and Herbarium, Copenhagen, Denmark
- CAHP – College of Agriculture, University of the Philippines, Laguna, Philippines
- CAL – Botanical Survey of India, Central National Herbarium, Calcutta, India
- CANB – Herbarium Australiense, CSIRO, Canberra, Australia
- COI – Botanical Institute, University of Coimbra, Portugal
- DD – Forest Research Institute, Dehra Dun, India
- DNA – Herbarium, Northern Territory, Darwin, Australia
- E – Royal Botanic Garden, Edinburgh, U.K.
- EA – East African Herbarium, Nairobi, Kenya
- FHI – Forest Herbarium Ibadan, Nigeria
- FI – Herbarium Universitatis Florentinae, Firenze, Italy
- G – Conservatoire et Jardin Botanique, Geneva, Switzerland
- HY – Botanical Department Herbarium, Osmania University, Hyderabad, India
- JCB – St. Joseph's College, Bangalore, India
- K – The Herbarium, Royal Botanic Gardens, Kew, Richmond, U.K.
- KUH – Department of Botany, Karachi University Herbarium, Pakistan
- L – Rijksherbarium, Leiden, the Netherlands
- LWG – National Botanic Research Institute, Lucknow, India
- MEL – National Herbarium of Victoria, Royal Botanic Gardens, South Yarra, Melbourne, Australia
- MGM – Manas Gangotri University, Mysore, India
- MH – Botanical Survey of India, Southern Circle (Madras Herbarium), Coimbatore, India.
- NT – Herbarium of the Northern Territory, Alice Springs, Australia
- OXF – Fielding-Druce Herbarium, Department of Botany, Oxford, U.K.
- P – Laboratoire de Phanerogamie, Muséum National d'Histoire Naturelle, Paris, France
- PAN – Department of Botany, Panjab University, Chandigarh, India
- PERTH – State Herbarium of Western Australia, Perth, Australia

- PNH – Philippine National Herbarium, National Museum, Manila, Philippines
- PRE – National Herbarium, Botanical Research Institute, Pretoria, South Africa
- PUN – Department of Botany, Punjabi University, Patiala, India
- RAW – National Herbarium of Pakistan (Stewart Herbarium), Rawalpindi, Pakistan
- RHT – Rapinat Herbarium, Tiruchirapalli, India
- TAI – The Herbarium, Department of Botany, National Taiwan University, Taipei, Taiwan.
- U – Institute of Systematic Botany, Utrecht, the Netherlands
- US – US National Herbarium, Smithsonian Institution, Washington D.C., U.S.A.
- W – Naturhistorisches Museum, Vienna, Austria
- WAG – Herbarium Vadense, Department of Plant Taxonomy, Wageningen, the Netherlands

I wish to acknowledge with sincere gratitude the facilities given and advice rendered by the directors or curators and staff members of the cited institutes. The herbarium collected by ICRISAT's Genetic Resources Unit is lodged at the Institute. Duplicates have been distributed to WAG, K and CAL.

### 3 HISTORY OF THE GENERA *CAJANUS* DC. AND *ATYLOSIA* W. & A.

#### 3.1 PRELINNEAN HISTORY OF PIGEONPEA

As Table 9 (Section 10.4) shows, there are many vernacular names of pigeonpea. Particularly the Sanskrit names are old, adopted from even older Dravidian names. The earliest mention of the crop, as *Tuvari*, is in the text *Gathasaptasati* of the third to fourth century AD (DE, 1974). Ancient manuscripts may yet reveal more about pigeonpea's earliest history and philology, particularly in the Indian subcontinent (K.L. MEHRA, pers. commun.). THOTHATHRI & JAIN (1981) reviewed the taxonomic history of *Cajanus*, but some further references could be included here. No cross-references to ancient Latin, Greek, or Semitic documents appeared in literature.

Probably the first mention of pigeonpea in Western scientific literature was by BAUHIN & CHERLER (1650-51), who depicted *Arbor trifolia indica*, but the illustration is not very clear. The next reference is by BREYNE (1680), who reported *Cajanus* from the garden of Hieronymus van Beverningk at Warmond near Leyden, the Netherlands. Better known is the *Hortus Indicus Malabaricus* (van RHEEDE tot DRAAKESTEIN, 1686), depicting pigeonpea with the Malayalam name *Thora Paerou*. JOHN RAY (1688) reported that pigeonpea was grown in Doody's Garden at Chelsea, a borough of London. PLUKENET (1692, 1696) used the English name *Pigeonpea*, from Barbados, for the first time, and referred back to van RHEEDE, BREYNE, and BAUHIN & CHERLER. PLUKENET (1692) listed *Kayan* and *cajan* as local names, these are of Malay origin, and are generic for several beans, peas and groundnut. PLUKENET referred to the plant again in 1696, as grown in William III's garden at Hampton Court. Other references are Herbar. Hertogh (material collected from Ceylon, sent to Commelin in Amsterdam and now preserved at Oxford), *Musaeum Zeylanicum* (HERMANN, 1717), *Paradisus Batavus Prodrromus* (HERMANN, 1689, from the Leyden Hortus), and *Horti Academici Lugduno-Batavi Catalogus, Appendix* (H.L.B. app., 1687), which fact suggests that the species was new for this garden at that time. Van ROYEN (1740) also enumerated *Cajanus* as grown in the Leyden Hortus.

LINNAEUS, prior to his *Species Plantarum*, referred pigeonpea to *Cytisus* in the *Viridarium Cliffortianum* (1737, grown in the Hartekamp garden), the *Hortus Cliffortianus* (1738), the *Flora Zeylanica* (1747), and in the *Hortus Upsalien-sis* (1748). He indicated (Hort. Cliff.) that pigeonpea was grown in Malabaria (India), Zeylonia (Ceylon) and Insulis Caribaeis (West Indies). Burman (1737), in his *Thesaurus Zeylanicus*, used the name *Cytisus zeylanicus*. SLOANE (1725) described the use of pigeonpeas in Jamaica, on other Caribbean islands, and in Surinam. The plant was usually grown in hedges on barren soil, and used for human consumption, but mainly fed to pigeons, whence the name. RUMPHIUS (1750) named pigeonpea *Phaseolus balicus* (MERRILL, 1917) and listed malay

and balinese local names. The illustrations in most of the mentioned works facilitate to recognize that the plants indicated are really pigeonpea.

### 3.2 CAJANUS

Following his earlier work (see 3.1), in his *Species Plantarum*, LINNAEUS (1753) named the pigeonpea *Cytisus cajan*.

ADANSON (1763) separated pigeonpea from the genus *Cytisus*, where it clearly did not belong, and named it *Cajan*.

In 1813 A.P. de CANDOLLE founded the genus *Cajanus* with two cultivated species, *C. bicolor* DC. and *C. flavus* DC. De CANDOLLE described these species as different forms of the cultivated pigeonpea, and the synonymy of both species included *Cytisus cajan* L., the name LINNAEUS had given to the pigeonpea. The name *Cajanus* DC. (1813) was based on *Cajan* Adanson (1763). Because De Candolle's name became so much more used, the Third Botanical Congress in Bruxelles (1910) conserved the genus name *Cajanus* DC. against *Cajan* Adanson, which had priority.

*C. bicolor* and *C. flavus* were separated by De CANDOLLE on the basis of a few characters: flower colour, seed number per pod, and length of stipels, which are based on a small number of genes. Several authors reduced the species to forms or (botanical) varieties: *C. cajan* var. *bicolor* (DC.) Purseglove (1968) and var. *flavus* (DC.) Purseglove (ibid., RACHIE & ROBERTS, 1974).

SPRENGEL (1826) put De Candolle's species into a single species, *C. indicus* Spreng., the most frequently applied synonym of *Cajanus cajan*, the use of which persisted into the middle of the 20th century.

Another generic synonym of *Cajanus* is *Cajanum* Raf. (1838) despite Rafinesque's claim that '*Cajanum thora*' (Rafinesque's type species) is totally unlike *Cytisus cajan* L. The epithet 'thora' is a south Indian vernacular for pigeonpea.

In the course of time the habit of de Candolle's two species was also declared to be different, *C. bicolor* being the tall, late-maturing 'arhar' type of the United Provinces (Uttar Pradesh) and *C. flavus* being the shorter, earlier 'tur' type of central India (DUTHIE & FULLER, 1883).

*Cajanus* DC. was often considered to be monotypic since all Asian and Australian wild *Cajanus* spp. ever described have been transferred to *Atylosia* on account of their seed strophiole. The existence of an African species, *C. kerstingii* Harms, has often been overlooked by workers on Asian crops and floras. This species is rather rare, few collections exist and literature references are scarce. *C. kerstingii*, because of the presence of a strophiole, should have been admitted as a species of *Atylosia*. HARMS (1915) had no ripe seeds at his disposal and could not therefore report the persistent strophiole.

### 3.3 ATYLOSIA

In 1834 WIGHT and ARNOTT founded the genus *Atylosia*, and admitted four species. The principal characters separating *Atylosia* from *Cajanus* were a persistent corolla, the absence of callosities on the vexillum, a large carunculus (strophiole, aril) on the seed, and palmately trifoliolate foliage. *A-tylos* is greek for 'without callosities', without protuberances.

At the same time, WIGHT and ARNOTT (1834) proposed the genus *Cantharospermum* consisting of two climbing species, while little more argument was given for segregation. *Cantharospermum* also had no callosities on the vexillum, and a large seed carunculus, but its corolla was caducous and the foliage pinnately trifoliolate as in *Cajanus*. Also *Cantharospermum* had coriaceous partitions between the seeds, which were membranaceous in *Cajanus* and cellular (no growths between the valves) in *Atylosia*. The climbing habit of the two *Cantharospermum* spp. approaches that of *Rhynchosia*, but that is also the case with *Atylosia rugosa* W. & A. but in the description no reference is made of that similarity. The generic name of *Cantharospermum* was an allusion to the specific epithet of the species known by Linnaeus, *Dolichos scarabaeoides*, in Greek.

Fairly soon *Atylosia* and *Cantharospermum* were considered congeneric, initially by BENTHAM (1852). As pointed out by SPRAGUE (1927), who discussed the correct name for the combined genus, BENTHAM adopted *Atylosia*. Some authors (TAUBERT, 1894; MERRILL, 1910) referred the problem to page priority, but this is not recognised by the Code. RAIZADA (1950) made a number of unnecessary new combinations under *Cantharospermum*, he followed MERRILL (1910) in this respect and apparently overlooked Sprague's publication.

*Atylosia* has not been revised before in its entirety. A recent study deals with Australian *Atylosia* (PEDLEY, 1981, REYNOLDS & PEDLEY, 1981). Some species in the genus were treated in several floras: important treatments are by BAKER (Fl. Brit. India, 1876), BENTHAM (Fl. Austral., 1864), BAILEY (Queensland Flora, 1900), GAMBLE (Fl. Presid. Madras, 1918) and HAINES (Bot. Bihar & Orissa, 1922). A detailed note on the taxonomy was written by PRAIN (1897). In the majority of regional floras, including the recent ones published in India (e.g. RAMASWAMY & RAZI, Flora of Bangalore, 1973; SALDANHA et al., Flora of Hassan District, 1976; Oommachan, Flora of Bhopal, 1977) only a few species are treated.

WIGHT and ARNOTT have not designated a type species in *Atylosia* or *Cantharospermum*. Hutchinson (1964) assigned a lectotype: *Atylosia candollei* W. & A. from India and Sri Lanka, the first species described in *Atylosia*.

## 4 RELATIONSHIPS OF *CAJANUS* AND *ATYLOSIA* IN THE SUBTRIBE CAJANINAE

### 4.1 OUTLINE

The following discussion outlines the case for merging *Cajanus* with *Atylosia*. The subtribe Cajaninae (as Cajaneae, BENTHAM, 1837), considered to be a tribe (Cajaneae) by HUTCHINSON (1964), consists of a number of closely related genera and clearly forms a natural group. Its only cultivated species is the pigeonpea, whereas other subtribes in the tribe Phaseoleae, in particular the Phaseolinae, count many edible legume species of economic importance (LACKEY, 1981). At the International Legume Conference at Kew (1978) a consensus of opinion approved Polhill's stand who kept the group as a subtribe in Phaseoleae (POLHILL, 1981; LACKEY, 1981). Generic boundaries within the subtribe are quite artificial and may be subject to reconsideration. Despite this artificiality, the distinction between the genera has always been very workable and suitable to taxonomical practice, hence the apparent reluctance to unite the genera.

Eight genera were recognized by BENTHAM & HOOKER (1862): *Cajanus* DC., *Fagelia* DC., *Cylista* W. Aiton (all then monotypic) and *Atylosia* W. & A., *Dunbaria* W. & A., *Rhynchosia* Lour., *Eriosema* (DC.) Reichenb. and *Flemingia* Roxb. ex W. & W.T. Aiton. A century later, three genera had been added (HUTCHINSON, 1964), *Carissoa* E.G. Bak., *Eminia* Taub. and *Chrysoscias* E. Mey. with 1, 6 and 3 species respectively. LACKEY (1977) further assigned *Baukea* Vatke (1 sp.), *Leycephyllum* Piper (1 sp.) and *Endomallus* Gagnepain (2 spp.) to the Cajaninae. He remarked that *Endomallus* was probably congeneric with *Dunbaria*. He placed *Eminia* in the Glycininae. GREAR (1978) reduced the monotypic genus *Leycephyllum* to *Rhynchosia*. *Chrysoscias*, a segregate from *Rhynchosia*, was also reduced by GREAR (ibid.) but Lackey (1978) did not follow him in this respect. *Fagelia* DC. appeared to be an illegitimate name (BAUDET, 1978; LACKEY, 1981) and had to be replaced by the later synonym *Bolusafr* Kuntze. LACKEY (1979) proposed to include *Adenodolichos* Harms as an aberrant member in Cajaninae unless a better alliance can be shown. Until the present publication thirteen genera including *Cajanus* and *Atylosia* have constituted the subtribe Cajaninae.

BAUDET (1978) distinguished two groups in the Cajaninae: the Rhynchosias-trae, with a 2-ovuled ovary and mainly African distribution; and the Cajanastrae with a multi-ovuled ovary and mainly Asian distribution.

The unification of *Atylosia* and *Cajanus* has been discussed many times. Except for F. von MUELLER (1860, 1881, 1882, 1889) no taxonomist had proposed the unification of the genera. Among the latest authors to discuss the unification is McCOMB (1975), who reviewed the successful intergeneric crosses reported in Leguminosae. Crosses between *Atylosia* and *Cajanus* would not in reality be of intergeneric nature. McCOMB judged the generic boundaries unwarranted,



keeping in view that all other successful intergeneric crosses in Leguminosae were subject to doubt. Unfortunately, McComb declared, none of the authors he reviewed had reported on the genetic control of the seed strophiole.

The presence of a strophiole remained the only character of importance when segregating the genera. REDDY (unpublished thesis, 1973) found that the strophiole inheritance is only governed by two genes. The strophioled character is dominant over the non-strophioled condition. REDDY, GREEN and SHARMA (1981) confirmed this with new crosses, and found an inhibitory gene action governing the strophioled seeds.

DALZELL (1850) stated that the carunculus of the unripe but fully developed pigeonpea seed is far from inconspicuous as stated by WIGHT and ARNOTT (the first to distinguish the genera). The morphology of his *Cajanus kulnensis* Dalz. (= *Cajanus heynei* (W. & A.) van der Maesen = *Dunbaria heynei* W. & A.) and *Cajanus goensis* Dalz. agree with *Cajanus*, except for the climbing habit, which was characteristic of *Cantharospermum*. Dalzell stated that these two species would perhaps serve to unite the two genera.

BENTHAM (1852) differentiated *Cajanus* and *Atylosia* on the basis of the presence or absence of callosities on the vexillum, either oblique or straight delineations on the pod, and the either small or large seed strophiole.

In 1861 BENTHAM mentioned that *Cajanus*, *Atylosia* and *Dunbaria* are almost sections of one genus, and resemble *Rhynchosia* but for the number of ovules (always more than two), and the absence of bracteoles and, wrongly, the absence of stipellae. Most *Cajanus* species have stipellae. In 1862 BENTHAM and HOOKER maintained the generic concepts of *Cajanus*, *Atylosia* and *Dunbaria*. Baker (1876) mentioned that *Atylosia* differed from *Cajanus* mainly by its arillate seeds. TAUBERT (1894) erroneously mentioned the absence of stipellae in Cajaninae, and stated the presence of the Nabelwulst (strophiole) as an important key character.

F. von MUELLER (1860), under the description of *C. confertiflorus*, suggested that *Atylosia* be subordinated as a subgenus to *Cajanus*. The stronger development of the strophiole offers the only and certainly not a manifest differential character. The insertion of the leaf stalks, persistence of corolla, presence of stipellae and callosities on the vexillum are not constant nor sufficient for discrimination above the species level. Von MUELLER later treated the Australian species of *Atylosia* as a 'section' in *Cajanus* (1876, 1881). After these proposals to unite *Atylosia* with *Cajanus*, von Mueller in 1891 even advised that *Cajanus*, *Atylosia* and *Dunbaria* should be reduced to sections of *Rhynchosia*. Bentham, in Bailey (1900) referring to von MUELLER, decided against unification of the genera as proposed by von MUELLER because of the different pod shape and the apparently constant strophiole.

PEDLEY (1981 b) doubted whether *Atylosia* and *Cajanus* are congeneric. He agreed that the problem is a difficult one but stated that in order to be consistent, *Dunbaria* and *Rhynchosia* would also have to be transferred to *Cajanus*, which is of value to no one, as a large genus is more difficult to oversee. The practical (but indeed rather artificial) distinctions between these other Cajaninae and

*Cajanus/Atylosia* are discussed in this outline (p. 19). PEDLEY is in favour of keeping the Australian *Atylosia* species separate from *Cajanus* and other *Cajaninae*. LACKEY (1977), who reviewed the tribe Phaseoleae, considered the pigeonpea to be nothing but a cultigen of *Atylosia*. STIRTON (pers. commun. in LACKEY, 1981) considers that by merging the genera the disruption through nomenclatural changes would be unfortunate, as all breeders know *Atylosia* and it would serve no real purpose to rename its species. However, many applied scientists are supporting the combination (ROY & DE, 1965; McCOMB, 1975; PICKERSGILL, 1976; REDDY, 1973; DE, 1974; PUNDIR, 1981; REDDY, GREEN & SHARMA, 1981). J.R. HARLAN and O. FRANKEL (pers. commun.) are of the opinion that pigeonpea cultivars and related wild species of *Atylosia* spp. are congeneric and belong in *Cajanus*.

GUNN (1981) discussed the taxonomic importance of seed arils, but denied (pers. commun.) their presence or absence to be of value in the distinction between genera, as is demonstrated in *Rhynchosia*, a large genus, which accommodates species with and without an aril.

PEDLEY (1981 b) found a solution to some remaining problems concerning generic limits in Australian *Cajaninae*. He used not only the unsatisfactory character ovule number, but also seed and pod characters to distinguish the genera. PEDLEY redefined three *Cajaninae* genera as follows (text not verbatim): *Rhynchosia* Lour.: ovules 1 or 2, pods (1 or) 2-seeded, no partition between the seeds, no distinct transverse reticulate veins, seeds without strophiole; *Atylosia* W. & A.: ovules 2-many, pods 2-many-seeded, with distinct partitions between the seeds, transverse or oblique lines but no reticulate veins, seeds with a strophiole; *Nomismia* W. & A.: ovules 1-2, pods compressed, orbicular, 1-2-seeded, strongly transversely veined, seeds with a large strophiole.

PEDLEY admitted that *Atylosia platycarpa*, *A. marmorata* and *A. mareebensis* have reticulate veins (all species of sect. *Rhynchosoides* of *Atylosia*), but the distinct depressions between the seeds are characteristic of *Atylosia*. With Pedley's definitions, the *Rhynchosia* subgenera *Phyllomatia* W. & A. and *Phytocentrum* W. & A. should be merged with *Atylosia*.

In 1920 HAINES described the wild pigeonpea. He named it *Atylosia cajanifolia* and noted the striking resemblance with *Cajanus*, but never pointed to its possible role in the solution of the problem of the origin of the pigeonpea.

As more wild species have become available through collection and exchange, the earlier inter-generic hybridization work in India has been expanded. With the possible transfer of useful genes from wild species to cultivated pigeonpea, at several institutes as well as at ICRISAT, a renewed interest exists in hybridization between species. At ICRISAT a hybridization programme along inter-generic lines started in 1974 based on 4 wild species also previously used in Poona (DEODIKAR & THAKAR, 1956) and Kharagpur (REDDY, 1973, 1981a,b,c). Successful hybrids were obtained from many crosses, including *A. trinervia*, *A. albicans*, *A. cajanifolia* as male, or in fewer instances female parents. The bushy species *A. lineata*, *A. sericea* and the common creeper *A. scarabaeoides*, continue to give fertile hybrids with pigeonpeas as in the earlier work. However, *A. platy-*

*carpa* (also available for experimentation at Poona and Kharagpur) and *A. volubilis* (collected in 1975) could not be crossed with *Cajanus* despite many attempts (REDDY, GREEN, & SHARMA; section 4.6).

Other members of the Cajaninae are also being used (REMANANDAN, 1981) for hybridization attempts. Apart from the first incentive, the transfer of useful genes, data on species relationship may result from these hybridizations as well. Crosses between *Dunbaria*, *Rhynchosia* and *Cajanus* have produced green pods, but these always aborted (unpublished work).

*Dunbaria* pods are not linearly depressed between the seeds. There are 3 or more ovules. One of its species has to be transferred to *Cajanus* because of the depressions on the ripe pod. The similarity of e.g. *D. ferruginea* W. & A. to the *Cajanus* – *Atylosia* complex is striking.

*Rhynchosia* spp. have seeds with or without strophioles, 1-2 seeds per pod and only 1 or 2 ovules per ovary. As in *Atylosia*, bushy and climbing species exist.

There are several border cases between *Atylosia* and *Rhynchosia*. *A. lineata* and *A. sericea* from the Western Ghats of India, (1000-1500 m) both of which produce hybrids with pigeonpea, produce 2-ovuled ovaries and 1-2 seeded pods almost without exception when grown at ICRISAT center near Hyderabad (alt. 550 m). In nature 3-seeded pods are quite common in *A. lineata*. *A. rugosa* resembles *Rhynchosia filipes* in several respects. In North India there exists a species *Rhynchosia pseudo-cajan*. Also in Australia several sections of *Rhynchosia* are quite similar to many *Atylosia* species (PEDLEY, 1981a). Pedley's redefinition of *Rhynchosia* and *Atylosia* is helpful in preserving the most often 2-seeded *Cajanus sericeus* (= *Atylosia sericea*) in the genus *Cajanus* in broad sense. *C. acutifolius* was placed in *Rhynchosia* by BENTHAM, and PEDLEY (1981 b) referred this species to *Atylosia*.

## 4.2 MORPHOLOGY

The morphological variation in the pigeonpea and its wild relatives is much greater in Asia, including especially India, than in Africa. This supports Indian origin of the pigeonpea, and the opinion that *Cajanus* and *Atylosia* are congeneric (DE, 1974; VAN DERMAESEN, 1980; SMARTT, 1980). In particular the similarity between pigeonpea and *A. cajanifolia* is striking, the latter could well be the progenitor, or both could have evolved from a common ancestral stock. The morphology is discussed in the following sections.

### 4.2.1 Habit and growth

The genus *Atylosia* contains erect bushy species and creeping-climbing ones. Some are of moderate stature, up to a metre, some are tall bushes up to 4 m or strong climbers attaining heights of 6 m or more on supporting trees. Both *Cajanus cajan* and *C. kerstingii* are shrubs. Environmental factors like daylength and temperature affect habit, and habit is of little or no formal taxonomical

significance within pigeonpea, but it is useful for distinguishing cultivar groups, when restricted to plants growing in their natural conditions. Except for *A. platycarpa*, which persists a second year only in good conditions, all species are perennials, albeit short-lived in several cases.

The pigeonpea is mostly grown as an annual, but most genotypes do not put all reserves into seed production. The short-duration cultivars Prabhat and Pant A3 are the best examples of genotypes of an almost annual nature. The perennial nature of the pigeonpea is exploited when the plant is used for hedges, wind breaks, and vegetable production in farmers' backyards. In cultivation, however, many old plants succumb due to accumulation of diseases and, possibly, nematodes. In India on a field scale the crop is rarely left to stand. In Kenya old plants are frequently seen in mixed cultivation, where new pigeonpeas are added each year to fill gaps.

In some species flowering occurs after the rains, however flowering is more common after the cold season which follows the rains. Table 2 lists some observations on flowering of species grown at ICRISAT Centre. Pigeonpea alone has a tremendous range: it may take between 54 and 254 days after sowing for different cultivars to flower. The earliest flowering line was cv. Pant A3 (India), the latest were *JM 2381, 2435* (Kenya). Daylength is of major influence, the

TABLE 2. Flowering data of some *Cajanus* spp. at ICRISAT, Patancheru, India

	Sowing date	Days to flower a	Maturity
1978-1979			
<i>C. albicans</i>	24-7-7	488b	565
<i>C. cajan</i>	3-7-78	84-210c	147-254
<i>C. cajanifolius</i>	do	73	113
<i>C. crassus</i>	14-6-77	194d	272
<i>C. lineatus</i>	3-7-78	168	232
<i>C. platycarpus</i>	do	43-53	ca 80
<i>C. scarabaeoides</i>	do	73-131	103-185
<i>C. sericeus</i>	do	105	143
1979-1980			
<i>C. albicans</i>	21-6-79	138-152	193-236
<i>C. cajan</i>	26-6-79	70-204	132-249
<i>C. cajanifolius</i>	21-6-79	129e	169
<i>C. crassus</i>	14-6-77	188d	254
<i>C. goensis</i>	21-6-79	226	257
<i>C. heynei</i>	do	180	231
<i>C. lineatus</i>	do	168-229f	219-232g
<i>C. marmoratus</i>	do	143	174
<i>C. mollis</i>	do	425b	485h
<i>C. platycarpus</i>	do	41-48	82i
<i>C. reticulatus j</i>	do	69-188	106-227k
<i>C. scarabaeoides</i>	do	70-76i	117-132
<i>C. sericeus</i>	do	120-129f	157-167

TABLE 2. (continued)

	Sowing date	Days to flower a	Maturity
1980-1981			
<i>C. albicans</i>	25-6-80	484-506b	570-574
<i>C. cajan</i>	26-6-80	64-228c	124-260
<i>C. cajanifolius</i>	25-6-80	115-120h	174-210
<i>C. crassus</i>	do	174-192f	214-250
<i>C. goensis</i>	do	222	257
<i>C. heynei</i>	do	209	256
<i>C. lineatus</i>	do	182-230f	211-259
<i>C. marmoratus</i>	do	90	178
<i>C. mollis</i>	do	406b	451
<i>C. platycarpus</i>	do	39-51f	75-93
<i>C. reticulatus j</i>	21-6-79	425-437b	534-537
<i>C. rugosus</i>	25-6-79	202-210	248-256
<i>C. scarabaeoides</i>	do	59-116f	105-154
<i>C. sericeus</i>	do	114	139
1981-1982			
<i>C. albicans</i>	10-6-81	150-238i	?
<i>C. cajan</i>	24-6-81	63-200c	110-260
<i>C. cajanifolius</i>	10-6-81	139-172f	186-219
<i>C. crassus</i>	do	174-223f	251-275
<i>C. kerstingii</i>	do	212	no set
<i>C. lanceolatus</i>	do	239	307
<i>C. latisepalus</i>	do	218	274
<i>C. lineatus</i>	do	188-216f	236-272
<i>C. mollis</i>	do	399-419b	459
<i>C. platycarpus</i>	do	50-57	89
<i>C. scarabaeoides</i>	do	98-132	141-170
<i>C. sericeus</i>	do	140	184

- a) Ca 50% of the plants in flowering;  
b) No flowering the first year of growth;  
c) Wide range of cultivars; in 1977-78: 54-254;  
d) Plants ratooned after May-June, flowering date counted from sowing date of other spp.;  
e) Seeds from open-pollinated flowers;  
f) More accessions than in 1978;  
g) Latest flowering accessions produced no seed;  
h) Estimated;  
i) Different accessions from 1978;  
j) Var. *grandifolius*;  
k) First and last mature pods.

pigeonpea is a short day plant and differential response towards critical day-length exists.

The flowers occur in axillary and terminal racemes. The flowering habit is generally known to exist in two kinds: determinate and indeterminate. This does not conform to basipetalous and acropetalous, as used by RACHIE & ROBERTS (1974), but relates to short-duration flowering, where the flowers occur more

or less in the same plane, in terminal racemes; and to long-duration flowering with flowers in axillary racemes spread over considerable lengths of stem. In all cases the inflorescences are acropetalous.

The overproduction of flowers in pigeonpea is not matched by the wild species, where casual observations show that pod formation may occur in a high percentage of the flowers produced. Flower drop is low in *A. scarabaeoides* and *A. platycarpa*, and is quite high in *A. volubilis*. *Atylosia cajanifolia* is similar to the pigeonpea in this regard.

The pods of wild *Atylosia* spp. shatter, the valves generally drop later than the seeds. The valves curl after snapping open with audible cracks. Most cultivars of pigeonpea are non-shattering, except when pods are left on the bush well beyond maturity. Insect-attacked pods, with no fully formed or half-eaten seeds left, remain on the plant.

#### 4.2.2 *Indumentum*

The indumentum of *Atylosia* and *Cajanus* spp. is characteristic of the subtribe *Cajaninae*. The hairs are of two types: simple and glandular. The glandular hairs appear to consist of short multicellular hairs developing into small spherical glands filled with yellow oily material. On the ovary the glands are very dense. On the pod wall of *C. cajan*, apart from the vesicular glands, a further type of glandular hairs is frequent. This type consists of a multicellular base, spherical in shape, with a tapering end consisting of a few cells (BISEN & SHELDRAKE, 1978). Leaf anatomy and indumentum of *A. candollei* and *A. rugosa* were studied by PARKIN & PEARSON (1903). Of interest is a layer of tannin-sacs in *C. rugosus* mesophyl, while vesicular glands were not reported. LACKEY (1977) observed vesicular glands and bulbous-based hairs in all *Cajaninae* studied but in *C. kerstingii* he reported absence of bulbous-based hairs (1978). Distillation of the essential oils from the leaves of pigeonpeas resulted in a mixture of compounds, among which was the terpenoid L-copaene (GUPTA et al., 1969). The wild species of *Cajanus* have not been investigated but possibly contain similar compounds in the glandular hairs. Casual observations show that the bitter exudates in *Atylosia cajanifolia* appear in larger quantities than in many pigeonpea cultivars, while unripe seeds of many wild species, if tasted raw, are decidedly more bitter than pigeonpeas. Vegetable cultivars of pigeonpea taste sweeter than many other cultivars. Hooked hairs (see BAUDET & MARÉCHAL, 1976) are absent in all species treated in this revision.

#### 4.2.3 *Leaves*

The leaves of *Atylosia* and *Cajanus* spp. are trifoliolate. The leaflets are often elliptic or oblique-cordate. The top-leaflets are almost symmetrical, but the side leaflets are broader at the side furthest away from the top-leaflets. Each leaflet is connected to the petiole or rhachis by a petiolule, acting as a pulvinus. The petiole also has a pulvinus located at its base. The leaflets of the pigeonpea move continuously during the day, depending on turgor changes in the pulvini influenced by light and water states. At night an upright sleep position is as-

sumed, caused by geotropic sensitivity of the pulvini (BISEN and SHELDRAKE, 1978). PARKIN & PEARSON (1903) observed that *A. rugosa* leaves move into a profile position in bright sunlight. During the partial eclipse in Sri Lanka in February 1980 I observed that *A. trinervia* and *A. rugosa* leaves acquired a sleeping position.

The size of the leaflets varies greatly between species and is influenced by the environment. In wild species smaller leaflets are produced during hot dry weather, and large leaflets under cool and wet conditions. In pigeonpea, genetic differences for leaf size exist between cultivars, causing the leaf surface area to vary between 13 and 93.5 sqcm (MURTHI & VAN DER MAESEN, 1979) while a minute leaf variant measures 6 sqcm only for the three leaflets. The lengths of the petiole and rachis vary greatly. The petiolule length is not so variable. The stipellae vary from traces to 4 mm in pigeonpea; in wild species it varies from 0 to 5 mm. Stipules, persistent or sometimes caducous, range between 1 and 15 mm, the longest I have found are those of *A. sericea*.

#### 4.2.4 Seedlings

The seeds of *Atylosia* and *Cajanus* spp. have hypogaeal germination. The epicotyls of the seedlings are green, light green, or purplish. The first two leaves are simple and opposite. The first leaves are either narrowly ovate or more broadly ovate. The apexes have a small mucro. The presence of glands is as for the other leaves of the species. The hairy stipules can be fused partly or entirely, and measure 0.5 to 1.5 mm. Descriptive data are summarized in Table 3.

#### 4.2.5 Pollen morphology

Knowledge on pollen morphology of *Cajanus* spp. is very scanty. According to TEWARI & NAIR (1978) the tribe Phaseoleae is multipalynous: 3-colporate and 3-porate pollen grains occur. *Atylosia* and *Cajanus* belong to the 3-colporate group, which is supposedly less advanced. ARACHI (1968) described the pollen grains of *Atylosia crassa* as isopolar, with a circular outline in polar view, transversely elliptic in equatorial view, 3-colporate, with a circular endoporus. Exine sculpture is described as reticulate. SRIVASTAVA (1978) studied the pollen morphology of three pigeonpea cultivars and their hybrids. He also mentions the 3-colporate grains, but the ornamentation is called areolate (= negatively reticulate). SRIVASTAVA furthermore compared the size of the pollen grains of several hybrids and found dominance of the male parent and a variation in the size of the areolae (luminae?) of the hybrids. He concluded that in *Cajanus cajan* areola size provides an index of hybridity.

#### 4.2.6 Flower and seed colour

The flowers of *Cajanus cajan* are mostly yellow, the wing and especially the keel are often paler than the flag. The yellow varies from almost white (ivory-white) or pale yellowish green to an intense yellow, and the range extends to dark orange or purple. The darker colours often occur as second colours: as

TABLE 3. Seedling characteristics of *Cajanus* spp. (first opposite leaves).

Species	Coll. No.	Shape and Size	Base	Apex	Stipules
<i>C. albicans</i>	JM 2356	ovate, 23-26 × 13-16 mm	cordate	obtuse	setaceous
<i>C. cajan</i>	*	narrowly ovate, 32-80 × 10-26 mm	cordate to truncate	acute to acuminate	lanceolate
<i>C. cajanifolius</i>	JM 2739	narrowly ovate, 30-40 × 13-16 mm	rounded	acute-acuminate	lanceolate
<i>C. crassus</i>	JM 1984	ovate, 22-32 × 16-21 mm	cordate	acute	lanceolate
<i>C. lanceolatus</i>	CQ 1618	ovate, 30-40 × 8-10 mm	cordate	acute	setaceous
<i>C. lineatus</i>	ICP 7225	ovate, 11-18 × 7-12 mm	truncate	obtuse-acute	lanceolate
<i>C. marmoratus</i>	EC 121072	narrowly ovate, 30-35 × 15 mm	cordate	acute	lanceolate
<i>C. mollis</i>	JM 2943	narrowly ovate, 14-22 × 7-10 mm	rounded	acute	setaceous
<i>C. platycarpus</i>	Kharagpur	narrowly ovate, 25-36 × 9-13 mm	truncate	obtuse	narrowly ovate
<i>C. reticulatus</i>	CQ 1818	ovate, 17-22 × 17-19 mm	cordate	acute	setaceous
<i>var. grandifolius</i>					
<i>C. rugosus</i>	JM 3567	ovate, 13-20 × 8-14 mm	truncate to cordate	obtuse	setaceous
<i>C. scarabaeoides</i>	JM 1985	narrowly ovate, 18-28 × 8-14 mm	cordate	acute	lanceolate
<i>C. sericeus</i>	ICP 7470	ovate, 17-21 × 8-11 mm	cordate	acute	setaceous
<i>C. trinervius</i>	JM 3099	ovate, 15-22 × 9-14 mm	truncate	obtuse-acute	lanceolate

\* 100 randomly selected cultivars



veins on the flag, or covering the back or the base of the flag, and the tip of the keel. At ICRISAT six colour classes are used for classification. Table 4 lists these with the reference number of the Royal Horticultural Society Colour Chart. Classification is done with the fully opened flowers, a stage lasting rarely more than two days. The colour of fading flowers becomes paler, sometimes the red becomes more intense before it turns to brown. The presence of continuous variation is a consideration against simple classification of pigeonpea in two botanical varieties *flavus* and *bicolor* (with plain yellow, and yellow + red flowers respectively).

The colour range of seeds is very large, at ICRISAT ten classes are used for classification, although the variation is continuous. Table 5 lists those classes with RHS Colour Chart references.

The inheritance of flower, pod and seed colour is complex, although based on relatively few genes. Several factors and alleles play a role, and linkages have been found. DAVE (1934) established that: orange yellow flowers are completely

TABLE 4. Pigeonpea flower colours\*.

Colours	I = Ivory	Candidus (Green white 157B)
	LY = Light yellow	Lutescens (Yellow 6D)
	Y = Yellow	Aureus (Yellow 9B)
	O = Orange	Aurantiacus (Orange 25B)
	R = Red	Ruber (Red 53A)
	P = Purple	Purpureus (Red purple 59A)

\* in reference to the Royal Horticultural Society Colour Chart (1966)

TABLE 5. Pigeonpea seed colours\* and colour pattern.

Colours	W = White	Candidans (Yellow white 158 C)
	C = Cream	Eborinus (Greyed white 156 C)
	O = Orange	Aurantiacus (Greyed orange 163 B)
	B = Brown	Fuscus (Brown 200 D)
	LB = Light brown	Subfuscus (Yellow orange 163 B)
	G = Grey	Griseus (Greyed green 197 A)
	GB = Grey brown	Griseo-brunneum (Greyed brown 199 B)
	DG = Dark Grey	Atroschistaceus (Black 202 B)
	P = Purple	Purpureus (Greyed purple 187 A)
	DP = Dark purple	Atropurpureus (Black 202 A)
Pattern	P = Plain	Guttatus (spotted)
	M = Mottled	Variegatus (variegated)
	S = Speckled	Guttato-variegatus
	MS = Mottled + Speckled	Fasciatus (banded)
	R = Ringed	

The dark purple class is almost black, with a purple shine, which lessens when the seed ages.

\* In reference to the Royal Horticultural Society Colour Chart (1966).

linked to purplish black seeds; purple black standard is completely linked to maroon pod colour; and purple veined standards are completely linked to green pods. Orange flower colour is monogenic and dominant over yellow, as are purple to yellow, orange to red-veined yellow, and purple to purple-veined yellow. In other crosses or colours, ratios of 9:7 and 12:3:1 were obtained. Brown seed coat is monogenically inherited and dominant to white, as is purplish black to brown, while purplish black and white gave F<sub>2</sub> ratios of 9 purplish black : 3 white purple spotted : 3 brown : 1 white (DAVE, 1934). Similar results were obtained by later workers (refer DAHIYA, 1980): darker colours are most often dominant to lighter ones. Inhibitor alleles and linkages have been frequently reported and different gene symbols have been proposed.

The flowers of the related wild species have a pale yellow or yellow colour, with or without red veins on the dorsal side of the vexillum.

### 4.3 SEED STROPHIOLE

The major remaining character used in separating *Cajanus* from *Atylosia* is the presence or absence of a seed strophiole. The use of the word strophiole is here confined to the external structure around the hilum, a rim-aril, not to other structures. Some authors (referred to by ROLSTON, 1978; GUNN, 1981) considered the area in the palisade layer with long narrow macrosclerids, with or without a strophiolar plug and cleft, to be the strophiole, or even as equivalent to the lens or boss of a legume seed. GUNN (1981) prefers the generic name of 'aril' to strophiole, independent of its origin, until the anatomists establish the nature of all legume arils. Because of its frequent use in *Cajaninae* taxonomy, the word strophiole is retained in this revision.

The strophiole in *Cajanus/Atylosia* has a lengthwise groove dividing the structure into two parts (fig. ). It is a conspicuous, regular rim-aril in Gunn's (1981) terminology. Sometimes the strophiole is horseshoe-shaped (*Atylosia platycarpa*). In pigeonpea, ripe seeds were usually considered not to have a strophiole, but the developing seeds do have one that usually shrivels completely. However, in at least 144 accessions out of more than 10,000 maintained in the world collection at ICRISAT the seeds show a more or less developed seed strophiole. In these accessions the strophiole is not vestigial. The accessions with a strophiole originate from various states in India, so these are not confined to a certain area. Similar observations were made by ARORA (1977) who reported the presence of strophiolate seeds in pigeonpeas collected from Mizoram, Maharashtra, Tamil Nadu, Bihar and Madhya Pradesh. In tribal areas of India, where ancient landraces can be expected, this character seems to be more frequent. N. MURTHI ANISHETTY (pers. commun.) also found more strophiolate pigeonpeas in Orissa tribal areas. In addition to the states mentioned, some accessions from Andhra Pradesh, Uttar Pradesh and outside India from the West Indies and Colombia possess strophioled seeds.

The origin and function of the strophiole have different explanations. ROL-

STON (1978) reviewed the uses of the word and importance of the structure in relation to water impermeable seed dormancy. EAMES (1961) defines the strophiole as an aril, a fleshy tissue restricted to crests e.g. along the raphe, where the basal stalk of the ovule (funicle) joins the ovule body. The aril may represent an outgrowth of the outer integument of the ovule, which means a 'strophiole' or 'caruncle' in classic morphology. The presence of an aril has been considered as a primitive angiosperm character, but Eames points to the presence of arils in taxa scattered in the Angiosperms, and considers the aril as an ecological modification related to dissemination. STRASBURGER (1976) refers strophioles to elaiosomes if they are rich in fat, protein or sugar and play a role in dispersal by ants. USHER (1966) uses caruncle and strophiole as synonyms, defined as an outgrowth near the micropyle and hilum of the seed, whereas STRASBURGER and EAMES confine the caruncle, called false arils or arilloids by EAMES, as an outgrowth around the micropyle only (e.g. *Ricinus*). ESAU (1960) describes the aril as a fleshy outgrowth arising at the base of the ovule, enveloping the seed. The theory that the aril is a primitive character (1949 Durian theory by CORNER, 1976) would fit the case of *Cajanus* nicely, where most derived, cultivated, pigeonpeas have no strophiole and all other *Atylosia* and *Cajanus* spp., wild and unselected, possess one.

Evaluating the presence of an aril from a biological point of view, it might be regarded as a significant character in wild species (survival value), whereas in cultivars its eventual disappearance is irrelevant.

REDDY (1973) found that the presence of the seed strophiole was governed by two complimentary genes. The character was found to be recessive, as shown in segregating populations of the crosses of pigeonpea cv. T21 with *A. scarabaeoides*, *A. lineata* and *A. sericea*.

In *Rhynchosia* species with and without a strophiole are present. GUNN (pers. commun.) reported that in larger genera where seed arils are common, some non-arillous species are always found, in which only the groove on the hilum is present.

#### 4.4 NUMBER OF OVULES

In the Cajaninae an important character is the number of ovules and subsequent number of seeds per pod. The number of seeds may be lower than the ovule number as a result of abortion. HUTCHINSON (1964, tribe Cajaneae) and LACKEY (1977) used in their key: ovules 4 or more per pod for *Atylosia* and *Cajanus*. This has been corrected (PEDLEY, 1981; LACKEY, 1981): 3 or more, rarely 2 for *Cajanus*, *Dunbaria* and *Bolusafr*a. For the 1-2 seeded members of Cajaninae the key should read: ovules 2 or rarely 3 per ovary. This is rather ambiguous, but it also points to the close relationship within Cajaninae. Previously, BENTHAM (1862) and BAKER (1876) used the 3- or more-ovuled character in their keys to distinguish taxa in Cajaninae.

Within species (see *A. sericea*, *A. lineata*) a variable number of ovules exists:

it may be 2 or 3, likewise in *Cajanus cajan* it varies from 3-9. The character is inherited relatively simply, although several genes are involved. For convenience, the key character of two ovules, versus three or more ovules per ovary should be maintained for a subdivision of Cajaninae.

It is likely that genetic variability with regard to ovule number exists within the wild species. In the pigeonpea the number of ovules varies from 3 to 9. I have not come across references on the role of genetic and ecological factors on the phenotypic expression of the character of number of ovules in pigeonpea or its related species.

#### 4.5 CYTOLOGY

With the search for wild relatives of *Cajanus cajan*, long considered to be the single species of a monotypic genus, interest was directed towards *Atylosia* for transfer of useful genes not detected in the cultivated species, *C. cajan*. The reports of DE (1974) and ARIYANAYAGAM & SPENCE (1978) give an outline of the cytological work done since DEODIKAR and THAKAR (1956) studied the karyotype of *A. sericea*, *A. lineata* and *Cajanus cajan*. Like the pigeonpea, the wild species were found to have a chromosome number of  $2n = 22$ . Authors reporting  $2n = 22$  for the pigeonpea include ROY (1933) KRISHNASWAMY and Ayyangar (1935), FRAHM-LELIVELD (1953, 1957), DATTA and SAHA (1972, 1975) and AKINOLA et al. (1972). *Atylosia barbata* (now referred to *C. goensis*) has reportedly  $2n = 22$  chromosomes (TSCHECHOW and KARATASCHOWA, 1932). *A. scarabaeoides* has  $n = 11$  or  $2n = 22$  (Bir and SIDHU, 1966, 1967; SIKDAR and DE, 1967; MEHRA and DHAWAN, 1971). Some reports exist on natural and induced tetraploidy ( $2n = 44$ ) or aneuploids.

The high degree of homology between the chromosome complements was shown in somatic karyotype studies. DEODIKAR and THAKAR (1956) concluded that *C. cajan* and *A. lineata* had six similar pairs of chromosomes in common, and *C. cajan* and *A. sericea* four pairs. KUMAR et al. (1958) obtained the first hybrid between *C. cajan* and *A. lineata*. ROY and DE (1965) and SIKDAR and DE (1967) added further data on chromosome morphology. REDDY (1973, 1981a,b,c) studied both the somatic and meiotic chromosomes of three species of *Atylosia*, *A. lineata*, *A. sericea* and *A. scarabaeoides*, and *C. cajan* (cv. T-21). Somatic karyotype analysis revealed that five pairs of chromosomes are common to all the four species. Further, *C. cajan* and *A. lineata* showed seven identical chromosome pairs and *C. cajan* and *A. sericea* and *C. cajan* and *A. scarabaeoides* showed six pairs of identical chromosomes each. On the basis of the direct comparison of pachytene chromosomes of the parents it was found that four chromosome pairs are common to all the four species. Similarly, 10, 7 and 7 chromosome pairs were identical for *C. cajan* and *A. lineata*, *C. cajan* and *A. sericea*, and *C. cajan* and *A. scarabaeoides* respectively. However, pachytene pairing in the hybrids indicated that *C. cajan* X *A. lineata* possessed nine ho-

moeologues; *C. cajan* X *A. sericea* and *C. cajan* x *A. scarabaeoides* hybrids eight homoeologues each.

DUNDAS & BRITTEN (in press) reported a detailed study on pachytene-stage chromosomes of pigeonpea and *Atylosia acutifolia* ( $2n = 22$ ), and their hybrid. No chromosome, despite similarity and homology, was entirely identical between the two species. Hybrid plants had 70% sterile pollen. Precise chromomere number and position served to distinguish the chromosomes, which are not greatly different in length from each other within and between the two species. The method has been described elsewhere (DUNDAS & BRITTEN, in press) and includes a key based on chromomere patterns to identify in pachytene cells the individual chromosomes of pigeonpea cv. Prabhat. This key will allow comparison of the chromosomes of cv. Prabhat with those of other cultivars and species.

Further proofs of various degrees of homology were obtained at ICRISAT where more intergeneric hybrids were produced after further wild species had been collected. The work of PUNDIR (1981) at Varanasi in close cooperation with ICRISAT included the cytological investigation of some newly acquired species and their hybrids. *A. platycarpa*, *A. trinervia*, *A. cajanifolia*, *A. crassa* and *A. albicans*, in somatic division, have quite identical chromosome complements ( $2n = 22$ ) (PUNDIR & SINGH, 1978), like the earlier investigated species which were again included. *Rhynchosia rothii* Benth. ex Aitch. also appeared to have a similar complement of  $2n = 22$  chromosomes. Homology again proved to be remarkable. In meiosis, concurrent figures ( $n = 11$ ) were found for all the species investigated (PUNDIR, 1981; KAMESWARA RAO, 1978). *Cajanus kerstingii* Harms also has been found to have  $2n = 22$  chromosomes (LACKEY, 1977).

PUNDIR (1981) found two satellite chromosome pairs in *C. cajan* cvs Pant A-2 and UPAS 120, against earlier reports of one pair. *A. sericea* and *A. scarabaeoides* were found to have one pair. *A. lineata*, *A. albicans*, *A. cajanifolia*, *A. platycarpa* and *Rhynchosia rothii* had two pairs of satellite chromosomes. Karyograms further included centromere positions and chromatin length, the latter being almost analogous, ranging from  $37.7 \mu\text{m}$  to  $56.2 \mu\text{m}$ , suggesting little differentiation in chromatin length among the species studied.

The work of SATEESH KUMAR (1985, see also SATEESH KUMAR et al. 1984) further elucidated the genome relationships between pigeonpea and its wild relatives. Results suggest that the Australian species (*C. lanceolatus*, *C. latisepalus* and *C. reticulatus* var. *grandifolius*) are more diverged from *Cajanus cajan* than the Asian species. In spite of normal meiosis of *Cajanus cajan* X *albicans* the high degree of pollen sterility was explained by nucleolar variation.

At this juncture it may be recalled that in Phaseoleae, especially Phaseolinae and Cajaninae, a chromosome number of  $2n = 22$  is extremely common (e.g. FRAHM-LELIVELD, 1953, 1957, 1969; DATTA and SAHA, 1972, 1975; LACKEY, 1977) which points to the internal unity of the Cajaninae. In Phaseolinae a more complex pattern exists with counts of both 20 and 22. DATTA & SAHA (1972) even proposed a close relationship between Phaseolinae and Cajaninae on account of hybrids obtained between *Lablab purpureus* (L.) Sweet (as *Dolichos lablab* L.) and *Cajanus cajan*. The cytological data were not confirmed by mor-

phological study since the F1's were not grown to maturity. More results should be awaited before deciding that actual hybrids were obtained despite karyological data, showing chromosomes from both parents but with a total chromosome length reduced to about half the length of either parent. McCOMB (1975, see also 3.1) did not refer to the Datta and Saha paper but their results could constitute perhaps another rare exception to the general absence of true cross-compatibility between members of different genera in Leguminosae.

All papers detailing cytotaxonomic evidence of affinity between *Cajanus* and *Atylosia* species, followed by reports on the actual hybrids obtained and their karyotype behaviour, suggest that the genera should be united.

#### 4.6 INTERGENERIC AND INTERSPECIFIC HYBRIDIZATION

##### 4.6.1 Crossing efforts

The main efforts in interspecific hybridization with pigeonpea, always hitherto referred to as intergeneric hybridization, have been directed towards species of *Atylosia*. With this genus most successes have been achieved, most often with the pigeonpea as female parent (ICRISAT, 1977, 1978). Limited attempts to cross *Rhynchosia* and *Dunbaria* species with *Cajanus cajan* have so far been unsuccessful at ICRISAT and Varanasi, despite hundreds of pollinations. Only *R. rothii* Benth. ex Aitch. and *D. ferruginea* W. & A. have been used, but when more species are included, perhaps different results could be obtained.

In Table 6 some results of several years of crossing are listed. The attempted crosses of *C. cajan* with *A. crassa*, *A. platycarpa* in all possible directions depending upon availability of simultaneous flowering, have so far failed. *Atylosia trinervia*, now referred to as *Cajanus trinervius*, was collected in 1976 above 2300 m in the Nilgiri Hills in South India. Transplanted shrubs have survived a few years, but have failed to flower in Hyderabad, where the altitude of 550 m results in a much warmer climate. Hybridization was accomplished, however, by bringing flower buds, packed in plastic bags on ice in thermos flasks, from Ootacamund in the Nilgiri Hills down to Hyderabad. Pollination even after this storage for 48 hours proved successful. Also pollen of *C. heynei* (= *Dunbaria heynei*) was collected in the same fashion, since at first ripe seeds were not available for cultivation in the garden at ICRISAT Center. The crosses did not succeed.

Crosses with *A. platycarpa* have not been successful. In Trinidad ARIYANAYAGAM and SPENCE (1978) reported that hybrids were obtained, but these were, in all likelihood, apomicts. However, a bridge cross was recovered from crosses with some F3's of pigeonpea and *A. sericea* (ARIYANAYAGAM, 1981). Earliness, practical day-neutrality and virtual annuality are among the traits valuable for incorporation into the pigeonpea. Another recent source of near day-neutrality is a mutant, obtained in Queensland, Australia (BYTH, pers. commun.), from material of cv. Pant A-8 sent by ICRISAT.

Applications of gibberellic acid solutions in concentrations of 30-500 ppm increased pod and seed set in many interspecific combinations. In crosses with

TABLE 6. Results of interspecific crosses at ICRISAT's Genetic Resources Unit

Cross	No. of pol- linations made	No. of pods collected	%pod set	Seedlings emerged	Seedlings survived
1977-78					
<i>C. lineatus</i> × <i>C. scarabaeoides</i>	67	3	4.48	3	3
<i>C. lineatus</i> × <i>C. albicans</i>	25	2	8.00	2	0
<i>C. lineatus</i> × cv. UPAS-120	10	1	10.00	1	1
cv. UPAS-120 × <i>C. lineatus</i>	90	1	1.11	1	1
<i>C. lineatus</i> × cv. Pant A2	168	2	1.19	2	2
<i>C. cajanifolius</i> × cv. Pant A2	876	18	2.05	21	21
<i>C. cajanifolius</i> × cv. UPAS-120	714	12	1.78	18	18
cv. Pant A2 × <i>C. scarabaeoides</i>	409	4	0.97	5	5
cv. Pant A2 × <i>C. albicans</i>	663	3	0.45	3	3
cv. Pant A2 × <i>C. trinervius</i>	50	8	16.00	13	9
cv. UPAS-120 × <i>C. trinervius</i>	36	4	11.11	4	3
cv. UPAS-120 × <i>C. albicans</i>	430	1	0.23	1	1
<i>C. scarabaeoides</i> × <i>C. sericeus</i>	182	1	0.55	1	1
1978-79					
<i>C. albicans</i> × <i>C. lineatus</i>	453	7	1.54	15	15
<i>C. albicans</i> × <i>C. scarabaeoides</i>	536	8	1.49	6	6
1979-80					
cv. UPAS-120 × <i>C. sericeus</i>	120	1	0.83	1	1
<i>C. lineatus</i> × <i>C. sericeus</i>	75	1	1.3	1	1
1980-81					
cv. Prabhat × <i>C. reticulatus</i>	165	4	2.42	8	8
cv. Prabhat × <i>C. lanceolatus</i>	100	2	2.00	2	2
1981-82					
cv. NP(WR)-15 × <i>C. latisepalus</i>	56	1	1.78	3	3

*Atylosia* species, otherwise incompatible with *Cajanus cajan*, treatment delayed pod drop and provided prospects for the culture of immature embryos (SATEESH KUMAR et al. 1983). Further research with hormones appeared promising, the concentration of 40-50 ppm GA3 was most useful, but did not allow complete seed formation in unsuccessful combinations (SATEESH KUMAR, 1985). In-vitro regeneration of pigeonpea and wild *Cajanus* species from cotyledons and immature embryo's proved possible, but anther culture did not meet with success.

The species interfertile with pigeonpea and hitherto classified in *Atylosia* belong to the secondary genepool of pigeonpea, not in the tertiary as suggested by SMARTT (1980). Those *Atylosia* (now *Cajanus*) species not crossing with pigeonpea belong to the tertiary genepool, as are the species of other *Cajaninae* genera, in the sense of HARLAN and DE WET (1971). SMARTT (1980) distinguishes a quaternary genepool, to express even further genetical distance, and in which other *Cajaninae* could also be classified.

A remarkable intergeneric hybrid was reported by DATTA and SAHA (1972) between *Lablab purpureus* and *Cajanus cajan*. The seven F1 seedlings were used for root-tip investigation only and did not grow to maturity.

#### 4.6.2 Hybrids

Through the hybridization work between wild and cultivated species of *Cajanus* (as perceived in this revision) since the early fifties of this century, many fertile and less fertile hybrids have been generated. This is not the place to describe fully all material obtained, also it has to be taken into account that little material has been preserved in herbaria because of the need for seeds in the breeding programmes and unfamiliarity among breeders with this way of keeping a reference. Many hybrids are a blend of pigeonpea and the wild species, or of two wild species, as can be expected (Plate 4, Sect. 10.4). Later generations throw several segregants which are very different. Most hybrids have quite an intermediate morphology between the parents (Table 7). Mainly to record morphological diversity, which might have also been generated during evolution, a few main characteristics are tabulated for some combinations. Several generations are included in the observations. Material has been conserved at ICRISAT. Successful crosses are listed in 4.6.1. Most of these have also been listed by REMANANDAN (1981), who also reported on the backcrosses made. Other crosses also made

TABLE 7. Characteristics of some interspecific hybrids in *Cajanus*.

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*C. cajan* ICP 7035 × *C. scarabaeoides*: straggling shrub, 0.5–1 m, small elliptic leaflets, flowers 10 mm long, pods up to 40 × 8 mm long, hairy, 2–4 seeds of ca 5 mm long.

*C. cajan* ICP 6997 × *C. scarabaeoides*: semi-erect shrub, up to 1 m, small elliptic leaflets, flowers up to 12 mm long, pods up to 40 × 9 mm, hairy, 4–5 seeds of ca 5 mm long.

*C. scarabaeoides* × *C. sericeus*: straggling shrub, intermediate elliptic leaflets, flowers ca 9 mm long, pods up to 14 × 7 mm long, hairy, 2–3 seeds of ca 4 mm long.

*C. albicans* × *C. lineatus*: prostrate shrub of 25 cm, more erect and taller the second year, leaflets obovate, flowers up to 15 mm long, pods ca 20–25 × 9 mm hairy, 2–4 seeds of 5 mm long.

*C. cajan* cv. Pant A2 × *C. lineatus*: erect shrub, 0.75 m, leaves obovate-elliptic, flowers ca 14 mm long, pods not available.

*C. sericeus* × *C. cajan* cv. ICP 6915: erect shrub, elongate-elliptic leaflets, flowers ca 15 mm, pods ca 20 × 10 mm, hairy, 1–4 seeds of ca 4 mm long.

*C. albicans* × *C. scarabaeoides*: climber up to 3 m, obovate-rounded leaflets, flowers ca 10 mm, pods ca 25 × 8 mm, hairy, 1–3 seeds of 4–5 mm long, grey green, black speckled.

*C. cajan* cv. UPAS 120 × *C. trinervius*: spreading shrub, elongate-obovate leaflets, flowers ca 15 mm, pods ca 20 × 10 mm, 1–2 seeds of 4–5 mm long, grey-black.

*C. albicans* × *C. cajan* cv. ICP 3783: semi-erect shrub, ca 1 m tall, obovate leaflets, flowers ca 16 mm, pods up to 40 × 12 mm, not hairy, (1) 2–4 seeds of 4 mm long, grey with black mottles.

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at ICRISAT were published by REDDY, GREEN and SHARMA (1981), who also elaborated on segregation patterns.

Natural hybrids are rare. Apart from natural outcrossing in ICRISAT's Botanical Garden, witnessed by hybrids growing from seed harvested from e.g. *Cajanus cajanifolius* and *C. sericeus*, only two vouchered hybrids came to my notice. One is *Atylosia cajanooides* Jacob de Cordemoy, very likely a *C. cajan* X *scarabaeoides*, collected once last century in Reunion along the Marsouines river near the waterfall of St Benoit. Another hybrid of the same combination was found on Guam (herb. US). On both islands only *C. cajan* and *C. scarabaeoides* are found.

#### 4.6.3 Anthesis and pollination

The flowering of pigeonpea has been described by HOWARD, HOWARD and KHAN (1919) and MAHTA and DAVE (1931). Recently, further observations were published by DATTA and DEB (1970) and PRASAD, PRAKASH and HAQUE (1977). The anthers expand during the growth of the bud, burst the day before the flower opens, and thus pollen reaches the stigma. Times of expansion of the flag differ depending on weather and genotype, starting from the early morning hours and lasting to late in the afternoon. The corolla may remain open from 1.5 to 3 hours (PRASAD et al., 1977) to about 1.5 days (HOWARD et al., 1919). Environmental and genetic factors appear important in this respect. The stigma is receptive long before the anthers dehisce and remain receptive for another 20 hours thereafter. This enables emasculation and hybridization in the bud stage, a technique commonly used by breeders. During the flowering period buds and flowers are available in abundance for crossing.

Different reasons have been advanced to explain the large proportion of flower shedding in pigeonpea, but none seems satisfactory. Cross-pollination or at least visiting by bees appears to increase seed yield. Podset was experimentally enhanced by tripping the flowers (A.N. MURTHI, pers. commun.).

The papilionaceous flowers of pigeonpea (and its wild relatives) are both autogamous and allogamous. Bud self-pollination precedes unfolding of the petals, at which time insect pollination may take place. Part of the flower's life cycle is cleistopetalous, closed during anthesis. This condition is not cleistogamous (see FAEGRI and VAN DER PIJL, 1979; STRASBURGER, 1976) for this term is used for bud-like flowers which fail to open. Strictly speaking, in cleistogamy, anthesis does not occur. The situation in pigeonpea, and many other cultivated legumes, is best termed preanthesis cleistogamy (LORD, 1981). However, an accession with buds which did not open and produced pods was detected in material from Tanzania, grown at ICRISAT Center in early 1982, and this is a case of true cleistogamy. Cleistogamy was also reported by MAHTA and DAVE (1931) and DATTA and DEB (1970). The phenomenon was apparently induced by environmental factors, since under short daylength and lower temperatures more cleistogamous flowers were found. The morphology of those flowers was not described, but DATTA (pers. commun.) stated that the buds did not open. The flag remained presumably as in the late bud stage, as was later found at ICRISAT too. The

development of the bud was arrested at a late stage (see also UPHOF, 1938).

Cross-pollination ranges between 3 and 40%, and varies according to location, cultivars, method of detection, insect population and time of flowering (see SHARMA and GREEN, 1976; BHATIA et al., 1981). ONIM (1981) even found outcrossing between 25.2 and 94.5% in Kenya, the latter figure resulting from doubling the figures of the purple-stemmed progeny.

Most of the insect pollination of the typical insect-blossoms is by bees; at ICRISAT Center megachilids and xylocopids are the major pollinators (WILLIAMS, 1977). BEES, attracted by the flag, land on the alae and force the keel petals apart to reach the nectar. Pollen is then deposited on their bodies, and on the stigma. Insect pollination gives an increased podset over auto-selfpollination, and mechanical injury of the stigma may favour penetration of the pollentubes (HUIBERS-GOVAERT, pers. commun.). There is some evidence for certation, REDDY & MISHRA (1981) found that pollination without emasculation resulted in no more than 0.7 % selfing. HUIBERS-GOVAERT (pers. commun.) ascribed the high percentage of outcrossing to increased vigour of heterofertilized ovules. LOVETT-DOUST & LOVETT-DOUST (1983), in a general review, suggest that both pollen certation and female choice may determine which embryo develops, often inhibiting a plant's own pollen, and so ensure outbreeding.

Pollination by thrips, which are found in great number in flower buds and flowers of wild and cultivated *Cajanus*, is negligible, as shown in tests at ICRISAT, in 1977 (GUPTA et al., 1981). When the thrips population was controlled, pod setting was not adversely affected on normal plants with bagged inflorescences. Bagged male sterile flowers hardly produced pods, even when normal flowers were also enclosed, either with or without thrips. Although pollen is carried on thrips bodies as they move from flower to flower, there is little evidence that they pollinate, let alone cross-pollinate. Movement from plant to plant seems less likely than between flowers on the same plant.

The obcordate leaf mutant of *Cajanus cajan* (SINGH et al., 1942) has generally open flowers, and appears to attract different insect species when compared with those visiting normal flowers. This precludes the use of the obcordate leaf character as a marker for cross-pollination and isolation studies. The purple stem character is presently employed for these purposes. Male-sterile flowers are visited as normal by insects, enabling the production of hybrid pigeonpeas.

Pigeonpea plots should be isolated for the production of pure seeds. The smallest distance necessary for the purpose has still to be experimentally confirmed for various countries, but at ICRISAT a distance of at least 150 m is kept between isolation plots. ARIYANAYAGAM (1976) reported that in Trinidad ca 15 m is sufficient to reduce outcrossing to less than 3%. The foraging behaviour of pollinating bees seems restricted to an area close to their starting point.

A late opening flower of pigeonpea was detected in progenies of pigeonpea cv. T21 X *C. lineatus*, and in cv. Royes. No cross-pollination was observed during several seasons at ICRISAT (L.J. REDDY, pers. commun., ICRISAT, 1981). This characteristic appears to be useful when pure seeds are required e.g. in seed production of improved cultivars or if outcrossing is not wanted. The keel

of the flower encloses the other petals ('wrapped flower'), apparently preventing the normal pollinators from entering. Thrips are present as usual. The late opening flowers are cleistopetalous for most of their life cycle.

#### 4.7 CHEMOTAXONOMY

LACKEY (1977) evaluated several species of the subtribe Cajaninae for the presence of the free amino acid canavanine, a compound mainly found in seeds of papilionoid legumes. All Cajaninae, including *Cajanus cajan*, *C. kerstingii*, *Atylosia goensis* (as *A. barbata*), *A. cinerea*, *A. lineata*, *A. scarabaeoides* and *A. trinervia*, lacked canavanine. The absence can be regarded either as a primitive character, or as a derived one where the ability to produce the compound can be assumed as irreversible. Cajaninae form obviously a uniform group in respect to the lack of canavanine.

HARBORNE et al. (1971) have summarized some other chemical constituents present in Cajaninae. The reaction on amyloids of the seeds (a polysaccharide) was positive in *Atylosia* and *Cajanus*, but was negative in two species of *Rhynchosia*. Urease, an enzyme in the globulin class, which is a metabolic product of e.g. canavanine, is present in *C. cajan*. Starch is present in *C. cajan* and one *Atylosia* species, as far as has been investigated. Taxonomical consequences are still under consideration. Phytohaemagglutinins were absent in *C. cajan* (also reported as *C. indicus*). In *A. goensis* (as *A. barbata*) a non-specific PHA and an anti-animal PHA were detected. These chemicals are of value for the taxonomy at generic level.

Results of seed protein electrophoresis pattern research were published recently, and show remarkable similarity between the species of *Cajanus* and *Atylosia*. The lines of *C. cajan* show very little intraspecific variation. The pattern of *C. cajanifolius* warrants placement as a different species from the pigeonpea (G. LADIZINSKY & HAMEL, 1980; PUNDIR, 1981). *Cajanus lineatus*, *C. platycarpus*, *C. cajanifolius* and *C. scarabaeoides* have each their own protein profiles, but each band has a homologue in the standard profile of *C. cajan* or in one of its variants (Ladizinsky & HAMEL, 1980). Similarity in electrophoretic pattern between pigeonpea and some wild relatives was also reported by SINGH et al. (1981), who also published data on seed protein fractions and amino acid composition of eight Cajaninae. The total protein content in wild species ranged between 28.3 and 30.5%, compared with a value of 24.2% for pigeonpea. *A. crassus* had the highest lysine and phenylalanine levels, *A. scarabaeoides* had the lowest lysine content. On the whole the variation was only slight.

The results of PUNDIR (1981) confirm this homology, adding results of *Cajanus albicans*, *C. crassus* and *Rhynchosia rothii*. *C. platycarpus* and *C. crassus* had a banding pattern less homologous to the pigeonpea than the other species studied, while *Rhynchosia rothii* was even more distinct.

SINGH & JAMBUNATHAN (1981) studied the protease inhibitor activity of the seeds of pigeonpea and some related species. The levels of inhibition varied be-

tween 12.5 and 15.1 units/mg in pigeonpea, between 13.3 and 25.8 for *Atylosia* and the value in *Rhynchosia rothii* was 82.4 units/mg meal. The chymotrypsin inhibitor activity in the wild species was about three times the mean of pigeonpea, 15.2 against 4.2 units/mg, but in *A. cajanifolia* the level was similar to that of pigeonpea. In-vitro digestibility of protein varied between 52.6% (*A. volubilis*) and 68.1% (*A. sericea*), the mean value for pigeonpea was 60.5%. *Rhynchosia rothii* had a low value of 40.9%, comparable with soybean, probably due to the high level of protease inhibitors.

KRISHNA & REDDY (1982) studied the esterase isozyme patterns of pigeonpea and six *Atylosia* species. The patterns of *A. cajanifolia* and *C. cajan* suggest a closer phylogenetical relationship than with other species, the single esterase band of pigeonpea was shared by no other investigated species. *Cajanus albicans* and *A. scarabaeoides* showed three common bands, indicating a closer relationship to each other than to other species, while the pattern of *A. platycarpa* suggested a more distinctly different position in the genus.

## 5 CAJANUS AND ATYLOSIA ARE CONGENERIC

Morphological considerations, backed by genetical evidence, and chemical and cytological data, point to the congenericity of *Atylosia* and *Cajanus*. Features of the plants in both genera overlap and it is unnatural to keep them apart. While all the wild species possess a strophiole, in the pigeonpea it is small or vestigial. Quite a few accessions of the pigeonpea germplasm collection at ICRISAT possess a more or less well developed seed strophiole. In young pods all pigeonpea accessions have a strophiole, but mostly this is reduced to traces at maturity.

The characteristics used by BENTHAM (1852) to differentiate the genera now overlap. Our observations show that the direction of delineation of the legume is not always constant within one species. The callosities are present in 13 species, and not in another 11, in 6 species the callosities are inconspicuous, and of one species the vexillum was not available for inspection.

It is also not possible to decide on a partial merger by referring only *Atylosia cajaniifolia* and a few other bushy species of *Atylosia* to *Cajanus*, and to maintain only creeping and climbing species in *Atylosia*, since the latter have too many similarities with the bushy species, and several cross well with pigeonpea.

*A. cajaniifolia* is a *Cajanus* in every respect but for the well developed seed strophiole. This is shown by our recent collections from Bailadilla Hills, Madhya Pradesh, and Orissa, where *A. cajaniifolia* is growing in the wild. Perhaps because it resembles pigeonpea so strikingly, one wonders why it was nearly always overlooked and not collected or studied. This may well be explained by the extremely rare occurrence of the species. On the other hand, casual observers might have assumed that the plant was just a pigeonpea escaped from cultivation, and so paid no further attention.

Interspecific hybridization is often possible, though degrees of relatedness exist and with some species crosses with *Cajanus* have so far proved impossible. The hybrids are often viable and cytological data support the concept of congenericity because of the large degree of homology between the chromosome complements.

Following the evidence presented, it is proposed to unite *Atylosia* W. & A. (1834) with *Cajanus* DC. (1813). *Cajanus* is the older name and, moreover, is a conserved one. The merger involves a number of new combinations, more than would have been necessary if *Cajanus* had been discarded as a genus. This course of action, however, would suit all agronomists well, as the only cultivated species, the pigeonpea, can retain its well-known scientific name. It is unfortunate that many specific epithets for the wild species first occurred as nomina nuda in Wallich's list (1831-32) and cannot be considered for the new combinations. Very often the Wallichian specimens of the species under discussion were labelled as *Cajanus* but these have not always been used as basionyms by subsequent authors. Some *Atylosia* spp. were validly described as *Cajanus* originally,

and these names could be reinstated.

The two species described in *Endomallus* both belong to *C. goensis*, therefore this genus is also reduced to the synonymy of *Cajanus*.

Even if species from other genera in the Cajaninae would be considered to belong to *Cajanus*, new combinations could be made without altering the position of the species under discussion here, since *Cajanus* precedes all other names and has anyhow been conserved.

Further research into interspecific and intergeneric relationships could include pollen morphology, cytological work, chemotaxonomy and numerical analysis. The wild populations need to be sampled further to obtain good representations within the 'biological species', and samples conserved.

With reference to the work of PEDLEY (1981 b, see 4.1), I prefer to keep *Rhynchosia rufescens* DC. (subgen. *Phyllomatia* W. & A.) in *Rhynchosia*.

Having looked through material of *Dunbaria* at several of the herbaria mentioned in Section 2, and recognising the paucity of specimens in many of the species, it appears that also *Dunbaria* is also in need of further collecting and revision. A recent regional revision of *Dunbaria* and *Flemingia* is available for Indo-China (NGUYEN VAN THUAN, 1979). *Eriosema* and *Rhynchosia* are presently receiving attention for the Flora of Southern Africa (STIRTON 1978, pers. commun.). *Rhynchosia* has been revised for the Flora of Tropical East Africa (VERDCOURT, 1971). GREAR (1978) revised the new world species of *Rhynchosia*. A generic revision in Cajaninae is long overdue (STIRTON, pers. commun., and LACKEY, 1977).

## 6 GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

Phytogeographical data are important considerations to decide upon taxonomic status of a group of plants, and provide information where to collect more material. Table 8 summarizes the distribution of the species of *Cajanus*.

The genus *Cajanus* is mainly distributed throughout the Indian subcontinent, South East Asia and north Australia. Pigeonpea is now cultivated in virtually all tropical countries of the world, especially in the semi-arid areas. The distribution of each species is given in the maps and special notes are added where needed. The pigeonpea is a cultivated crop but may be found as an escape, as is often true in Africa. In India pressure on the land by grazing accounts for the very rarely reported occurrence of pigeonpeas growing wild.

My opinion is that pigeonpea originated in India, spread around 2200-2000 BC to Africa where a secondary center of diversity developed (VAN DER MAESEN, 1980). LADIZINSKY & HAMEL (1980) suggest a polyphyletic origin of the pigeonpea based on seed protein examination of four species of *Atylosia* and *Cajanus*. They did not consider the morphologically closest relative, *C. cajanifolius*, to be the single immediate progenitor. With the slave trade the pigeonpea was carried from Africa to the Americas, where in the Caribbean it is an important crop. However, 89% of the world's reported acreage is still in the Indian Subcontinent. A detailed account on the occurrence of pigeonpea has been prepared separately (VAN DER MAESEN, 1983 a).

Informative reviews on the agronomy of pigeonpea were given by GOODING (1962), AKINOLA, WHITEMAN & WALLIS (1975) and EL-BARADI (1978). A review of root nodulation of *Atylosia* and *Cajanus* can be found in ALLEN & ALLEN (1981). As far as known, all species have nodulated roots. Pigeonpea is nodulated by *Rhizobium* of the cowpea group,

The wild species overlap the distribution of the pigeonpea to a large extent, except in Australia and Papua New Guinea where renewed attempts to grow pigeonpea as a crop are rather recent. *C. scarabaeoides* is the most commonly encountered wild species and it has the widest distribution; recently it was even collected near the sea shore in Jamaica. Occurrence of this species in Africa is also mainly near the shores of seas and rivers. It may have been carried with other food grains, as on more than one occasion I observed *C. scarabaeoides* growing in India in fields of pigeonpeas or cowpeas. An occurrence in Lusaka, Zambia, was a reported introduction from West Africa and is the only known location deep inside Africa.

The phytogeographic data strongly support the Asiatic and specifically the Indian origin of *Cajanus* (DE, 1974; SMARTT, 1980).

Apart from the high-altitude species like *C. trinervius*, *C. rugosus*, *C. mollis*, and *C. grandiflorus* to some extent, all species occur between 0 and 1500 m. *Cajanus* spp. are climbers, creepers or bushes in grassy vegetation, and in open forests of semi-deciduous nature in semi-arid or semi-humid tropical climates.







Grazing reduces the abundance of most of the more susceptible species and with the reduction of forest areas we find several species only in the remnants of forests, in forest reserves, and on hill tops. A few centuries ago the distribution of many species must have been much wider than today, but that is not a feature of *Cajanus* alone. A good example is the present disjunct area of distribution of *C. goensis*, and to some degree of *C. crassus* in the Indian subcontinent. *Cajanus* spp. do not occur naturally in rain forests. In South East Asia rain forests separate the areas of the *Cajanus* species requiring less moist conditions (East Java, the lesser Sunda Islands). During the Pleistocene Ice Age the lowering of the sea level created more drought areas which may have served as stepping stones for non-rain forest species (VAN STEENIS, 1961).

Within each suitable ecological niche wild *Cajanus* species are most often found on less approachable places: hill slopes, ledges out of reach of cattle or protected by prickly *Lantana*. However, occurrence near roadsides, riversides or footpaths rather than deep inside dark forests, points to the need for a semi-open habitat receiving reasonable penetration by sunlight. This has proved convenient for collecting: for where roads cut through the areas of distribution, the wild species were growing to greater perfection. Rarely, except *C. scarabaeoides* and *C. crassus*, are the species a major part of the vegetation, although some may be common locally.

The Australian species, most of which are endemic, are distributed in northern Australia. Some are common, others are very rare. *C. pubescens* occurs in the most arid ranges, *C. mareebensis* is a very local endemic. The true areas of the species (PEDLEY, 1981 a) may not be reflected by present herbarium collections.

*Cajanus* species are found on a variety of soils. Pigeonpea grows primarily on Entisols (Indo-Gangetic alluvial belt) and deep Vertisols (black cotton soils) but also on Alfisols (red soils of the Deccan) (REDDY & VIRMANI, 1981). In Africa pigeonpea is often found on red soils. Wild species inhabit well-drained, more or less infertile soils of many types, of medium to high pH. If known, details are given under each species in chapter 10.

All species which I have offered to cattle or goats (*C. trinervius*, *C. crassus*, *C. heynei*, *C. albicans*) proved to be palatable to them. No species has a strong smell, so all are likely to be grazed. *C. scarabaeoides* is reportedly a useful but unimpressive species in grasslands for fodder (DABADGHAO & SHANKARNARAYAN, 1973) and I have seen *C. lineatus* and *C. sericeus* damaged by grazing. Langur monkeys eat the leaves of *C. crassus* (LINDBURG, 1976). Insects, like podborers (*Heliothis armigera* Hubn.) and podflies (*Melanagromyza obtusa* Mall.), also attack wild *Cajanus*, but in a few species (*C. scarabaeoides*, *C. sericeus*) some degree of antibiosis is observed (S.S. LATEEF, W. REED, pers. commun.). In general insect attack in wild *Cajanus*, *C. cajanifolius* excepted, is less severe than in *C. cajan*. Plant fungi and viruses do attack wild *Cajanus* spp. but several species offer promise for disease resistance. In the forests of India, for instance in Chota Nagpur, I several times observed a yellow mosaic in *C. scarabaeoides*. Screening and genetic conservation is warranted and being carried out at several places, including ICRISAT.

## 7 DESCRIPTION OF THE GENUS *CAJANUS*

*Cajanus* DC. (nom. conserv.).

*Cajanus* de Candolle, Cat. Hort. Monsp. 85 (1813); DC., Prodr. 2: 406 (1825); Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 1: 256 (1834); Steudel, Nomencl. Bot. Ed. 2. 2: 248 (1841); Bentham & Hooker, Gen. Pl. 1:541 (1865); Baillon, Hist. Pl. 2: 258 (1870); id., Dict. Bot. 1: 546 (1876); Mueller, F. von, Census Austral. Pl. Suppl. 1-4: 41 (1881); Taubert in Engler & Prantl, Natürl. Pflz.fam. 3-3: 372 (1894); Hutchinson, Gen. Fl. Pl. 1:421 (1964); Lackey, Bot. J. Linn. Soc. 74: 163-178 (1977); Allen & Allen, Leguminosae 81, 123 (1981); Lackey, Adv. Legume Syst. 1: 327 (1981); Pedley, Austrobaileya 1-4: 378 (1981); Reynolds & Pedley, ibid. 1-4: 420 (1981).

Type species: *Cajanus cajan* (L.) Millsp.

Synonyms: *Cajan* Adanson, Fam. Pl. 2:326 (1763), *nom. rejic.*; Huth, Helios 11: 133 (1893).

Type species: not indicated, but referring to cultivated pigeonpea.

*Atylosia* Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 1: 257 (1834); Bentham in Miq., Pl. Jungh. 2: 242 (1852); Bentham & Hooker, Gen. Pl. 1: 542 (1865); Bentham, Fl. Austral. 2: 262 (1864); Merrill, Philipp. J. Sci. Bot. 5:128 (1910); Sprague, Kew Bull. 1927: 134 (1927); Hutchinson, Gen. Fl. Pl. 1: 421 (1964); Lackey, Adv. Legume Syst. 1: 327 (1981); Reynolds & Pedley, ibid. 1-4: 420-428 (1981).

Lectotype species: *A. candollei* W. & A. (Hutchinson, 1964).

*Cantharospermum* Wight & Arnott, Prodr. Fl. Pen. Ind. Or. 1: 255 (1834); Bentham in Miq., Pl. Jungh. 2: 242 (1852); Bentham & Hooker, Gen. Pl. 1: 542 (1865); Taubert in Engler & Prantl Natürl. Pflz.fam. 3-3: 373 (1894); Dalla Torre & Harms, Gen. Siphonog. 244 (1901); Thonner, Blütenpfl. Afr. 303 (1908); id. Fl. Plants Afr. 283 (1915); Ewart & Davies, Flora of the Northern Territory, Melbourne: 152 (1917); Sprague, Kew Bull. 127: 134 (1927); Raizada in Mooney, Suppl. Bot. Bihar Orissa 52-53 (1950).

Type species: not indicated.

*Cantharosperma* Hasskarl, Cat. Bogor. 281 (1844), orthographic variant. Cf. Index Nominum Genericorum.

*Cajanum* Rafinesque, Sylva Tellur. 25 (1838).

Type species: *Cajanum thora* Rafin.

*Endomallus* Gagnepain, Not. Syst. 3: 185 (1914); Gagnep., Fl. Gén. Indochine 2: 267-269 (1916); Lackey, Synops. Phaseoleae 26 etc. (1977); Nguyen Van

Thuan, Fl. Cambodge, Laos, Viet-nam 17: 128 (1979).

Type species: Thuan merged both species to *Endomallus pellitus* Gagn., which therefore is the type species. This species is conspecific with *Cajanus goensis* (see 10.11).

*Cajanus* DC. (incl. *Atylosia*):

Perennial, rarely annual, erect *bushes*, 0.5-4 m, or creepers or climbers, strong or weak. Pubescence various. *Leaves* pinnately, sometimes digitately trifoliolate. Leaflets with vesicular glands below, membranaceous or rather thick, *stipellae* present or absent. Flowers in axillary or terminal pedunculate or almost sessile racemes, yellow, or lined with red or flag dorsally reddish, up to 3 cm long. *Bracts* small or large, caducous, bracteoles absent *Calyx* teeth acute, acuminate or elongate-acuminate, two upper ones more or less connate. *Corolla* persistent or not, vexillum obovate-orbicular, reflexed, clawed, auriculate. *Wings* obliquely obovate, auriculate, keel rounded-oblique, obtuse. *Ovary* subsessile, ovules (2-)3-10, style thickened above the middle, upcurved, upper part glabrous or slightly hairy, not bearded. *Stamens* 9 connate, vexillar stamen free, anthers uniform. Fruit a pod, linear-oblong, apex obtuse or acute, compressed, bivalved, depressed between the seeds with transverse lines, more or less septate between the seeds. *Seeds* reniform to suborbicular, shiny, white, brown, grey, purple or black, variegated or not, strophiole conspicuous or vestigial (in *C. cajan* and *C. heynei*).

Note : LUSHINGTON (1915) lists a vernacular name for *Atylosia* in Oriya: Vanadhakijati, very similar to Adhakijati for *Cajanus*. Several wild species have local names reminiscent of those of pigeonpea.

## 8 SECTIONAL ARRANGEMENT

### 8.1 DISCUSSION

In 1852 BENTHAM described four sections in *Atylosia*:

1. *Atylia* (persistent corolla, coriaceous pods, brown, hispid, depressed but not lineate between the seeds, stems erect): *A. major*, *A. candollei*, *A. lawii* and *A. lineata*.
2. *Cantharospermum* (corolla caducous before maturity, coriaceous pods, grey-tomentose, deeply lineately depressed between the seeds): *A. mollis*, *A. nivea*, *A. albicans*, *A. rugosa* and *A. scarabaeoides*.
3. *Rhynchosoides* (corolla deciduous, pods softly reticulate, hairs not grey, not so distinctly lineate between the seeds): *A. elongata*, *A. platycarpa*.
4. *Circinnaria?* (keel with coiled beak, pod stipitate, bristly): *A. Circinnalis*.

The latter species is referred to *Dunbaria*, the first three sections have been scarcely used. BENTHAM (1864) refers to the sections, BAKER (1867) recognized *Atylosia* and *Cantharospermum* (incl. *Rhynchosoides*) as subgenera. PRAIN (1897) followed Baker in this respect and mentioned that the subgenus *Cantharospermum* ought to have the generic rank as given by WIGHT and ARNOTT. He recognized section *Rhynchosoides* again, in subgenus *Cantharospermum*. TAUBERT (1894) did not alter the situation much. VON MUELLER did not describe sections, but suggested various solutions. In 1860 he classified *C. grandifolius* and *C. confertiflorus* in a section *Atylosia*. Later no formal classifications were made by him either.

The presence or absence of callosities has, apparently, played a minor role in Baker's and Prain's treatments. It is a rather cumbersome character for sectional classification and keys. Now many more species have been recognized, classification into sections is more difficult. Few convenient rather artificial characters may separate otherwise closely related species. The traditional character of persistence/non-persistence of the corolla at fruit maturity may be unreliable when few specimens are seen, the maturity stage of the specimen may make a decision difficult. Taking into account a few key characters the genus *Cajanus* could be divided into six sections. Older classifications and circumscriptions of the sections had to be slightly modified to accommodate the earlier unclassified species. Type or lectotype species have been designated.

## 8.2 KEY TO THE SECTIONS OF *Cajanus*

- 1a. Seed strophiole vestigial to conspicuous, divided, stems erect, climbing or weakly trailing . . . . . 2
- 1b. Seed strophiole large, undivided, horseshoe-shaped, stems trailing on the ground . . . . . Sect. **Rhynchosoides**
- 2a. Erect shrub . . . . . 3
- 2b. Stems trailing or climbing . . . . . 5
- 3a. Leaflets elliptic, tip acuminate . . . . . Sect. **Cajanus**
- 3b. Leaflets generally obovate, tip obtuse, acute or acuminate . . . . . 4
- 4a. Corolla persistent . . . . . **Atylia**
- 4b. Corolla caducous . . . . . **Fruticosa**
- 5a. Corolla persistent . . . . . **Volubilis**
- 5b. Corolla late caducous . . . . . **Cantharospermum**

## 8.3 THE SECTIONS OF *Cajanus*

### 8.3.1 Section **Cajanus**

Stems erect, leaflets elliptic, tip acuminate, indumentum sparse, corolla not persistent, pods large, apex long-acuminate, strophiole divided or vestigial.

*Caulis erectus, foliola elliptica, acuminata, indumentum sparsum, Corolla caduca, fructus saepe magnus, apice acuminatus, strophiola vestigialis vel magna, divisa.*

Type species: *C. cajan* (L.) Millsp.

- *C. cajan* (L.) Millsp.
- *C. cajanifolius* (Haines) van der Maesen

### 8.3.2 Section **Atylia** Benth in Miq., Pl. Jungh. 243 (1852) = Sect. *Atylosia* von Mueller, Pl. Fitzalan 9, 1860).

Stems erect, leaflets obovate or elliptic-rounded, indumentum considerable to dense, corolla persistent, pods small, apex rounded to acuminate, strophiole divided.

Lectotype species: *C. lineatus* (W. & A.) van der Maesen

- *C. cinereus* (F.v. Muell.) F.v. Muell.
- *C. confertiflorus* F.v. Muell.
- *C. lineatus* (W. & A.) van der Maesen
- *C. lanuginosus* van der Maesen
- *C. reticulatus* (Dryander) F.v. Muell.
- *C. sericeus* (Benth. ex Bak.) van der Maesen
- *C. trinervius* (DC.) van der Maesen

In the genus *Atylosia* the section *Atylia* should have been named *Atylosia*, according to modern rules. Since all species are in *Cajanus* now, Bentham's name need not to be altered.

### 8.3.3 Section **Fruticosa** van der Maesen sect. nov.

Stems erect, leaflets lanceolate to rounded, indumentum almost absent to dense, corolla not persistent, pods small to medium, apex rounded to acuminate, strophiole divided.

*Caulis erectus, foliola lanceolata ad rotundata, indumentum absens ad confertum, corolla non persistens, fructus parvus ad mediocris, apice rotundatus ad acuminatus, strophiola divisa.*

Type species: *C. kerstingii* Harms

- *C. acutifolius* (F.v. Muell.) van der Maesen
- *C. aromaticus* van der Maesen
- *C. crassicaulis* van der Maesen
- *C. kerstingii* Harms
- *C. lanceolatus* (W.V. Fitzg.) van der Maesen
- *C. latisepalus* (Reynolds & Pedley) van der Maesen
- *C. niveus* (Benth.) van der Maesen
- *C. pubescens* (Ewart & Morrison) van der Maesen
- *C. viscidus* van der Maesen

### 8.3.4 Section **Cantharospermum** (W. & A.) Benth. in Miq., Pl. Jungh. 243 (1852).

Stems climbing in grass or trees, leaflets obovate, acute to rounded, indumentum sparse to rather dense, corolla not persistent, pods small to medium, apex rounded to acuminate, strophiole divided.

*Caulis serpens vel volubilis, foliolium obovatum, acutum ad rotundatum, indumentum sparsum ad subdensum, corolla caduca, fructus parvus ad mediocris, apice rotundatus ad acuminatus, strophiola divisa.*

Lectotype species: *C. albicans* (W. & A.) van der Maesen

- *C. albicans* (W. & A.) van der Maesen
- *C. elongatus* (Benth.) van der Maesen
- *C. goensis* Dalz.
- *C. rugosus* (W. & A.) van der Maesen
- *C. scarabaeoides* (L.) Thouars

### 8.3.5 Section **Volubilis** van der Maesen sect. nov.

Stems climbing, leaflets rhomboid to obovate, acute to acuminate, indumentum considerable to dense, corolla persistent, pods small to medium, apex rounded to acuminate, strophiole divided.

*Caulis volubilis; foliola rhomboidea ad obovata, acuta ad acuminata, indumen-*

*tum subdensum ad densum, corolla persistens, fructus parvus ad mediocris, apice rotundatus ad acuminatus, strophiola divisa.*

Type species: *C. crassus* (Prain ex King) van der Maesen

- *C. crassus* (Prain ex King) van der Maesen
- *C. grandiflorus* (Benth. ex Bak.) van der Maesen
- *C. heynei* (W. & A.) van der Maesen
- *C. mollis* (Benth.) van der Maesen
- *C. villosus* (Benth. ex Bak.) van der Maesen
- *C. volubilis* (Blanco) Blanco

#### 8.3.6 Section **Rhynchosoides** Bentham in Miq., Pl. Jungh. 243 (1852).

Stems trailing, annual or perennial, leaflets elongate to rounded, indumentum sparse, corolla not persistent, pods broad, flat, apex rounded. Seed strophiole horseshoe-shaped.

Lectotype species: *C. platycarpus* (Benth.) van der Maesen

- *C. platycarpus* (Benth.) van der Maesen
- *C. mareebensis* (Reynolds & Pedley) van der Maesen
- *C. marmoratus* (R. Br. ex Benth.) F. von Mueller

This classification into sections does not always exhibit natural relationships. The climbing *C. elongatus* is an odd member of Sect. *Cantharospermum* and looks similar to the more or less erect *C. viscosus*. The erect *C. niveus* resembles climbing *C. albicans* very much. *C. villosus* looks akin to *C. scarabaeoides*, although its links with *C. crassus* are perhaps stronger. Section *Rhynchosoides*, as the name implies, is close to the genus *Rhynchosia* and crosses of *C. platycarpus* with species of other sections of *Cajanus* always failed (ICRISAT observations). *C. lineatus*, *C. sericeus*, *C. rugosus*, *C. viscidus* have some characters in common with species of various *Rhynchosia* sections.



## 9 KEYS

### 9.1 KEY TO THE SPECIES IN ASIA AND AFRICA

- 1 a Erect shrubs . . . . . 2
- b Climbing or creeping plants . . . . . 8
- 2 a Widely cultivated for seed, sometimes an escape to the wild; ripe seeds without strophiole or with small vestigial strophiole . . . . . **4 C. cajan**
- b Occurring wild; ripe seeds with conspicuous strophiole . . . . . 3
- 3 a Leaflets elliptic-acuminate . . . . . 4
- b Leaflets obovate, tip rounded or acute . . . . . 6
- 4 a Leaflets with acute tip, indumentum greyish short . . . . . 5
- b Leaflets thick, with rounded tip, indumentum golden brown, copious, long on leaf margin (S India, Sri Lanka, hill tops) . . . . . **29. C. trinervius**
- 5 a Leaflets short-elliptic; pod wall thick, sutures 1 mm wide, tipped by ca 10 mm style (W Africa) . . . . . **14. C. kerstingii**
- b Leaflet as long-elliptic; pod wall thin, sutures inconspicuous, tipped by ca 2 mm style (E Central India) . . . . . **5. C. cajanifolius**
- 6 a Leaves pinnately trifoliolate, leaflets rounded-obovate, whitish below; pods 4-6 seeded (Burma) . . . . . **22. C. niveus**
- b Leaves digitately trifoliolate, leaflets obovate-oblong, glaucous-green below . . . . . 7
- 7 a Leaflets broad, with acute to rounded tip, stipules short, 2-3 mm (India, W Ghats) . . . . . **18. C. lineatus**
- b Leaflets narrow, with rounded tip, stipules long, above 5 mm (India, W Ghats, E Ghats) . . . . . **28. C. sericeus**
- 8 a Annual creeper in grass, pods flat, broad, papery . . . . . **23. C. platycarpus**
- b Perennial creepers or twiners, pods narrower, more rounded and thicker . . . . . 9
- 9 a Leaves pinnately trifoliolate . . . . . 10
- b Leaves (sub)digitately trifoliolate . . . . . 16
- 10 a Leaflets membranaceous, thinly puberulous, pods with long caducous hairs . . . . . 11
- b Leaflets thick, more or less short indumentum . . . . . 12
- 11 a Calyx with few conspicuous bulbous-based hairs (Philippines) . . . . . **32. C. volubilis**
- b Calyx with fine hairs (India, Sri Lanka) . . . . . **13. C. heynei**
- 12 a Leaflets small, elliptic or obovate-obtuse, twiner in grasses (Asia, Africa, Australia) . . . . . **27. C. scarabaeoides**
- b Leaflets larger, obovate-acuminate, climber in shrubs and trees . . . . . 13
- 13 a Flowers large, ca 25-30 mm (NE India, China), corolla persistent, calyx with bulbous-based hairs . . . . . **12. C. grandiflorus**

- b Flowers generally smaller, less than 15-28 mm long, calyx hairs not bulbous-based . . . . . 14
- 14 a Indumentum fine, spreading, green, bracts very hairy; corolla not persistent (India, SE Asia) . . . . . **11. C. goensis**
- b Indumentum short, dense and grey or golden brown below, bracts short-puberulous; corolla persistent . . . . . 15
- 15 a Leaflets semi-coriaceous, densely grey-hairy below, end leaflets longer than broad; pods 8-10 seeded; flowering after the monsoon (Himalaya foothills above 800 m) . . . . . **21. C. mollis**
- b Leaflets coriaceous, brown-pubescent below, end leaflets broader than long; pods 3-5 seeded; flowering the first months of the year (India, below 800 m, SE Asia) . . . . . **9. C. crassus**
- 16 a Leaflets obovate-rounded (S India, Sri Lanka) . . . . . 17
- b Leaflets obovate-acuminate (NE India) . . . . . 18
- 17 a Strong climber in trees, leaflets silvery below; pods (3-)5-6 seeded . . . . . **2. C. albicans**
- b Twiner in grasses, leaflets reticulate, densely grey-hairy below, pods (2-)3-4 seeded . . . . . **26. C. rugosus**
- 18 a Slender herbaceous twiner in grasses, woody rootstock; pods small 2-2.5 X 0.5-0.8 cm, reticulate, 3-4 seeded, glabrescent . . . . . **10. C. elongatus**
- b More robust twiner; pods larger 2-3.5 X 0.8-1.1 cm, not reticulate, 5-6 seeded, densely pubescent with long brown hairs . . . . . **30. C. villosus**

## 9.2 KEY TO THE SPECIES IN AUSTRALIA AND NEW GUINEA

- 1 a Shrubs, erect or with straggling branches . . . . . 2
- b Prostrately creeping plants, branches twining at the ends . . . . . 13
- 2 a Cultivated, in Australia rather a new crop, or as an escape to the wild; ripe seeds without strophiole or with small vestigial strophiole **4. C. cajan**
- b Occurring wild, ripe seeds with conspicuous strophiole . . . . . 3
- 3 a Leaflets narrow-lanceolate, 3 (or 1) per leaf . . . . . **15. C. lanceolatus**
- b Leaflets rhomboid, ovate, obovate or rounded, 3 per leaf . . . . . 4
- 4 a Leaves digitately trifoliolate . . . . . **7. C. confertiflorus**
- b Leaves pinnately trifoliolate . . . . . 5
- 5 a Leaflets thin-coriaceous to membranaceous, pubescence very short, apex acute . . . . . 6
- b Leaflets thick-coriaceous, pubescent, apex more obtuse . . . . . 8
- 6 a Shrub with straggling branches, leaves viscid . . . . . **31. C. viscidus**
- b Shrub erect, leaves glandular but not sticky . . . . . 7
- 7 a Leaflets elongate to rounded-ovate, apex acute, almost non-aromatic; pods (1-)2-4 seeded . . . . . **1. C. acutifolius**
- b Leaflets broadly ovate, apex acute, aromatic; pods (6-)8-10 seeded . . . . . **3. C. aromaticus**

- 8 a Stems very thick also towards the apex, whitish-pubescent; leaves very thick . . . . . 9
- 8 b Stems thin also towards the apex, pubescence grey or brown; leaves reticulate, not so thick . . . . . 10
- 9 a Indumentum white, very dense, covering stems and leaves; inflorescences much longer (up to 14 cm) than the leaves (up to 7 cm) **8. C. crassicaulis**
- b Leaves woolly, green with yellow-brown veins, young stems and peduncles visible through the white hairs; inflorescence as long as the leaves (up to 8-9 cm) . . . . . **16. C. lanuginosus**
- 10 a Calyx teeth lanceolate or acuminate . . . . . 11
- b Calyx teeth broad-acuminate . . . . . **17. C. latisepalus**
- 11 a Leaflets often large, rhomboid to rounded, to 12.5 cm long, tip acute to rounded, pubescence relatively thin, hairs long, on new leaves and branches dense and conspicuously golden brown, more rarely grey; calyx teeth linear-lanceolate, curved in open flower . . . . . **25. C. reticulatus**
- b Leaflets smaller, to 5(-7) cm long, elliptic to obovate, tip obtuse, pubescence silvery grey to brown; calyx teeth short-acuminate . . . . . 12
- 12 a Leaflets quite thick, upper side reticulate, veins concolorous, top leaflets with 5-6(-8) pairs of major secondary veins, pubescence short, greyish below, not filling reticulations; pods narrow, short, pubescent, sutures narrow . . . . . **24. C. pubescens**
- b Leaflets thick, upper side flat, veins whitish, top leaflet with 7-9 pairs of major secondary veins, pubescence very short, close, velvety, filling reticulations; pods broad, grey-velvety, pubescence very short, sutures broad . . . . . **6. C. cinereus**
- 13 a Leaflets rounded, apex obtuse or emarginate or acuminate; pods flat, broad . . . . . **20. C. marmoratus**
- b Leaflets obovate or lanceolate . . . . . 14
- 14 a Leaflets lanceolate; pods broad, flat, variegated with purple . . . . . **19. C. mareebensis**
- b Leaflets obovate; pods small, more rounded, uniformly coloured . . . . . **27. C. scarabaeoides**

## 10 ALPHABETICAL TREATMENT OF SPECIES

### 10.1 *Cajanus acutifolius* (F. v. Muell.) van der Maesen comb. nov.

Fig. 1, p.53, Map 2, p. 54

*Cajanus acutifolius* (F. von Mueller) van der Maesen comb. nov.

Basionym: *Atylosia acutifolia* F. v. Muell., Pl. Fitzalan 9 (1860).

Lectotype: Australia, Northern Territory, Upper Victoria River, F. von Mueller s.n. (K; MEL 61477 teste REYNOLDS & PEDLEY, 1981).

Paratype: Australia, Northern Territory, Gulf of Carpentaria, F. von Mueller s.n. (MEL? not seen).

Homotypic synonyms: *Rhynchosia acutifolia* (F. v. Muell.) F. v. Muell. ex Benth., Fl. Austral. 2: 264 (1864); F. v. Mueller, Census Austral. Pl. Suppl. 1-4: 41 (1881); F. v. Mueller, Second Census Austral. Pl. 71 (1889); Bailey, Queensland Fl. 2: 440 (1900). Based on *Atylosia acutifolia* F. v. Muell.

Other specimens cited by BENTHAM: Australia, Queensland, Gilbert River, F.v.Mueller s.n. (not seen); NW Coast, A.Cunningham (K).

*Atylosia acutifolia* (F.v.Muell. 'ex Benth.') Reynolds & Pedley, Austrobaileya 1-4: 423 (1981), based on *Atylosia acutifolia* F. v. Muell.

Heterotypic synonym: *Rhynchosia quadricalloso* Domin, Bibliothek. Bot. 89: 782 (1926); Reynolds & Pedley, Austrobaileya 1-4: 423 (1981).

Type: Australia, Queensland, Savanna forests near Pentland, Domin III 1910 (holo: PR, not seen).

Erect or spreading *shrub*, 1-2 m. *Branches* and leaves covered with short silvery hairs, terminal young shoots brown-hairy, vesicular glands prominent, especially frequent on calyx and pods. *Branches* striate, old and young parts terete. *Stipules* small, triangular, ca 1 mm long, persistent. *Leaves* pinnately trifoliolate, petiole 0.9-2.5(-3) cm, rachis 4-9 mm. *Leaflets* coriaceous, glandular-punctate both sides, dull green and silvery-hairy above, glaucous-green and silvery-hairy below also on prominent ribs, top leaflet elongate-ovate to rounded-ovate, 2-5(-7) cm long, 0.5-1.8(-2.5) cm wide, apex acute, mucro inconspicuous, base cuneate, side leaflets ovate, 1.5-3.3 cm long, 0.4-1.6(-2.2) cm wide, apex acute, petiolules 1.5-2(-3) mm long, stipellae absent. *Racemes* mostly short, 1-3 per leaf axil, 3-8(-10) flowered at the tip, peduncles 1.8-4.5(-8) cm long, pedicels 3-6 mm, nodes prominent at fruiting stage, internodes 0.5-2 mm often zig-zag

FIG. 1. *C. acutifolius*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X (1, 7-9: *Remanandan* 4254; 2-6: idem, cult. ICRISAT).



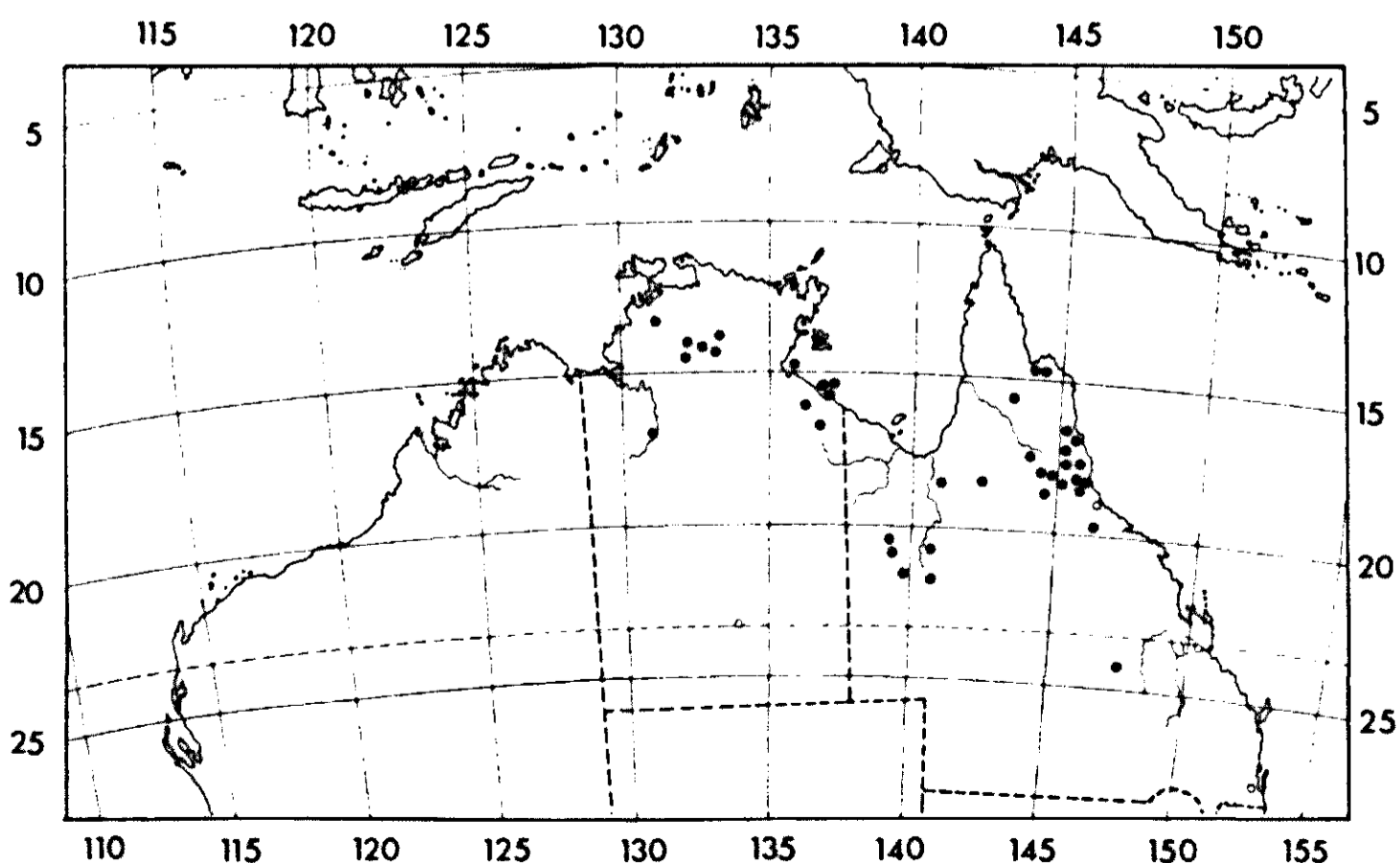
oriented, flowers yellow, flag dorsally streaked orange, reddish-brown or purplish, late-caducous. *Bracts* small, obtuse scales, ca 1 mm, pubescent at the peduncle but darker brown, caducous. *Calyx* pubescent, interior also, glands prominent, tube 2-4 mm, teeth lanceolate, the upper ones connate except at the tip, ca 2-5 mm, the lower one longest. *Vexillum* obovate, ca 13 mm long, 11 mm wide, base clawed, auriculate, margins of auricles introflexed, two callosities near the base. *Alae* obovate, ca 13 mm long, 4 mm wide, base obliquely biauriculate. *Keel* petals oblique, ca 12 mm long, 5 mm wide, ventrally adnate. *Ovary* densely white-pubescent, ca 3 mm long, 2-4 ovules. *Style* ca 11 mm long, last 5 mm upcurved, base pubescent, curve flattened, stigma not broadened. *Stamens* ca 15 mm long, free part 5 mm, upcurved, anthers dorsifix. *Pods* oblong, 1.5-2.3 cm long, 0.6-1 cm wide, rounded or rounded-acuminate at the tip, cuneate at the base, densely covered with yellow glands and short silvery hairs, transverse depressions oblique, base of the style quite persistent, (1-)2-4 seeds. *Seeds* oblong, (greyish) brown with black mosaic, or dark brown, ca 3-4 mm long, 2 mm wide and thick, strophiole prominent, divided.

**Distribution:** Australia, Northern Territory, Queensland and Western Australia.

**Ecology:** Near rocks, in stony soils, sandhills, on riverbanks, in speargrass (*Heteropogon contortus*), *Acacia* and *Eucalyptus* open forests, remarkably drought tolerant.

**Altitude:** 0-600 m.

**Flowering:** Feb-Apr, Jun, Jul, Dec (NT); Feb, Apr-Sep (Qld).  
**Fruiting:** Mar-Apr, Jul, Oct (NT); Feb, Apr-Sep (Qld).



MAP 2. *Cajanus acutifolius*

### Specimens examined:

AUSTRALIA, NORTHERN TERRITORY: Vanderlin Island, *Anon. s.n.* (MEL); *ibid.*, island g in the Gulf of Carpentaria, *R. Brown 4208* (BM); Groote Eylandt, Bartalumba Bay, *Dunlop 2645* (CANB); Maria Island, Gulf of Carpentaria, *id. 2791* (BRI, NT); Wessel Islands, *Latz 3348* (CANB, K, NT); ca 9 km N of Pine Creek township, *Lazarides & Adams 147* (CANB); ca 17 km SW of Mt Gilruth, *Lazarides 8013* (BRI); Camp Site, Port McArthur Island, Edward Pellew Group Islands, *McKean EP 51* (CANB); Upper Victoria River, *F. von Mueller s.n.* (K); Coomalie Creek, *Parker 363* (CANB); 48 km S of McArthur River Station, *Perry 1722* (CANB); 3 km E of Borroloola Station, *id. 1790* (CANB); 25 km WSW of Victoria River Downs Station, *id. 2097* (CANB); nr Jabiluka Mining Project, *Remanandan 4269* (ICRISAT); 16 km E of Moline, *id. 4271* (ICRISAT); Edith River Falls, *Wilson 357* (CANB).

QUEENSLAND: Herbert River, *Anon. s.n.* (MEL); Tait (Tate ?) River, *Weldon Birch & Zelling s.n.* (MEL); NW Coast, *Cunningham s.n.* (K); Basalt Walk, Fletchers Creek, *Daintree s.n.* (MEL); N Kennedy distr., *id. s.n.* (MEL); Herbert River, *Dallachy 153* (MEL); *ibid.*, *id. s.n.* (MEL, 4 sheets); S of Selwyn, Gregory N distr., *Gittins 711* (BRI); Duchess, *Hubbard 7374* (BRI, K, L); Upper Gilbert River, *Stephen Johnson s.n.* (MEL, P); Springsure, *W.T. Jones 3526* (CANB); Trinity Bay, *Karsten s.n.* (MEL); Clare, *Kleinschmidt 144* (BRI, CANB); Boyle Creek, NW of Mareeba, *McKee 9166* (CANB, K); Mt Isa, Burke distr., *Mrs Morris s.n.* (BRI); Rockingham Bay, *von Mueller s.n.* (MEL, P); NW Highway, 9.7 km W of Mt Isa, *Ollerenshaw & Kratzing 1223* (BRI); Red Falls picnic area, Greenvale area, *Remanandan 4217* (ICRISAT); nr Almaden 4 km E, *id. 4254* (ICRISAT, WAG); 21 km W of Gordonvale on Yungaburra Highway, *id. 4266* (ICRISAT); Walkers Creek, Burke distr., *Scarth-Johnson 343 A* (BRI); Concurry, *id. 523* (BRI, K); 5.6 km E of Almaden on Petford rd, *Staples 2306* (BRI, ICRISAT); Picnic Hole on Walsh river upstream of Mungana crossing, *id. 2474* (BRI, ICRISAT); along Gillies Highway 5-12 km above Little Mulgrave river, *id. 2478 A & B, 2479 A & B* (BRI, ICRISAT); Almaden hills, *Theuston 574* (BRI); Black Rock 26 km S of Lynd Junction on Hann Highway between Hughenden and Mt Garnet, *Webb & Tracey 10148* (BRI); Palmer River, *Wycliffe 72* (MEL).

WESTERN AUSTRALIA: outside vine thicket at 'Helipoint', Mitchell Plateau, North end, Beard 8456 (PERTH).

Notes: Although purely bi-ovuled and two-seeded specimens exist, many do possess 3- and 4-seeded pods. VON MUELLER named the species an *Atylosia*, BENTHAM classified it under *Rhynchosia*. The situation is similar to that in *C. lineatus*. In agreement with REYNOLDS and PEDLEY (1981) I judge this species to belong to *Cajanus* (incl. *Atylosia*) rather than to *Rhynchosia*. The type specimens could not be inspected, but protologues, lectotype and specimens cited by BENTHAM left no doubts.

*Latz 3348* is a specimen with almost obtuse, rounded-ovate leaflets, which are very silvery-shiny. In *McKean EP 51* and *R. Brown 4208* many leaflets have an acuminate leaflet base, but otherwise fit perfectly into the species. Leaf size, seed number per pod and indumentum are the more variable characters in *C. acutifolius*.

### 10.2 *Cajanus albicans* (W. & A.) van der Maesen comb. nov.

Fig. 2, p.56, Map 3, p. 58, Plate 1, p. 59

*Cajanus albicans* (WIGHT & ARNOTT) van der Maesen comb. nov.

Basionym: *Cantharospermum albicans* W. & A., Prodr. 256 (1834)

Type: India, Dindigul Hills at an elevation of 2500 feet, Wight 759a (holotype: E; isotypes: B, C, E, G, P).





Homotypic synonym: *Atylosia albicans* (W. & A.) Benth. in Miq., Pl. Jungh. 1: 243 (1852); Thwaites, Enum. Pl. Zeyl.: 91 (1864); Baker in Hooker, Fl. Brit. India 2: 215 (1876); Taubert in Engl. & Prantl, Natürl. Pflz.fam. 3-3: 373 (1894); Trimen, Hand-Book Fl. Ceylon 2: 78-79 (1894, repr. 1974); Willis, Ann. Roy. Bot. G. Peradenya 4-7: 494 (1910); Rama Rao, Flow. Pl. Travancore: 127 (1914); Gamble, Fl. Presid. Madras 2: 369 (1918), 260 (repr. 1967); Matthew, Materials Fl. Tamilnadu Carnatic 181 (1981); id., Illustr. Fl. Tamilnadu Carnatic 182 (1982).

Heterotypic synonyms: *Cajanus albicans* Graham ex Wallich, nom. nud., Wallich's Cat. 5582 (1831), based on: India, *Wallich 5582* (Wallich 5582c: *Rhynchosia?* *Kennedia?* Hb. Wight (E, G, K).

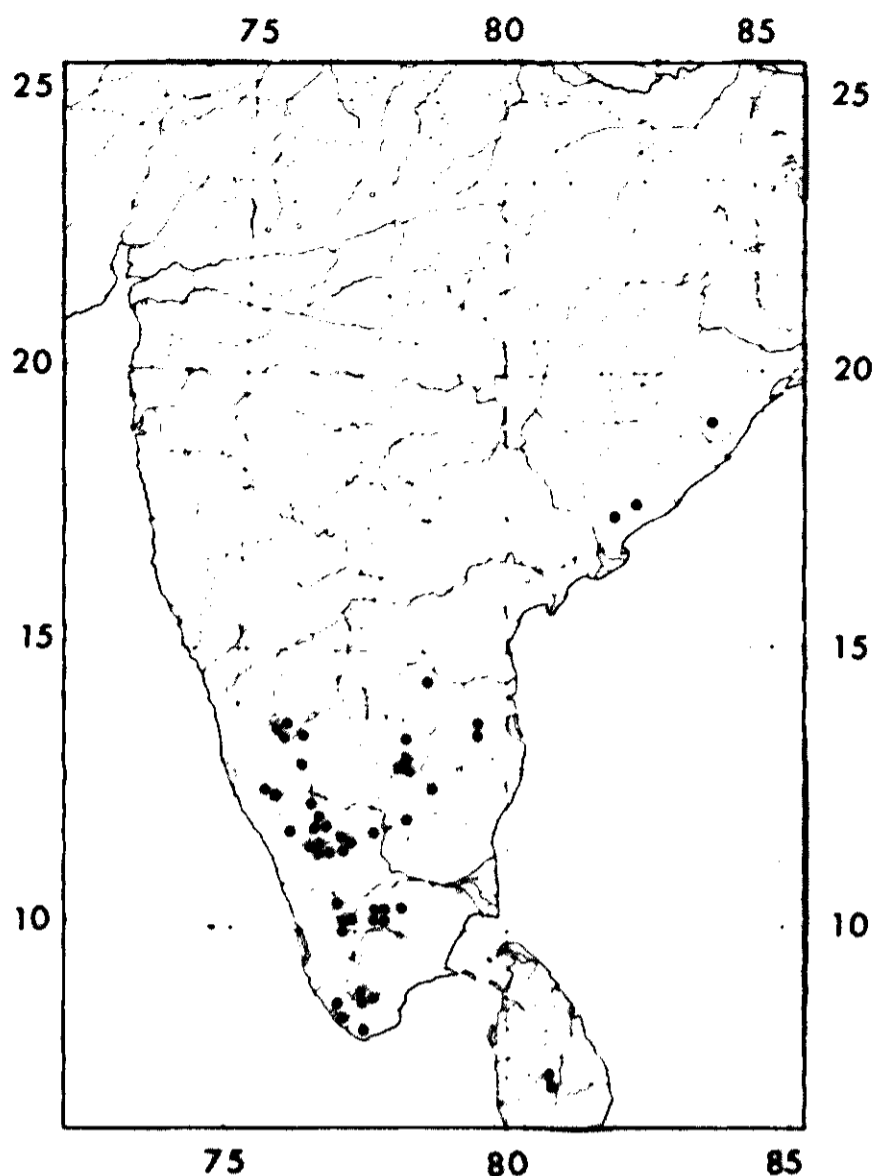
*Cajanus wightianus* Graham ex Wall., Wallich's Cat. 5583 (1831) nom. nud., based on: India, Dindigul Hills from 1500 to 2500 feet above the sea among bushes, *Wallich 5583 Hb. Wight* (BR, CAL, E, G, K, MEL, W).

*Cajanus wightii* Graham ex W. & A., Prodr. 1: 256 (1834). Orthographic variant.

Type: *Wallich 5583 Hb. Wight* (K, holo).

Climber, perennial, base woody. *Branches* green, whitish pubescent, terete, up to ca 6 m long. *Stipules* triangular-acute, ca 2 mm long, pubescent, inconspicuous, caducous. *Leaves* subdigitately trifoliolate, petiole 1-3.5 cm, rachis 0-4 mm. *Leaflets* coriaceous, glandular-punctate below, lower surface densely grey-pubescent with short adpressed hairs in all directions, ribs prominent, grey-pubescent, with long and short hairs, upper surface green, thinly pubescent more so on the ribs, top leaflet obovate or rounded, apex obtuse or subacute, mucronate, base cuneate, 19-42 mm long, 15-34 mm wide, side leaflets somewhat obliquely obovate or rounded, apex and base as in top leaflet, 16-32 mm long, 12-28 mm wide, petiolules ca 2 mm, stipellae very minute, pubescent, setaceous, 1 mm. *Racemes* lax, 1-4 (Baker: 12) flowered, short, peduncle 8-30 mm, pedicels filiform, 6-12 mm, in fruit sturdier, flowers yellow, once reported orange (Rama-murthy 23485), sometimes standard brown based. *Bracts* very minute, triangular, 1 mm, pubescent. Calyx pubescent (interior also), hairs grey, uniform, short, tube 2-3 mm, teeth triangular 1-4 mm long, the upper ones almost entirely connate. *Vexillum* obovate, base clawed, auriculate, apex emarginate, 15-20 mm long, 10-15 mm wide. *Alae* obovate, base clawed, biauriculate, ca 15 mm long, 5 mm wide. Keel petals rounded-oblique, clawed, ca 15 mm long. *Ovary* densely white-pubescent with short hairs, ca 6 mm, style ca 13 mm, pubescent, top 5 mm upcurved, glabrous, stigma capitate. *Stamens* ca 18 mm, last 3 mm free, upturned, anthers dorsifix. *Pods* oblong, 1.5-3.5 cm long, 7-12 mm wide, densely

FIG. 2. *C. albicans*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X (1-9: *van der Maesen 2648*).



MAP 3. *Cajanus albicans*

covered with short adpressed hairs, transverse depressions at more or less right angles to the sturdy sutures. Tip of style remains, (2-)5-7 seeds. *Seeds* rectangular-rounded, about 5 mm long, 3 mm wide, 2-3 mm thick, grey and black mosaic; strophiole divided, greenish, 1 X 2 mm.

**Distribution:** Peninsular India, Sri Lanka.

**Ecology:** Tropical dry deciduous forests or scrub vegetation.

**Altitude:** 500-1700 m.

**Flowering:** Oct-Jan (-Apr).

**Fruiting:** (Nov) Dec-Apr.

#### Specimens examined:

INDIA: ANDHRA PRADESH: Cuddapah distr.: Cuddapah hills, *Beddome* 2272 (BM). Chittoor distr.: Tirumalai, road to Papavinasam, *van der Maesen* 2356 (K, ICRISAT, WAG); Tirupathi hills top, *Saldanha* 15189 (JCB, K, US); Ballapalle, *Wagh* 7643 (BLAT). Vishakhapatnam distr.: Lamsingi Ghat, *Gamble* 21800 (K). E. Godavari distr.: Ettakonda, *Narayanaswami et al.* 100 (CAL); way to Yarlagadda nr Nulakamaddi, *id.* 324 (CAL). Karnataka: Maisor and Carnatic, *Hooker and Thomson* (E, U); *ibid.* *Thomson s.n.* (BR, DD, E, G, K, L, MEL, OXF, P, STU, US, W). Coorg distr.: Manchanhalli, *Arora* 46018 (BSI); Nagarhala, *id.* BSI 24150 (BSI). Bangalore distr.: Banergatta forest sanctuary, 20 km from Bangalore, *Govindu* 170 (UAS); Bangalore, *Lawson s.n.* (OXF); Banergatta National Park, *van der Maesen* 2337 (K, ICRISAT, WAG); Bangalore, *Munro* 788 (K); Ragihalli, Banergatta National Park, *Saldanha* 18539 (JCB). Chikmagalur distr.: 5 and 12 km N of Chikmagalur, Bababudan hills, *Kameswara Rao & Chandra* 138, 145 (ICRISAT, WAG); Santa-veri, Bababudan hills, *Meebold* 10055 (CAL, E). Hassan distr.: Nagpuri, *Jarrett and Ramamoorthy*



PLATE 1. *Cajanus albicans*, climber in a tree in Bandipur forest, Mysore district, S India, 930 m.

s.n. (JCB, US); Shigegudda Hill Top, *Saldanha* 9189-9191 (JCB); Hassan, *Wadhura* 24053 (BSI). Kolar distr.: Nandi hills, 2 km below top, *van der Maesen* 3023 (ICRISAT, WAG). Mysore distr.: near Bandipur, *van der Maesen* 2648, 2652, 3357, 3360 (ICRISAT, WAG); Bandipur, *Meebold* 11541 (CAL); *ibid.*, *Naithani* 23103 (MH); Chamundi hills (nr Mysore), *Raghavendra Rao* 1455 (MGM). Kerala: Trivandrum distr.: Trivandrum, *Lawson* 254 (CAL, K); *ibid.* *Meebold* 12651 (CAL); SE of Trivandrum, Valluvankal, 1 km to Balmore, *Remanandan* 4816 (ICRISAT, WAG). Cannanore distr.: Manantody (Manantavadi), *Lawson* s.n. (OXF). Idiki distr.: Kandahur H.R., Travancore, *Barnes* s.n. (DD); Travancore High, Range Mashi Shola, *id.* 79 (A); Kottur, *id.* 933 (GH); 42 km N of Munnar, *van der Maesen* 3472 (ICRISAT); Santhanpara, Travancore, *Meebold* 13229 (CAL). Maharashtra: Bombay, *Dalzell* s.n. (DD, K); Konkan, *Stocks* s.n. (K, OXF); Malabar, Konkan, *Stocks & Law* s.n. (BM, C, FI, G, L, P, W). Tamil Nadu: Coimbatore distr.: Dhimbam, *Barber* 8607 (K); Hassanur, *Fischer* 596 (CAL); Bolampatti valley, *id.* 1509 (CAL); Hassanur, Kodaikanal, Oothu rd, *Ramamurthy* 23485 (MH); 131 (DD); Kollegal, Arepalagam, *Naganathan* 78662 (MH); Pannaikadu-Kodaikanal, Oothu rd, *Ramamurthy* 23485 (MH); Vellingiri to Vellumalai, *Sebastine* 2428 (CAL, MH); Shiruvani, *K. Subramaniam* 1775 (CAL, MH); Sadvayil, *K.N. Subramaniam* 1018 (L). Dharmapuri distr.: Denkanikotta taluk, Ayyur, Tholuvabetta Reserve Forest Kamagiri, *Matthew & Venugopal* 17095 (RHT); Kundulkottai Reserve Forest, 8 km to Anchetty, *id.* 20368 (RHT); Javalagiri towards Yellumalarakoil, *Matthew* 24508 (RHT); Harur taluk, Chitteri hills, Alangalmalai slopes, *Venugopal* 20856 (RHT). Kanyakumari distr.: Kottur forest, *Barnes* 933 (GH). Madurai distr.: Machur, lower Palni hills, *Bourne* 661 (CAL); *ibid.*, *id.* 886 (K); Kodaikanal Ghat, km 13 and Poombarai Valley, *id.* 2570 (K); 20 km SE of Kodaikanal, path to Dolmen Circle, *van der Maesen* 3555 (ICRISAT, K, WAG); Villipatti (nr Kodaikanal), *van Malderen* 1347 (CAL); 28 km to Kodaikanal, *A.N. Murthi* 582 (ICRISAT); Shoranur, *Rapinat* s.n. (RHT); Punalur, *id.* s.n. (RHT); Foot of Kodai hills, *id.* s.n. (RHT); Kodaikanal, *id.* s.n. (RHT); Kodaikanal 1300 m, *Saulière* 512 (K); *ibid.* 471 m, *id.* 527 (K). Nilgiri distr.: Nilgiris, *Cleghorn* s.n. CAL; *ibid.*, coll. *Wight in herb.* *Dalzell* s.n. (CAL); Devala, SE Wynad, *Gamble* 15535 (CAL); Kolakamki, *id.* 16773 (BSI); Adderley, *Rathakrishnan* 39165 (MH); Madanad Res. Forest, *Vajravelu* 39539 (MH); Kielkudah-Pegumbahalla, *id.* 43602 (MH). North Arcot distr.: Elagiris nr Jalarpet, *Barnes* s.n. (DD); Way to Kambukundi, Javadi hills, *Subramanyam* 7432 (MH). Ramanathapuram (Ramnad) distr.: Way to Virusadi, Mudaliaruthu, *Vajravelu* 76789, 76790 (MH). Salem distr.: Attur taluk, Chinnakalrayam, Sengudamparuthai, *Alphonse Amalraj* 10789 (RHT); Pacchaimalais, Kannimar shola, way to Kaikatty from Karupankaduthittu, E forest, *Arochiasamy* 7014 (RHT); Kavery Peak, Yercaud, *Deb* 31261 (MH); Attur taluk, Kottapatti to Thenkalvaraj, *Jayaseelan* 21918 (RHT); Namakkal taluk, Kollis, Solakkadu, to Semmedu, *Karunanidhi* 9606 (RHT). N. Salem distr.: *Krishnan* s.n. (DD); Kolli hills, Semmedu, *Manoharan & Alamelu* 18146 (RHT); Solakkadu to Semmedu, *Matthew* 4720 (RHT); Shevaroy hills, Mohanad, off Semmanatha, *Matthew et al.* s.n. (RHT); Kollimalai, Sirumalai, *id.* 8115, 8412 (RHT); Pacchaimalais, Kannimar shola, way to Kaikatty from Karupankaduthittu, Puthur, *id.* 10597 (RHT); Karupankaduthittu, *id.* 11708 (RHT); Rasipuram taluk, Bodaimalais, Melur, Thanikalkottu, *id.* 15362 (RHT); Shevaroy hills or Sirra Mullay, *Wight* 772 (C, L, K, MEL, P). Tiruchirapalli distr.: Thuraiyur taluk, Pacchaimalais, top of Sengattupattu, *Matthew & Rajamani* 524 (RHT); *ibid.*, *Matthew et al.* 28998 (RHT). Tirunelveli distr.: Courtallum, Five Falls Reserve Forest, *van der Maesen* 3072 (ICRISAT, WAG); Courtallum, *Rama Rao* 2074 (CAL); *ibid.*, *Wight* 256 (E).

SRI LANKA: nr Bibile, Uva prov., *Anon.* s.n. (PDA); Teldenya, *Alston* 1789 (K, PDA); Hantani, *Gardner* 241 (BM, FI, K); *ibid.*, *id.* CV 2783 (PDA); Haragama, Kandy distr., *Jayasuriya & Balasubramaniam* 445 (PDA, US); 1 km W of Urugala, Kandy distr., *van der Maesen* 4023 (ICRISAT, WAG); Peradenya junction, *de Silva* s.n. (PDA); Urugala, *Simpson* 9129 (BM); Bundala coastal dunes, Hambantota distr., *id.* 9953 (PDA); *Thwaites* (BM, CAL, G, P, W); *Walker* (E, FI, PDA); Mulhalkelle, Nuwara Eliya distr., *Worthington* 5649 (BM).

Notes: Two morphologically identical accessions of *C. albicans*: *van der Maesen* 2337, collected near Bangalore, and another, *van der Maesen* 2356 collected near Tirumalai, were sown in the Botanical Garden at ICRISAT on 30-7-1976 and 18-8-1976 respectively. The Bangalore accession flowered within two

months on 18-9-1976, whereas the Tirumalai accession did not flower until 20-11-1977. This difference may originate from differential local adaptation or, less likely, from a sharply delineated photoperiod reaction. Table 2 includes different accessions, which flowered in either the first year or the second. In 1981, and 1982 the difference between accessions was again marked, some did flower only feebly, but resumed full flowering and fruiting the next season.

R.S. RAO (1964) reported *Cajanus albicans* from Nulakamaddi and Ethakonda in E. Godavari district of Andhra Pradesh. In 1980 and 1981 the species was found near Paderu in Vishakapatnam district (VAN DER MAESEN, KAMESWARA RAO), the northernmost locations of the species.

*C. albicans* offers some antibiosis to podborers (*Heliothis armigera* Hubn.) but is vulnerable to *Tanaostigmodes*, a hymenopteran pigeonpea pest.

### 10.3 *Cajanus aromaticus* van der Maesen sp. nov.      Fig. 3, p.62, Map 4, p. 63

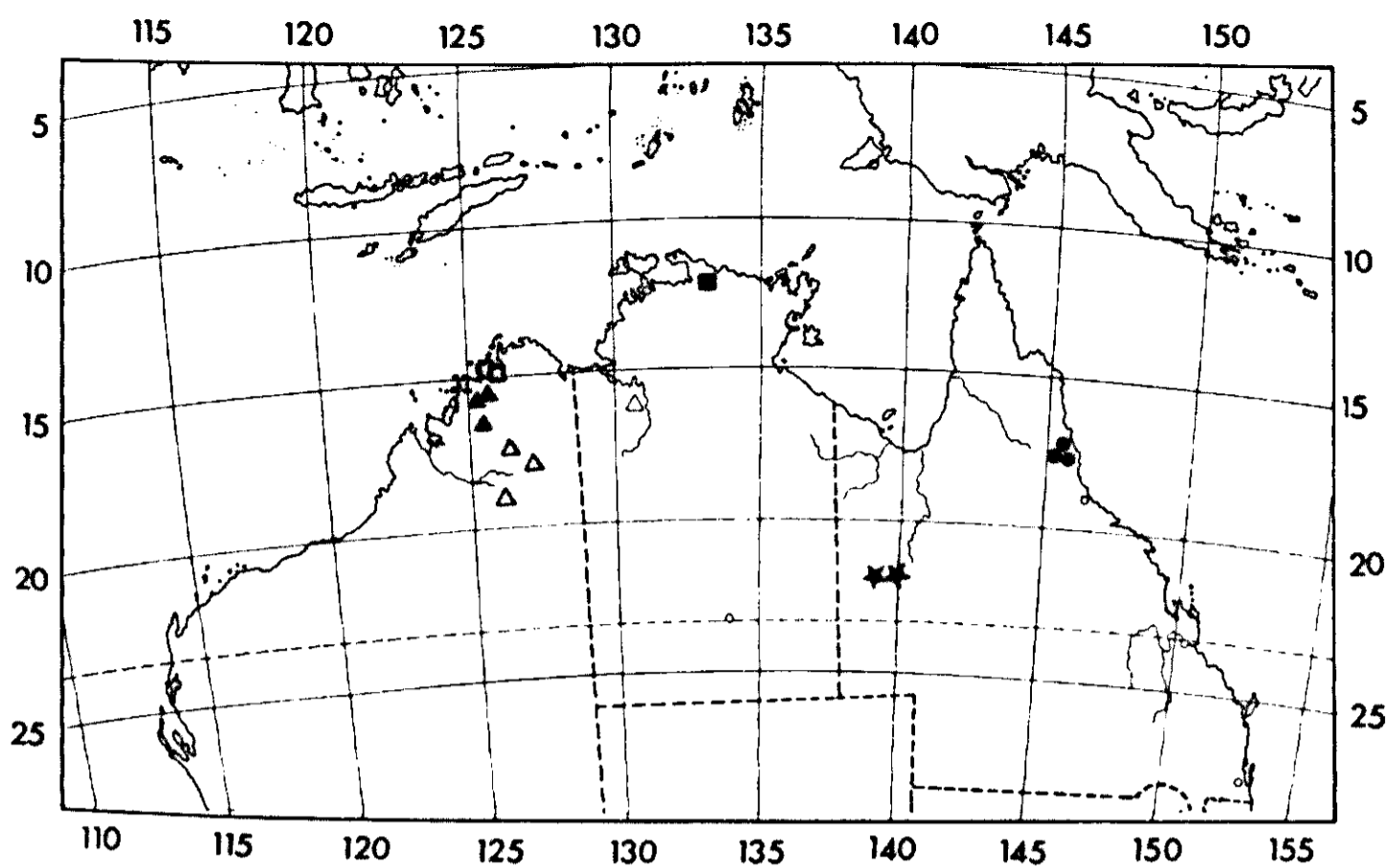
*Cajanus aromaticus* van der Maesen sp. nov.

Type: Australia, Northern Territory, Nimbuwah Rock, 45 km E of Oenpelli, J.R. Maconochie 1600 (holo: NT; iso: CANB, K).

*Frutex ad 2 m, Caulis erectus striatus, indumentum brevissimum. Folia trifoliolata, pinnata, foliolae ovatae, membranaceae, aromaticae, glandulae conspicuae. Calyx pubescens, dentibus triangularibus, glandulae parvae. Legumina oblonga, indumentum brevissimum, semina 8-10, rotundata-rectangularis, strophiola seminum divisum.*

Erect *shrub*, up to 2 m high, with upright striate branches. *Indumentum* very short, dense, stipules small, caducous, triangular scales of 1 mm long. *Leaves* pinnately trifoliolate, distinctly aromatic as in *Labiatae*, petiole striate, ca 1-2.5 cm, rachis striate, 0.4-0.7 cm, petiolules 1-3 mm long. *Leaflets* thin-coriaceous, almost membranaceous, glandular-punctate both sides, dull olive green, veins hardly sunken above, whitish green below, veins raised. Top leaflet ovate, 2.5-5 cm long, 2-3.3 cm wide, tip obtuse or acute, or slightly emarginate, base truncate to rounded, side leaflets obliquely ovate, 2-4 cm long, 1.5-2.2 cm wide, tip obtuse to acute, base truncate to rounded. *Stipellae* minute, as prolongation of striation, or absent. *Racemes* terminal or axillary, 1-3 per axil or node, up to ca 6-flowered, peduncles up to 4(-5) cm long, pedicels 5-7 mm long, flowers caducous, corolla not available for dissection, colour not reported. *Calyx* thinly glandular and pubescent, interior more copiously covered with fine white hairs, tube ca 3 mm, teeth ca 3-4 mm long, upper ones short and almost connate. *Stamens* ca 17 mm long, rather persistent. *Pods* sturdy, oblong, 3-4 cm long, ca 0.9 cm wide, base tapering, apex obtuse tipped with base of style, transverse depressions at a straight angle to the suture, sutures somewhat undulate, 8-10 seeded. *Seeds* rectangular-rounded, ca 4 mm long, 3 mm wide, 12 mm thick, brown to dark brown, strophiole conspicuous, brownish, divided.





MAP 4. ■ *Cajanus aromaticus*, △ *Cajanus crassicaulis*, ▲ *Cajanus lanceolatus*, ★ *Cajanus lanuginosus*, ● *Cajanus mareebensis*, □ *Cajanus viscidus*

Distribution: Australia, Northern Territory.

Ecology: Growing among broken sandstone boulders.

Flowering: Apr-May.

Fruiting: Jun.

Specimen examined:

AUSTRALIA, Northern Territory, Nimbuwah Rock, 45 km E of Oenpelli, *J.R. Maconochie 1600* (holotype: NT; isotypes: CANB, K).

Notes: The thin, almost membranaceous, aromatic leaves and long many-seeded pods separate *C. aromaticus* from other *Cajanus* spp. Although based on only one accession, its distinction is clear enough to merit the rank of species. The area of origin, as far as I am aware, has not been fully explored botanically, and more specimens can be expected from nearby areas. The dried leaves are aromatic, and an agreeable smell, similar to that in Labiatae, e.g. sage, emanates from them when they are crushed. The specimens were labelled *A. cinerea*, but that species is not at all aromatic.

FIG. 3. *C. aromaticus*: 1. branch, 1X; 2. leaflet, 2X; 3. detail upper leaflet surface, 2X; 4. detail lower leaflet surface, 2X; 5. seed, 3X (1-5: *Maconochie 1600*).





10.4 *Cajanus cajan* (L.) Millsp.

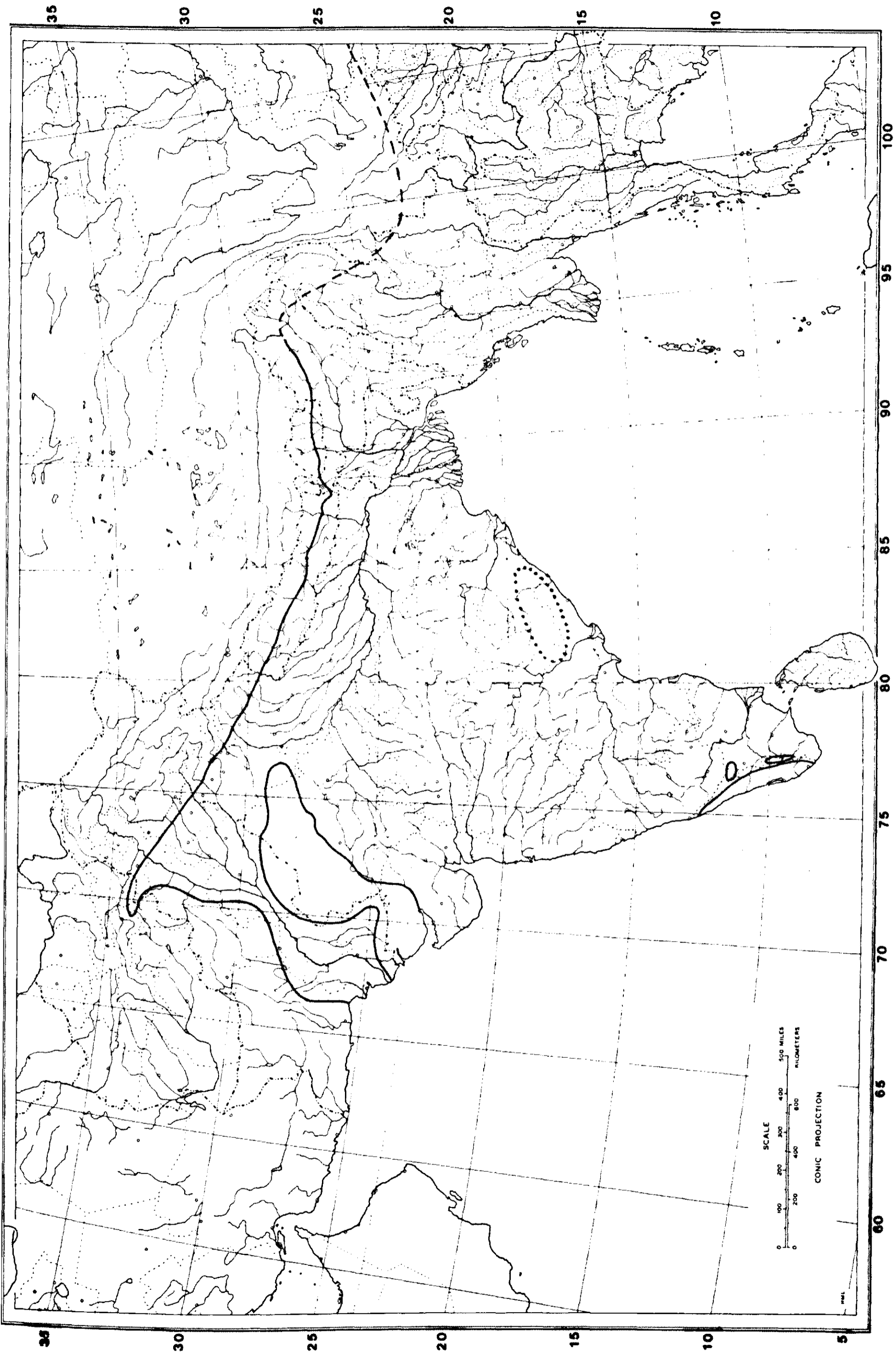
Fig. 4, p. 64, Maps 5-9, p. 67, 72, 77, 78, 89  
Plates 2-3, 5-7, p. 66, 69, 73, 75, 79

*Cajan(us) cajan* (L.) Millspaugh, Field Columb. Mus. Bot. 2-1: 53 (1900); Millspaugh, Fl. Island St. Croix, Field Col. Mus. Bot. 1-7: 796 (1902); Backer, Schoolflora Java 370 (1911); Merrill, Interpret. Herb. Amb. 282 (1917); Britton, Fl. Bermuda 182 (1918), as *Cajanus cajan* (L.) Millsp.; Britton & Millspaugh, Bahama Fl. 192 (1920), as *Cajanus cajan* (L.) Millsp.; Fawcett & Rendle, Fl. Jamaica 4-2: 71-72 (1920); Merrill, J. Straits Branch Roy. As. Soc. Special Nr.: 310 (1921); Merrill, Enum. Philipp. Pl. 2: 34 (1923); Backer & van Slooten, Javaansche Theonkruiden 152 (1924); Britton & Wilson, Sc. Survey Porto Rico 5: 414 (1924) as *Cajanus cajan* (L.) Millsp.; Ochse & Bakhuizen, Tropische Groenten 86 (1925); Heyne, Nuttige Pl. Ned. Indië 831, 832 (1927); Ochse, Indische Groenten 370-372 (1931); Backer, Onkruidflora Javaansche Suikerrietgronden 370 (1930); Amshoff, Fl. Suriname 2-2: 213-214 (1939); Exell, Cat. Vasc. Pl. S. Tome 163 (1944); Pellegrin, Legum. Gabon 165 (1948); Brenan & Greenway, Check-Lists Forest Trees & Shrubs British Empire 5, Tanganyika 2: 40 (1949); Williams, Useful Ornam. Pl. Zanzibar (1949); Heyne, Nuttige Pl. Indonesië 1: 831, 832 (1950); Lemée, Fl. Guyane Franç. 2: 148 (1952); Andrews, Flow. Pl. Anglo-Egyptian Sudan 2: 164 (1952); Hauman, Fl. Congo-Belge 6: 148 (1954); Cufodontis, Enumeratio, Bull. Jard. bot. Brux. 25-3: 321 (1955); Williamson, J., Useful Plants of Nyasaland. Zomba: 28,30 (1955); Abeele and Vandenput, Princip. Cult. Congo-Belge ed. 3: 855 (1956); Hepper, Fl. W. Trop. Africa 1-2: 559 (1958); Krishnaswami and Sakia, Indian Forester 85-5: 1-7 (1959); Ostendorf, Nuttige Pl. Suriname 87-88 (1962); White, Forest Fl. N. Rhodesia 146 (1962); Backer & Bakhuizen f., Fl. Java 1: 634 (1964); Phillips, Agric. Notebook 2nd ed., Nigeria 46-47 (1964); Gooding, Loveless & Proctor, Fl. Barbados 197 (1965); Terra, Groententeelt in de Tropen, RTI, 22 (n.d.); Terra, Tropical Vegetables, Commun. Dept. Agric. Res. RTI 54 (1966); Exell & Fernandes, Conspectus Fl. Angolensis 3:303 (1966); Boisseau, Plantes cult. spont. Dahomey 1: 16, 142 (1967); Berhaut, Fl. Senegal, 2nd ed. 20 (1967); Purseglove, Trop. Crops Dicot. 2: 236-271 (1968); Verdcourt, Fl. Trop. E. Africa ed. 2-1: 709 (1971); Stewart, D.D., Fl. W. Pakistan 398 (1972); Oza, G.M., Indian Forester 98-8: 477-478 (1972); Ramaswamy & Razi, Fl. Bangalore 739 (1973); Knapp, Vegetation von Afrika 19 (1973); De, Evol. Stud. World Crops (Hutchinson, J., ed.) 79-87 (1974); Westphal, Pulses Ethiopia 64, 71 (1974); Bailey, Manual Cult. Pl. 579 (1974 repr.); Westphal, Leguminous Crops, Mimeogr. Yaounde (1975); Zeven & Zhukovsky, Dict. Cult. Pl. Centres Diversity 67, 118 (1975); Smartt, Tropical Pulses 54-56

FIG. 4. *C. cajan*: 1. branch, 1X; 2. flower, 1½X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens, 2X; 7. pistil, 2X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X; 10. largest leaf, ½X; 11. smallest leaf, ½X; 12-18. seed shapes: 12: 3X; 13-14: 2½X; 16-18: 2X; (1-9: *van der Maesen* 4212, 10: ICP 9150 from Machakos, Kenya; 11: ICP 9880 from Andhra Pradesh, India; ICP 7332, small, Madhya Pradesh, India; 13: elongate, ICP 9880, Andhra Pradesh, India; 14: ICP 7568, square, Madhya Pradesh, India; 15: cowpea shape, ICP 7977, Andhra Pradesh, India; 16: pea shape, ICP 7345, Madhya Pradesh, India; 17: large, Madhya Pradesh, India; 18: *van der Maesen* 4212, Heho, Burma).



PLATE 2. *Cajanus cajan*, pods of a vegetable cultivar.



MAP 5. *Cajanus cajan* in south Asia

(1976); Berhaut, Fl. Illustr. Senegal 5: 72-75(1976); Oommachan, Fl. Bhopal 115 (1977); Brücher, Trop. Nutzpflanzen 166-167 (1977); Ohashi, Fl. Taiwan 3: 188, 190 (1977); Kay, Food Legumes, TPI Crop and Product Digest 3: 322-347 (1979); Nguyen Van Thuan, Fl. Cambodge, Laos, Viet-nam 17: 106-109 (1979); de Koning, la Forêt du Banco 2: 654 (1983).

Basionym: *Cytisus Cajan* Linn., Sp. Pl. 739 (1753); Jacquin, Obs. Bot. 1: 1-2 (1764); Burman, Fl. Indica 163 (1768); Miller, Gardeners Dictionary ed. 8: no. 11 (1768); Lamarck, Encycl. Meth. 2: 249-250 (1786); Aiton, Hort. Kewensis ed. 1, vol. 3: 50 (1789); Lunan, Hort. Jamaicensis 64 (1814).

Lectotype: Ceylon, *Cytisus racemis axillaribus erectis intermedio longius petiolato* Hermann Herb. I, Fol. 14 (BM), designated by E. WESTPHAL, Pulses in Ethiopia 64 (1974), chosen from syntypes Hermann 2.76 & 3.30 as designated by Verdcourt, Fl. Trop. E. Africa, Leguminosae: 709 (1971).

Homotypic synonyms: *Cytisus cayan* L. ex Mill., Gard. Dict. ed. 8, no. 11 (1768), orthographic variant.

*Cajan indorum* Medik. Vorles. Churzpf. Phys. Ges. 2: 263 (1787); Gunawardena, Gen. Spec. Plant. Zeylanicae 69 (1968), as *C. inodorus*. Superfluous name, based on *Cytisus cajan* L.

*Cajanus indicus* Spreng., Syst. 3: 248 (1826). Based on *Cytisus cajan* L., *Cytisus pseudo-cajan* Jacq., *Cajanus flavus* DC. and *Cajanus bicolor* DC.; Wight & Arnott, Prodr. 1: 256 (1834); Steudel, Nom. Bot. ed. 2: 170 (1841); Hooker, W.J., Niger Fl. 125 (1849); Miquel, Fl. Ind. Bat. 1-1: 174 (1855); Drury, Useful Pl. India 95 (1858); Thwaites, Enum. Pl. Zeyl. 90 (1858); Bentham in Martius, Fl. Brasil. 15-1: 199 (1859); Bentham, Fl. Hongkong. 89 (1861); Grisebach, Fl. Br. W. Indian Islands 191 (1864); Stewart, J.L., Punjab Plants 60 (1869); Baker in Oliver, Fl. Trop. Africa 2: 215 (1871); Baker in Hooker, Fl. Brit. India 2: 217 (1876); Drury, Useful Pl. India, ed. 2: 94-95 (1873); Mueller, F. von, Select Plants 38 (1876); Kurz, Forest Fl. Brit. Burma 1: 376-377 (1877); De Candolle, Orig. Pl. Cult. ed. 2: 266-267 (1883); Schweinfurth, Nature 29: 315 (1884); De Candolle, Orig. Cult. Pl. ed. 3: 332-333 (1886); Forbes & Hemsley, Fl. Sinensis, J. Linn. Soc. Bot. 2-1: 195 (1887); Filet, Plantk. Woordenboek Ned. Indië 154 (1888); Watt, Dict. Econ. Prod. India 2: 12-15 (1889); Collett & Hemsley, J. Linn. Soc. 28: 48 (1890); Trimen, Hand-Book Fl. Ceylon 2: 80 (1893; repr. 1974); Taubert in Engler & Prantl, Natürl. Pflz.fam. 3-3: 372 (1894); Jacob de Cordemoy, Fl. Reunion 397 (1895); Duss, Fl. Phaner. Antilles franç. 205-206 (1897); King, J. As. Soc. Beng. 66-2: 47 (1897); Cooke, Fl. Presid. Bombay 1: 435 (1903); Prain, Bengal Plants 272 (1903, repr. 1963); Urban, Fl. Portoricensis, Symb. Antill. 4-2: 306 (1905); Pulle, Enum. Vasc. Pl. Suriname 234 (1906); Watt, Commerc. Prod. India: 196-200 (1908); Boldingh, Fl. Dutch W. Indian Islands 96 (1909); de Clerq, Nieuw Plantk. Woordenboek Ned. Indië 538-539 (1909); Merrill, Enum. Philipp. Legum., Philipp. J. Sci. 5 C: 126 (1910); Gerth van Wijk, Dict. Plant Names 1: 211 (1911); Dunn & Tutcher, Fl. Kwangtung & Hongkong



PLATE 3. *Cajanus cajan*, left: 'indeterminate' flowering, right: 'determinate' flowering.

84 (1912); Koorders, Exkursionsflora Java 2: 403-404 (1912); Boldingh, Fl. Nederl. W. Indische Eilanden 225 (1913); Rama Rao, Fl. Plants Travancore 127 (1914); Harms in Engler, Pfl. Welt Afrikas 3-1: 649 (1915); Gagnepain, Fl. Gen. Indo-China 2-3: 278 (1916); Boldingh, Zakflora Landb.streken Java 116 (1916); Gamble, Fl. Presid. Madras 2: 369 (1918), 261 (repr. 1967); Sturtevant (Hedrick ed.), Rep. New York Agric. Exp. Sta. 1919, 2: 124-125 (1919); Urban, Fl. Domingensis, Symb. Antill. 8-1: 309 (1920); Blatter, Fl. Arabica, Rec. Bot. Surv. India 8-2: 173 (1921); Barker & Dardeau, Fl. Haiti 158 (1930); Kanjilal, Kanjilal & Das, Fl. Assam 2: 97 (1938); Pittier, Legum. Venezuela, Boln Tecn. 5: 29 (1944); Leon & Alain, Fl. Cuba 2: 342 (1951); Questel, Fl. St. Bartholomew 123 (1971); Matthew, Materials Fl. Tamilnadu Carnatic: 182 (1981).

*Cajanus striatus* Boj. Hort. Maurit. 109 (1837).

*Cajan Cajan* (L.) Huth, Helios 11: 133 (1893).

*Cajanus cajan* (L.) Merr., Merrill, Fl. Manila 255 (1912). Superfluous combination.

*Cajanus cajan* (L.) Druce, Rep. Bot. Exch. Cl. Brit. Isles 1916: 611 (1917); Baker, Legumin. Trop. Africa 459 (1926); Dalziel, Useful Pl. W. Trop. Africa: 233 (1937); Raponda-Walker & Sillans, Pl. Utiles Gabon: 248 (1961); Santapau, Fl. Khandala 3rd ed. 76 (1967). Superfluous combination.

*Cajanus cajan* (L.) Millsp. f. *bicolor* (DC.) Bak., Legum. Trop. Afr. 460 (1929); Cufodontis, Enumeratio, Bull. Jard. bot. Brux. 25-3: 321 (1955).

*Cajanus cajan* (L.) Millsp. var. *bicolor* (DC.), Purseglove?, Trop. Crops, Dicotyl. 1: 237 (1968).

*Cajanus cajan* (L.) Millsp. var. *flavus* (DC.), Purseglove?, l.c.

Heterotypic synonyms: *Cytisus pseudocajan* Jacq. Hort. Bot. Vindob. 2: 54, t. 119 (1772).

Type: Plate, t. 119 (no cultivated specimen found in Hortus Vindobonensis).

*Cajanus bicolor* DC., Cat. Hort. Monsp. 85 (1813); DC., Prodr. 2: 406 (1825); Macfadyen, Fl. Jamaica 296 (1837); Blanco, Fl. Filipinas ed. 2: 416 (1845).

Type: plant cultivated at Montpellier from seed sent from India (G-DC, holo; DC. microfiche 408.4).

*Cajanus flavus* DC., Cat. Hort. Monsp. 86 (1813). Based on *Cytisus cajan* L., and Plum., Ic. Pl. Amer. 114, f. 2. (ed. Burman); DC., Prodr. 2: 406 (1825); Macfadyen, Fl. Jamaica 296 (1837); Unger, Versuch Gesch. Pfl. Welt 24 (1852); Pickering, Chron. Hist. Plants 443 (1879).



PLATE 4. F<sub>1</sub> hybrid between *Cajanus cajan* cv. Baigani and *C. albicans*.

Type: plant cultivated at Montpellier (G-DC, holo; microfiche 408.6).

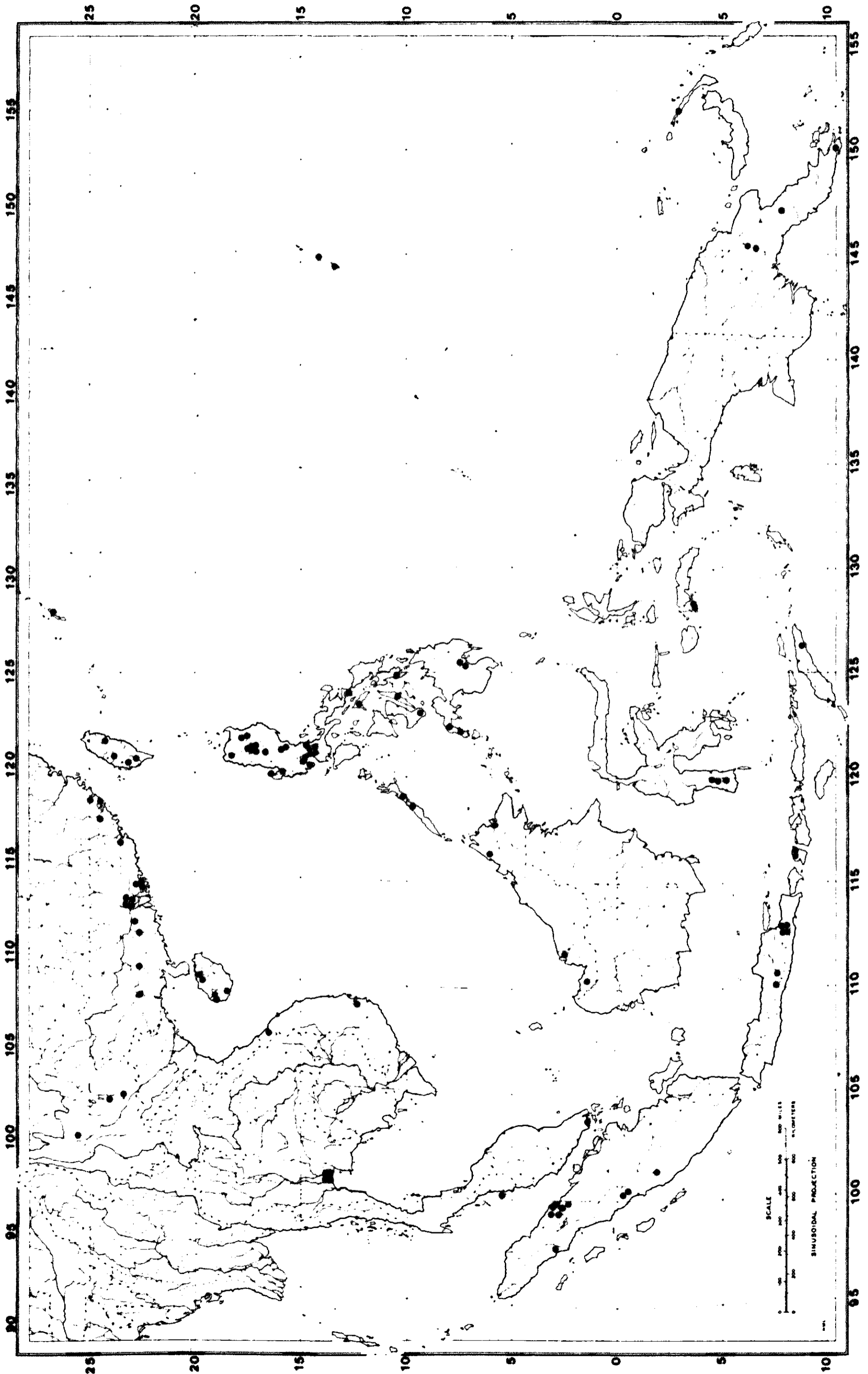
*Cytisus guineensis* Schum. & Thonn., Beskr. Guin. Pl. nr. 208 (1827). Danske Vid. Selsk. Afh. 4: 123 (1829).

Type: Guinea, Whyda: Isert s.n. (C, microfiche seen).

*Cajanum thora* Rafin., Sylva Tellur. 25 (1838). Based on *Cytisus pseudocajan* Jacq.

*Cajanus luteus* Bello, Anal. Soc. Espan. Hist. Nat. 10: 260 (1881). As variety of *Cajanus indicus* Spreng.

Type: Puerto Rico 231, Don Domingo Bello y Espinosa (B? not seen).





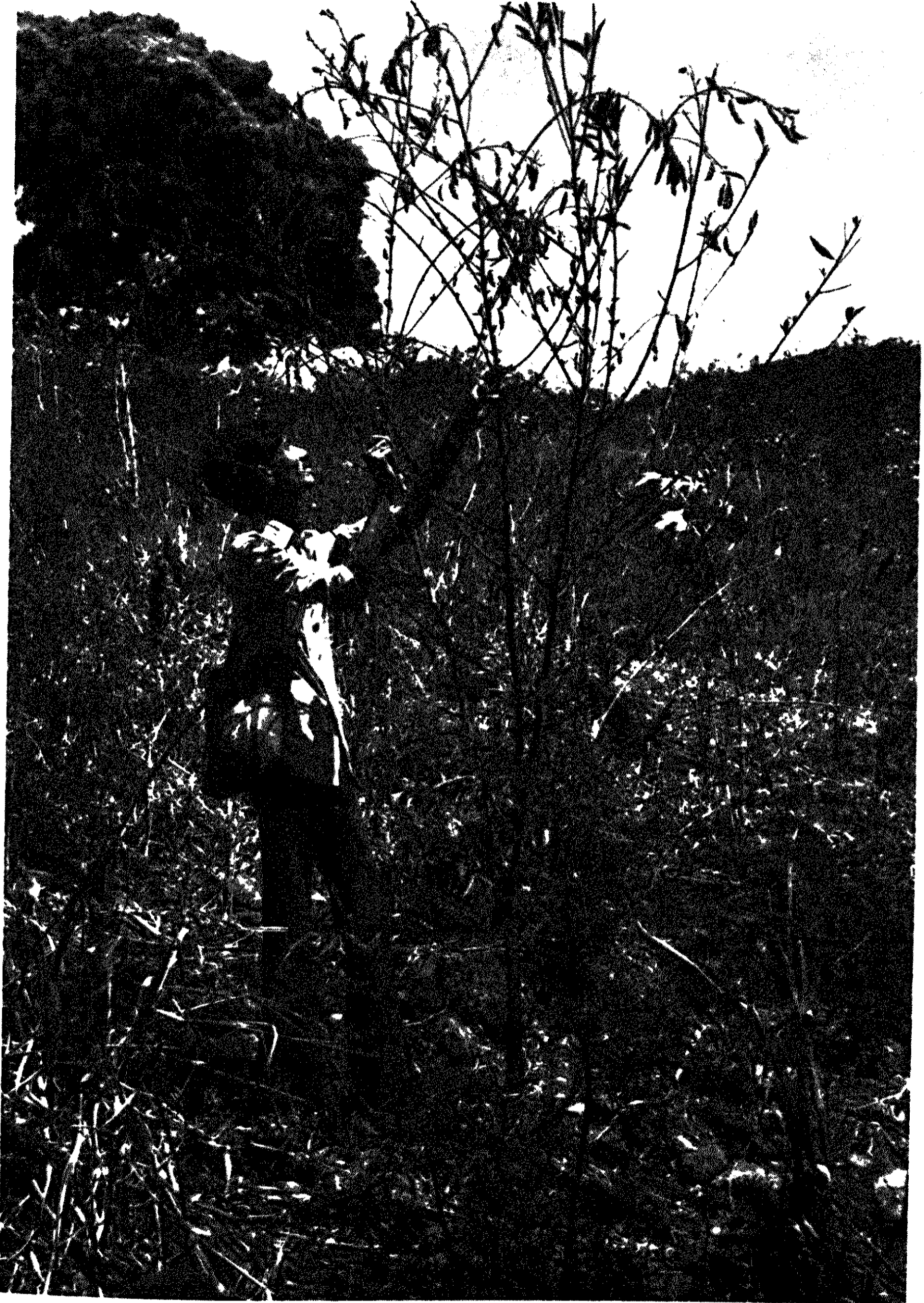


PLATE 5. *Cajanus cajan*, perennial, remnant of shifting cultivation, 'Konda kandi' (hill pigeonpea) at Pedapalli, Vishakapatnam district, Andhra Pradesh, India, 980 m (courtesy: Bot. Dept. Andhra Univ. Waltair).

*Cajanus indicus* Spreng. var. *bicolor* (DC.) O. Ktze, Rev. Gen. Pl. 1: 167 (1891).  
Var. based on specimen from Portorico, St. Thomas (NY? not seen).

*Cajanus indicus* Spreng. var. *flavus* (DC.) O. Ktze, Rev. Gen. Pl. 1: 167 (1891).  
Var. based on specimen from Dekkan (NY? not seen).

*Cajanus indicus* Spreng. var. *maculatus* O. Ktze, Rev. Gen. Pl. 1: . 167 (1891).  
Type: Bengalen (NY? not seen).

*Cajanus pseudocajan* (Jacq.) Schinz & Guillaumin, in Sarasin & Roux, Nova  
Caled. 1: 159 (1920).

Basionym: *Cytisus pseudocajan* Jacq.

*Cajanus obcordifolia* Singh, Indian J. Agric. Sci 12: 783 (1942).

Type: ex Gorakhpur, Bot. Garden Agric. Coll. Cawnpore (not preserved  
at Kanpur). Mutant form.

*Shrub*, 0.5-4 m, of perennial nature but mostly grown as an annual. *Stem* woody with age, ribbed when young, up to 15 cm diameter. *Branches* spreading to erect, few to many, slender to thick. *Indumentum* variable in density. *Stipules* triangular-lanceolate, 2-6 mm long. *Leaves* pinnately trifoliolate; petiole 1-8 cm, rachis 0.5-3 cm. *Leaflets* soft-coriaceous, glandular punctate, lower surface dull greyish green to almost silvery, upper surface green; top leaflet elliptical, ovate-elliptical or lanceolate, rarely obcordate, 4.5-13.7 cm long, 1.4-5.7 cm wide, apex acuminate to acute, mucronate, rarely emarginate, base cuneate; side leaflets as top leaflets but obliquely so, 3.6-12 cm long, 1.3-4.5 cm wide, apex and base as in top leaflet, petiolules 1-4 mm, pubescent; stipellae narrow-setaceous, 1-4 mm. *Racemes* short, many-flowered, axillary, peduncles (0-)1-8 cm, pedicels 7-15 mm; flowers predominantly yellow (very pale to bright), flag often dorsally veined or covered with red, orange or purplish, flowers sometimes orange, red or purplish, keel greenish-yellow, sometimes with reddish top. Per raceme 1-5(-10) pods may mature. *Bracts* small triangular or ovate-acuminate scales, 1-4 mm. *Calyx* campanulate, pubescent, tube (3-)4-5(-6) mm, teeth triangular-acuminate, 3-5(-7) mm, the upper ones shortest, free up to entirely connate, the lower one longest. *Vexillum* obovate-orbicular, 14-22 mm long, 14-20 mm wide, base clawed, biauriculate, with two callosities. *Alae* obovate, upper margin straight, base clawed, asymmetrically biauriculate, 15-20 mm long, 6-7 mm wide, with a callosity. Keel petals oblique, 14-17 mm long, 5-7 mm wide, base straight, ventral sutures jointed, more greenish than other petals. *Ovary* 5-8 mm, densely pubescent and glandular-punctate, 2-9 ovules; style glabrous, 10-12 mm long, upturned beyond the middle, stigma capitate, papillate. *Stamens* 15-18 mm long, free part 4-7 mm, lateral stamens with longest free part, upturned; anthers dorsifix, light or dark yellow. *Pods* oblong, straight or sickle-shaped, laterally compressed, green when young, straw-coloured when ripe, often streaked to various degrees with purple; 2-8(-13) cm long, 0.4-1(-1.7) cm wide, covered more or less



PLATE 6. *Cajanus cajan*, selfed with muslin bags at ICRISAT.

densely with short simple or longer bulbous-based hairs, glandular-punctate, sticky, transverse depressions at oblique angles to the sutures, base cuneate, apex acuminate, tipped with the base of the style, containing 2-9 seeds. *Seeds* globose or compressed-globose, ellipsoid or (rarely) cowpea-shaped, in well-filled pods squarish or oblique fitting the locules; white, cream, brown, purplish or almost black, plain or blotched with brown or purple, rarely in ring-pattern, 4-9 mm long, 3-8 mm wide, 3-6 mm thick, often wider than long, 4-26 g per 100 seeds; strophiole (rim-aril) vestigial, present in young pod, greenish, divided, present, vestigial or disappeared at maturity, white or straw-coloured remnants on the hilum. Hilum central, about half the length of the seed.

Specimens examined: numerous specimens have been seen and studied. Details of the occurrence of pigeonpea have been published earlier (VAN DER

MAESEN 1983) and only maps are reproduced here. Many specimens, especially of older collections, bear little or no location data. Herbarium specimens are often not sufficient for a study of infraspecific classification, as plant habit is rarely described and ripe seeds are often absent.

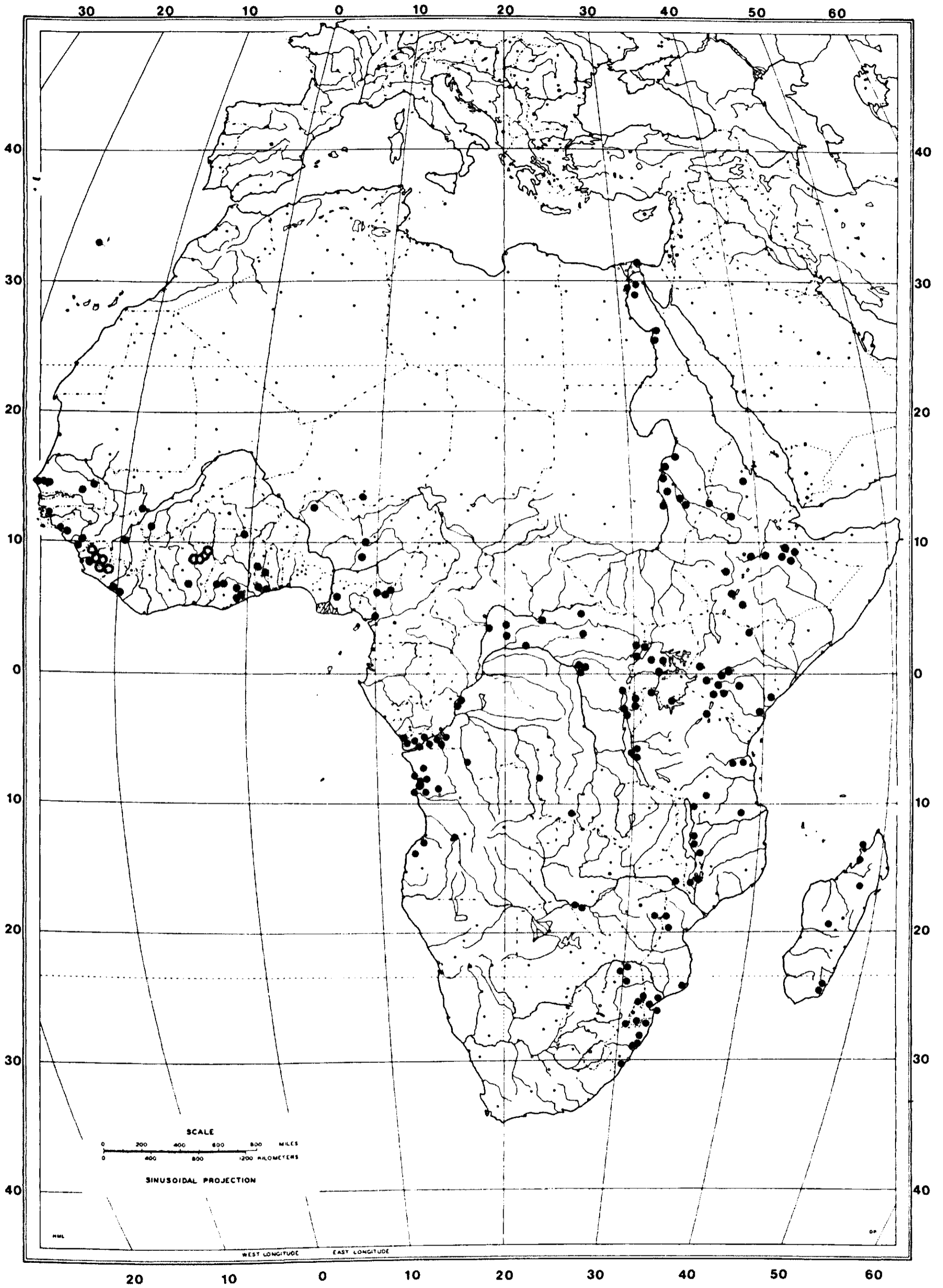
Notes: Although article 73/75 of the ICBN allows for correction of orthographic mistakes, the combination *Cajanus cajan* cannot be ascribed to HUTH (1893) as NICOLSON (1975) explained, as the combination by HUTH explicitly concerns a tautonym, not a paratautonym as put by NICOLSON. Article 23 prohibits the use of tautonyms, and overrules to my opinion the application of correction the spelling of an epithet. *Cajan cajan* (L.) Huth was an example in the discussion by HUTH, whether tautonyms would be admissible or not. HUTH cited tautonyms in alphabetical order up to the letter E, and discussed acceptance of tautonyms because KARSTEN took the initiative. It is uncertain whether HUTH plainly accepted the combination, because he stated that he did not like them. NICOLSON (pers. commun.) prefers Huth's priority, since to his opinion HUTH accepted the tautonyms. Stability of names is better served by maintaining the well-accepted subsequent combination by MILLSPAUGH (1900), although (us) was put in parentheses.

More variation is present in mutants or variants. Leaf mutants include obcordate leaflets (controlled by a single recessive gene), very narrow (sesame) type leaflets, minute leaflets, round and broad-elliptic leaflets (MURTHI & VAN DER MAESEN 1979). Variants such as leaves with a single or many (5 to 8) leaflets exist. Leaflets are rarely placed digitately and not pinnately.

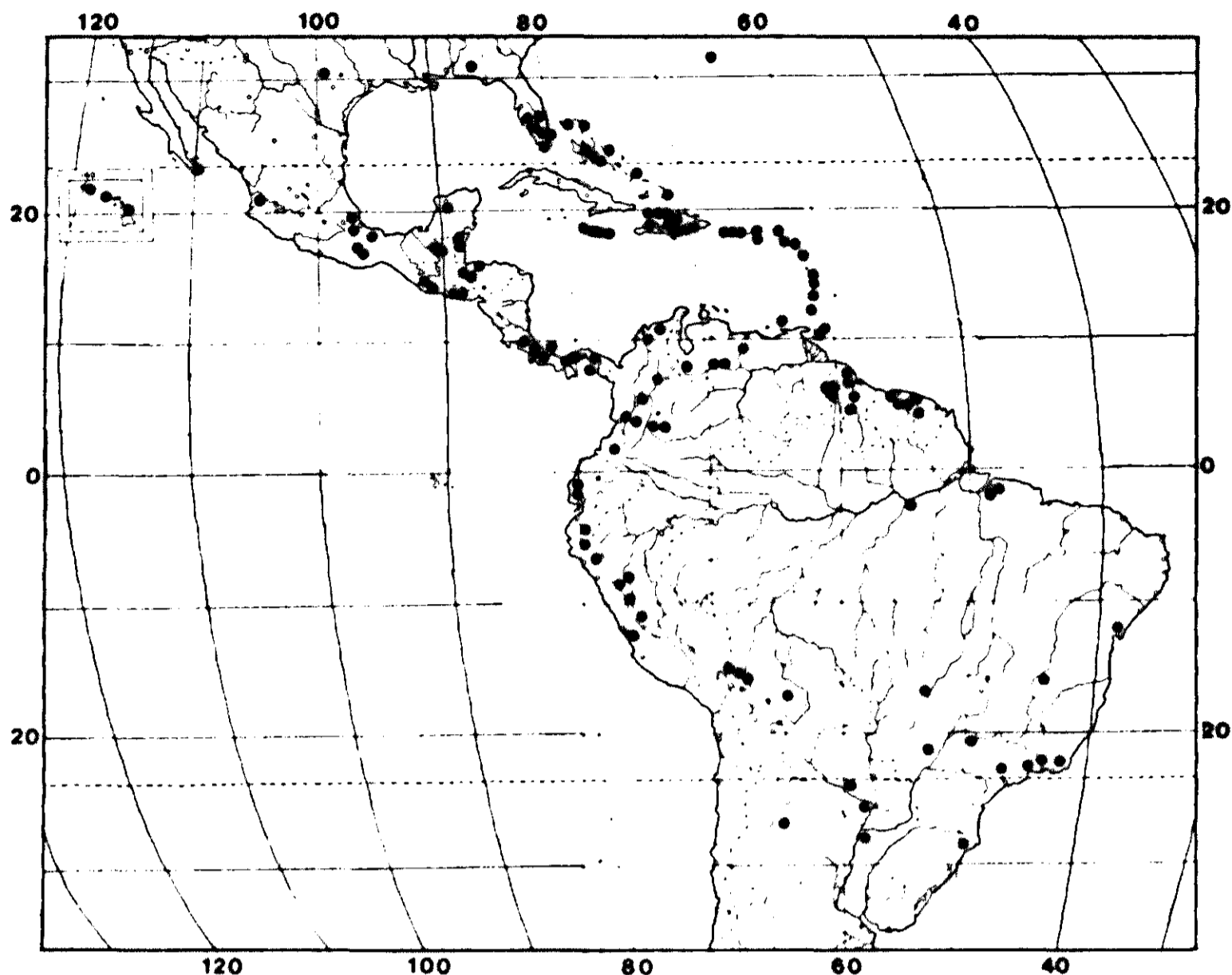
Dwarf variants do occur, e.g. a densely-foliated late flowering shrub with a tea-bush habit was detected at Hyderabad in 1976 in a progeny from cv. EC 100465 X cv. Gwalior 3-191-1. The dwarf character is much sought after for short-duration cultivars and high plant population, but unfortunately the tea-bush flowers late, 140 days after sowing.

Male sterility exists including heterostyly, sterile anthers and the open flowering related to this characteristic. True cleistogamy, i.e. flower buds which do not open but produce pods, has also been noted at ICRISAT. When the weather became warmer, later flowers opened. In another case, the 'wrapped flower', the keel encloses the wing petals and the flower expands but never opens. Both characteristics are useful for maintenance of purity in developed cultivars.

Distribution: Pigeonpea originated in India (VAN DER MAESEN, 1980), and is now cultivated in all tropical areas. It is the second most important pulse crop in the Indian subcontinent, and is also quite important in East Africa. In the West Indies it earns millions of dollars as a vegetable cash crop for local canning, freezing and export (see also VAN DER MAESEN 1983). World production in the 1970s reached almost 2 million tons per annum, of which over 90% was produced in Asia.



MAP 7. *Cajanus cajan* in Africa



MAP 8. *Cajanus cajan* in America

**Ecology:** Semi-arid tropics with seasonal rainfall at least during the vegetative phase, drier zones of the humid tropics, cultivated. Also semi-wild or as remnants of cultivation in open forests, river shores, savannas, grazing grounds and the like.

**Altitude:** 0-2000 m (in Venezuela up to 3000 m).

**Flowering:** (Aug) Sep-Mar(Apr) in the Indian subcontinent, throughout the year in Indonesia, Jan, Apr, Oct, Nov in Puerto Rico, May-Aug in Kenya. It may take between 56 and 210 days from sowing to flowering (normal rainy season cultivation at ICRISAT Center).

**Fruiting:** 3-6 weeks after onset of flowering. Harvests in India last from Sept-Oct through April depending on maturity group and latitude. Time to maturity varies at ICRISAT Center from 95 to 256 days, it is much reduced if sown in short days. The photoperiod sensitivity of the genotype, the latitude and the temperature influence flowering and fruiting.

**Vernacular names:** as for every ancient cultivated crop, pigeonpea has a large number of vernacular names in many languages and dialects. If slight differences between names exist, these can be attributable to transcription, others indicate real distinct pronunciation. The names are tabulated alphabetically (Table 9) within languages within countries or regions. Trade names, also

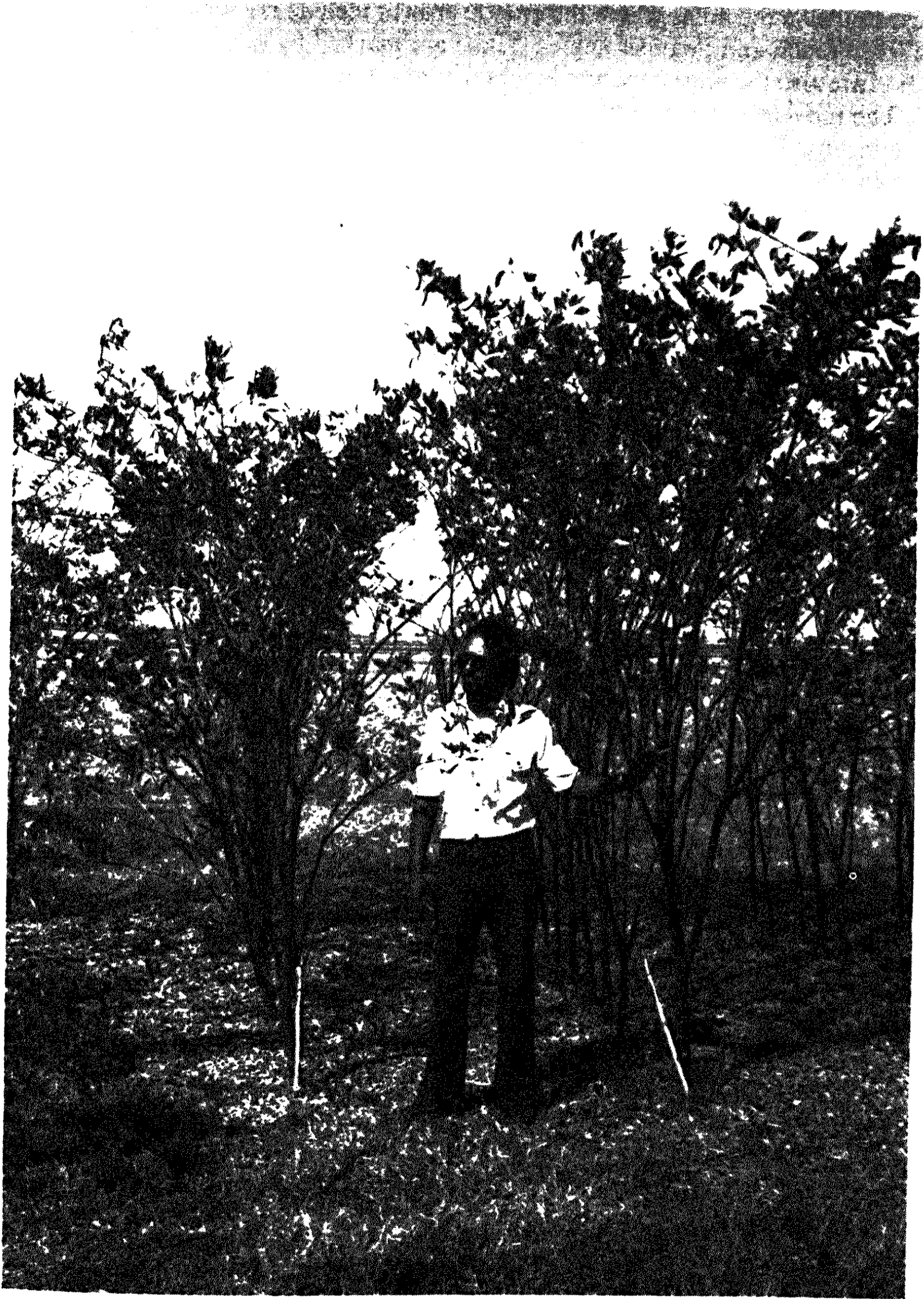


PLATE 7. *Cajanus cajan*, perennial stand of Kenyan cvs at ICRISAT.

used outside the areas where the crop is grown, include the most common English, French and Spanish names. These are marked by an exclamation mark (!) as are also the most common names within a language or country.

The movement of African names to the West Indies and South America is interesting. The name 'Kandulu' in the Indian Telugu language shifted to 'Guandu' in Portuguese and 'Gandul' in Spanish. This seems more probable than the suggestion by Menezes (in Vernon Royes, 1976) that 'Guandu' is a Portuguese transformation of 'Cajanus' by Africans in Brazil. 'Congo pea' from the West Indies could be either a corruption of 'Gungo' (Jamaica), or from its believed Congolese origin. The name is used in French and Portuguese-speaking Africa. Age and movement of vernaculars are interesting subjects for a linguist, and more affinities can certainly be detected.

Where necessary I have attempted to apply recent spelling. References are either to published papers or herbarium specimens. The ancient Indian references are given by De (1974). Some vernaculars are clearly derived from or shared with other pulses or seeds. Trimen (1894) erroneously lists Chick-Pea as an English name, this is of course *Cicer arietinum* L.

TABLE 9. Vernacular names of *Cajanus cajan* (L.) Millsp.

Country	Vernaculars	Language	Source
<b>ASIA</b>			
Bangladesh	Arhar, Tur, Tuver	Bengali	Pathak 1970
Burma	Pai-si-gong	Burmese	Kurz 1877, De 1974
	Pay-in-chong	Burmese	Kurz 1877, De 1974
	Pay-yen-khyung	Burmese	Blanco cf Pickering 1879
	Pesigon	Burmese	Kurz 1877, De 1974
	Pheang	Chin	Rai Lium Sum 1980 pers. comm.
China	Hpunlasi	Kachin	Hundley et al. 1961
	Muk tau	(Hainan)	McClure 8355 K
	Tan Shue	(Canton)	McClure 2316 BM
	Shan Tou Ken (Tree bean)		Kirtikar & Basu 1933 Henry s.n. BM
India (ancient)	Tuvarai, Tuvvari	Dravidian	De, 1974
	Tuvari	Prakrit (Maharashtra)	Gathasaptasati, 300 AD
	Tuvarica	Sanskrit	Amarkosa, 600 AD
	Adhaki	Sanskrit	Susrutasamhiti, 600 AD
	Arhuku	Sanskrit	Piddington ex DC. 1883
	Adhaki, Kakshi	Sanskrit	Kirtikar & Basu 1933
	Karvitabhujā, Mritana,	Sanskrit	Kirtikar & Basu 1933
	Mrittala, Mrittalaka,	Sanskrit	Kirtikar & Basu 1933
	Pitapusha, Shanapushpika,	Sanskrit	Kirtikar & Basu 1933
	Supya, Surashtaja, Tuvvari,	Sanskrit	Kirtikar & Basu 1933
Tuvarika, Vritabija	Sanskrit	Kirtikar & Basu 1933	



TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>	
India (modern)	Tan-gum, Da-yil (from Dhal)	Abor (NE Assam)	Burkill 1925	
	Gelooah-mah	Assamese	F. von Mueller 1876	
	Rahar	Assamese	Krishnaswami 1959	
	Arhar! Arahara	Bengali	Pathak 1970	
	Urur, Dhal urur	Bengali	Drury 1858	
	Tur, Tuver	Bengali	Pathak 1970	
	Red gram!	English	Pathak 1970	
	Shakhil, Shakull	Farsi	Kirtikar & Basu 1933	
	Nandu	Garo (Meghalaya)	Krishnaswami 1959	
	Arhar!, Arahara, Tur	Gujerati	Pathak 1970	
	Tuver	Gujerati	Pathak 1970	
	Dangri, Tuer, Turdal, Tuvero	Gujerati	Kirtikar & Basu 1933	
	Arhar!, Arahara, Ihora, Oror	Hindi	Pathak 1970, De 1974	
	Oroha, Laher	Hindi	Wood 1902	
	Tur, Tuver	Hindi	Pathak 1970	
	Adhaki, Dalu, Kariyudu, Thogari	Kannada (Cannarese)	Kirtikar & Basu 1933	
	Turuku-togari	Kannada (Cannarese)	Kirtikar & Basu 1933	
	Tuvari	Kannada (Cannarese)	Lushington 1915	
	Arhi	Kol (Chota Nagpur)	Lushington 1915	
	Dhingra, Kundi	Kangra	Haines 1920	
	Tori	Konkani	Kirtikar & Basu 1933	
	Adhaki, Kakshi, Tuvara!	Malayalam	Kirtikar & Basu 1933	
	Thora-paerou	Malayalam	Rheede 1686	
	Thuvaran	Malayalam	Pathak 1970	
	Arhar!, Arahara, Tur	Marathi	Pathak 1970	
	Theckek	Mikir (Assam)	Pathak 1970	
	Rari	Mundari	Krishnaswami 1959	
	Horodo, Kandulo	Oriya	Kirtikar & Basu 1933	
	Adhaki, Supiya, Tuvarika	Oriya	Kirtikar & Basu 1933	
	Arhar!, Tohar, Dinger	Punjabi	Lushington 1915	
	Kehu, Kohlu	Simla	Stewart 1869	
	Adagam, Adagi, Iyavai	Tamil	Kirtikar & Basu 1933	
	Paruppu, Tuvarai!	Tamil	Kirtikar & Basu 1933	
	Cegapputtuvarai	Tamil	Lushington 1915	
	Malaittuvarai,	Tamil	Lushington 1915	
	Vellaittuvarai			
	Adhaki, Ettakandulu,	Telugu	Lushington 1915	
	Kandi, Kandulu!,	Telugu	Lushington 1915	
	Kondakandi,			
	Peddakandi,	Telugu	Lushington 1915	
	Peddakondakandi,			
	Potukandi, Sinnakandi	Telugu	Lushington 1915	
	Raher	Santali	Wood 1902	
	Indonesia	Sarupapa	Alfur (N. Celebes)	Heyne 1927
		Kachang bali!, Kachang gude!,	Bahasa Indonesia	De Clerq 1909, Backer 1911
		Kachang (h)iris, Kachang	Bahasa Indonesia	De Clerq 1909,

TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>
	kayu!		Backer 1911
	Kachang turis, Turis, Tunis	Bahasa Indonesia	De Clerq 1909, Backer 1911
	Kachang puh, Kachang puuh, Kekatji	Balinese  Balinese	De Clerq 1909, Backer 1911 De Clerq 1909, Backer 1911
	Undis	Balinese	De Clerq 1909, Backer 1911
	Ritik lias	Batak	Heyne 1927
	Kantje	Buginese	De Clerq 1909
	Buntis	(E. Sumatra)	Toroës 2416 MICH
	Kasang bukuang	(E. Sumatra)	Boëea 9545 US
	Kasang kayu	(E. Sumatra)	Boëea 8511 US
	Puwe jai	Halmahera	Heyne 1927
	Kachang bali, kachang gude!	Javanese	De Clerq 1909, Backer 1911
	Kachang gar	Javanese	Junghuhn cf Bentham 1852
	Kachang kadju	Madurese	De Clerq 1909
	Bindatoe, Bindatoin	Makassar	Rumphius 1747
	Bantatuin	Makassar	Heyne 1927
	Kachang kayo	Minangkabau	De Clerq 1909
	Tulis	Roti	De Clerq 1909
	Lebuwi	Sasak	De Clerq 1909
	Tori	Sawu	De Clerq 1909
	Tunis, Turis	Timorese	De Clerq 1909
Japan	Ki-mame	Japanese	Kay 1979
Laos	Me ne nok	Lao	Kerr 2911 BM
Malaysia	Kachang	Malay	De 1974
	Kachang dal, Kachang hiris	Malay	Kay 1979
	kachang kayu	Malay	Ridley 1922
Nepal	Adhad	Nepali (W. hills)	V.S. Doherty, 1979, pers. comm.
	Arhar!	Nepali (Kathmandu)	V.S. Doherty pers. comm.
	Rar	Nepali (Kathmandu)	V.S. Doherty pers. comm.
Pakistan	Arhar!	Urdu	Ali 1977
	Dal, Rahas, Thohar, Thur, Thor	Urdu Urdu	Kirtikar & Basu 1933 Kirtikar & Basu 1933
Philippines	Tabios	Bicolano, Cebuano Visayan	R.B. Fox 90 PNH
	Kardis	Ibanag, Ilocano, Igorot	R.B. Fox 90 PNH

TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>
	Kudis	Igorot, Ifugao	R.B. Fox 90 PNH
	Kaldis	Igorot, Ilocano	R.B. Fox 90 PNH
	Kidis	Ilocano, Bontoc	R.B. Fox 90 PNH
	Caguios	Tagalog	Merrill 1912
	Callos	Tagalog	Merrill, 256 PNH US
	Gablos	Tagalog	Merrill, 256 PNH US
	Cadios, Kadyos, Kadios!	Tagalog, Mangyan, Visayan	Kay 1979
	Kagyos, Kagyus	Tagalog	R.B. Fox 90 PNH
	Kalios	Tagalog	R.B. Fox 90 PNH
Sri Lanka	Parippu (pulse)	Sinhalese	Gunawardena 1968
	Rata-tora	Sinhalese	Thwaites 1864
	Paripu (pulse)	Tamil	Gunawardena 1968
	Thavarai	Tamil	Trimen 1894
	Tora-parippu	Sinhalese	Hermann 1717
	Waelundu, Warlunduwael		Hermann 1717
	Wittrawinansa		Hermann 1717
Thailand	Togare/i	Thai	Kay 1979
	Tovarai	Thai	Kay 1979
	Tua-re	Thai	Kay 1979
	Tua-he, Tua-mahe	Thai	Pathanothai pers. comm. 1979
Turkey	Guvercin bezelyesi, Tohum	Turkish	
Vietnam	Cay dau chieu	Vietnamese	Gagnepain 1916
	Dau sang, Dau thong	Vietnamese	Gagnepain 1916
	Dau trieu, Dau xay	Vietnamese	Kay 1979
	Dok thua he	Vietnamese	Gagnepain 1916
	Dom san dek day	Vietnamese	Gagnepain 1916
	Mak thona he	Vietnamese	Gagnepain 1916
Yemen	Qishta	Arabic	Blatter 1921
<b>AFRICA</b>			
(General)	Pigeonpea!	English	
	Pois d'Angole!	French	
	Pois de Congo!	French	
Angola	Ervilha do Congo	Portuguese	
	Gibuapo		Gossweiler 4263 BM
	Jinsonge		Watt 1908
	Quinsonge		Watt 1908
	Quissonge	Kimbundu	Aranjo 77 LISC
Benin (Dahomey)	Adoua	Bariba	Boisseaux 1967
	Adjagui	Fon, Goun	Boisseaux 1967
	Klekloun	Fon	Boisseaux 1967

TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>
	Ambrevade	French	Boisseaux 1967
	Pois d'Angole	French	Boisseaux 1967
	Waken masar	Hausa	Boisseaux 1967
	Waken turawa	Hausa	Boisseaux 1967
	Ekloui	Mina	Boisseaux 1967
	Otili	Nagot	Boisseaux 1967
	Yepetoun	Somba	Boisseaux 1967
	Otiri	Yoruba	Boisseaux 1967
Egypt	Ads sudani	Arabic	El Baradi 1978
	Lubia hadjeri sudani	Arabic	Letourneux 251 W
	Lubie el Narh	Arabic	Kotschy 1013 W
	Shakhil, Shaz	Arabic	Kirtikar & Basu 1933
Ethiopia	Yewof-ater	Amharic	Westphal 1974
	Ringa	Ari (Gemu-Goffa)	Fukui 309 EAH
	Ohota-farengota	Konso	Westphal 1974
	Salboca-ghed	Somali	Westphal 1974
Gabon	Besange-be-djele	Bakele	Raponda-Walker et al. 1961
	Uhange-mwa-Mulungu	Benga	Raponda-Walker et al. 1961
	Ossanga	Eninga	Harms 1915
	Butsangi-bu-muri	Eshira	Harms 1915
	Osang-eli	Fang	Harms 1915
	Oando	Fioffe	Harms 1915
	Modjangi-a-getete	Mitsogo	Raponda-Walker et al. 1961
	Osange-werere	Mpongwe	Raponda-Walker et al. 1961
	Osange w'Orungu	Mpongwe	Raponda-Walker et al. 1961
	Mutsangi-a-mwiri	Ngowe, Balumbu	Raponda-Walker et al. 1961
	Osange-w'erere	Nkomi, Galva, Orungu	Raponda-Walker et al. 1961
	Osang'erere	Nkomi, Galva, Orungu	Raponda-Walker et al. 1961
Ghana	Adua	Dagomba	Dalziel 1937
	Blorfoyor, Blofo-yo Yor, Yo	Ga	Kirtikar & Basu 1933, Dalziel 1937
Kenya	Baraz		Grant of Pickering 1879
	Njogu	Kikuyu	Kathrass 871 EAH
	Mbas	Luo	Kokwara 2024 EAH
	Mbaazi!	Swahili	
Madagascar	Antsotry	Antsianaka	Kirtikar & Basu 1933
	Ambatry	Betsileo	Kirtikar & Basu 1933

TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>
	Ambarivatry Pois cajan, Ambrevade	Hova French	Kirtikar & Basu 1933 Frenee 104 MPU
Malawi	Nandolo Imbange Epweri Mbwete Mtambe za miti Mbenge, Nyandolo Mbelemende	Nyanja Ngondo, Sukwa Nguru Sena Tonga Tumbuka Yao	Williamson 1955 Williamson 1955 Williamson 1955 Williamson 1955 Williamson 1955 Williamson 1955 Williamson 1955
Mauritius	Ambrevade, Ambrevatte	French	J. de Cordemoy 1895
Mozambique	Dozi Feijao Boer	Portuguese Portuguese	Edwards V4225 PRE Torre 3523 LISC
Nigeria	Olele, Orele Shingwazo Aduwa Dan mata Waken damfani (fence bean) Waken masar (Egyptian bean) Waken stambul (Turkish bean) Waken turawa (white man's bean) Waken yan mata (girl's bean) Waken tantabani (pigeon's bean) Viovio, Iofio Alev a batur Otili/e	Benin Gbari Hausa Hausa Hausa Hausa Hausa Hausa Hausa Hausa Ibo Tivi Yoruba	Dalziel 1937 Dalziel 1937 Dalziel 1937 Lely 109 K Dalziel 1937 Kirtikar & Basu 1933  Kirtikar & Basu 1933  Kirtikar & Basu 1933  Dalziel 1937  Dalziel 1937  Dalziel 1937 Dalziel 1937 Dalziel 1937 Dalziel 1937
San Tome	Feijao Congo	Portuguese	Esp. Santo 4132 LISC
Senegambia	Cajan des Indes Pois d'Ambrevade Pois d'Angole!	French French French	Berhaut 1976 Berhaut 1976 Berhaut 1976
Sierra Leone	Konsin Konsho, e-konson Konsoba Soimese Yawendo	Timne, Koranko Limba Konno Kissi	Thomas 5155 B Dalziel 1937 Dalziel 1937 Dalziel 1937 Dalziel 1937
South Africa	Pigeonpea! Lidodze Dhal, Dhul Moswekane	English Bantu (Transvaal) Hindostani Sotho	Menne s.n. PRE Wissell s.n. PRE Pers. obs. 1982

TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>
	Tindhotse, Tindhotshi	Swazi	Pers. obs. 1982
Sudan	Adassi Ads sudani Lubia el Nach	Arabic Arabic Arabic	Bos 1427 WAG Kay 1979 Kotschy s.n. W
Tanzania	Kalabama Mbaazi! Baazi, Mbalassi, Mbani Mbarasi, Mbasi, Mbazi	Kitongwe Swahili Swahili Swahili Swahili	Takeya 5 EAH Williams 1949 Harms 1915 Kay 1979 Harms 1915
Togo	Adua	Tshaudjo	Dalziel 1937
Uganda	Apena Burusu/u Lopena Nogugu	– – – –	Kay 1979 Kay 1979 Kay 1979 Greenway 1828 EAH
Zaire	Ndeda Kindolia Osokgna Omokunde, Umukemde Lwando Zangizingungu Ngunde N'ledika Wandu, Wiandu, Wuandu Lukunda Mbaazi Kakunda bakishi, Nkol	Gimbi Kibali Kiker Kinyarunde Kiombe Kiombe Kipende Luozi Mayumbe, (Nadaka) Swahili –	Hauman 1954 Hauman 1954 Germain 4086 BR Hauman 1954 Hauman 1954 Hauman 1954 Hauman 1954 Gersson 76 BR Hauman 1954 Hendricx 3817 EAH De, 1974 De, 1974
Zambia	Imposo	–	Kay 1979
AMERICA			
(general)	Bipicaa, Ouandou, Quingongi	Carib	Pickering 1879
(esp. C. America)	Pigeonpea!  Angola pea Cadjan pea Goongo, gungo pea No-eye pea Seven year pea Pois Congo, Pois de Congo Pois d'Angole Guandu!	English  English English English English French French Spanish	Plukenet 1692, Miller 1747 Lunan 1814 Harms 1915 Fawcett & Rendle 1920 Fawcett & Rendle 1920 Lunan 1814 Duss 1897 Duss 1897
Brazil	Faijao andu Feijao guandu	Portuguese Portuguese	Mexia 5318 US Archer 8019 US

TABLE 9. (continued)

<i>Country</i>	<i>Vernaculars</i>	<i>Language</i>	<i>Source</i>
	Goandu, Guendu!, Guendu Guandu de fava larga	Portuguese Portuguese	Bentham 1859 Kay 1979
Colombia	Chicharo de paloma Frijol del ano Frijol paloma Frijol quinchoncho Frisol guandus Guandua	Spanish Spanish Spanish Spanish Spanish Spanish	Kay 1979 Lehmann 8660 K Arnay 324 CANB Fernandez 1325 US Barriga 8378 US Daniel 1484 US
Costa Rica	Fijol de palo, Petipoa Quimbolillo, Timbolillo	Spanish Spanish	Standley 48376 US
Cuba	Gandul!, Gandur Gadul	Spanish	Leon & Alain 1951 El Baradi 1978
Dominican Republic	Guandul!, guandula	Spanish	Urban 1920
Ecuador	Frujol da palo	Spanish	
El Salvador	Frijol de palo Alberga, Alverja	Spanish Spanish	Calderon 529 US
Guatemala	Cachito, Frijol chino, Frijol japones	Spanish Spanish	Kay 1979 Kay 1979
Haiti	Pois Congo	French	Barker & Dardeau 1930
Honduras	Chicharo	Spanish	Standley 53645 US
Jamaica	Christmas pea Congo pea Gungo	English English Spanish	Lunan 1814 Vernon Royes 1976 Vernon Royes 1976
Martinique and Guadeloupe	Pois d'Angole! Pois de bois, Pois de l'Inde Pois de lisiere Pois de sept ans	French French French French	Duss 26, US Duss 1897 Duss 1897 Duss 26, US
Mexico	Chicharo de arbol Chicharo	Spanish (Yucatan) Spanish (Yucatan)	Kay 1979 Hernandez 99 MICH
Netherlands Antilles	Wandoe	Dutch, Spanish	Gerth v. Wijk 1911
Nicaragua	Garbanzo falso	Spanish	Kay 1979
Panama	Frisol de palo Guandu!	Spanish Spanish	Celestine 120 US Celestine 120 US

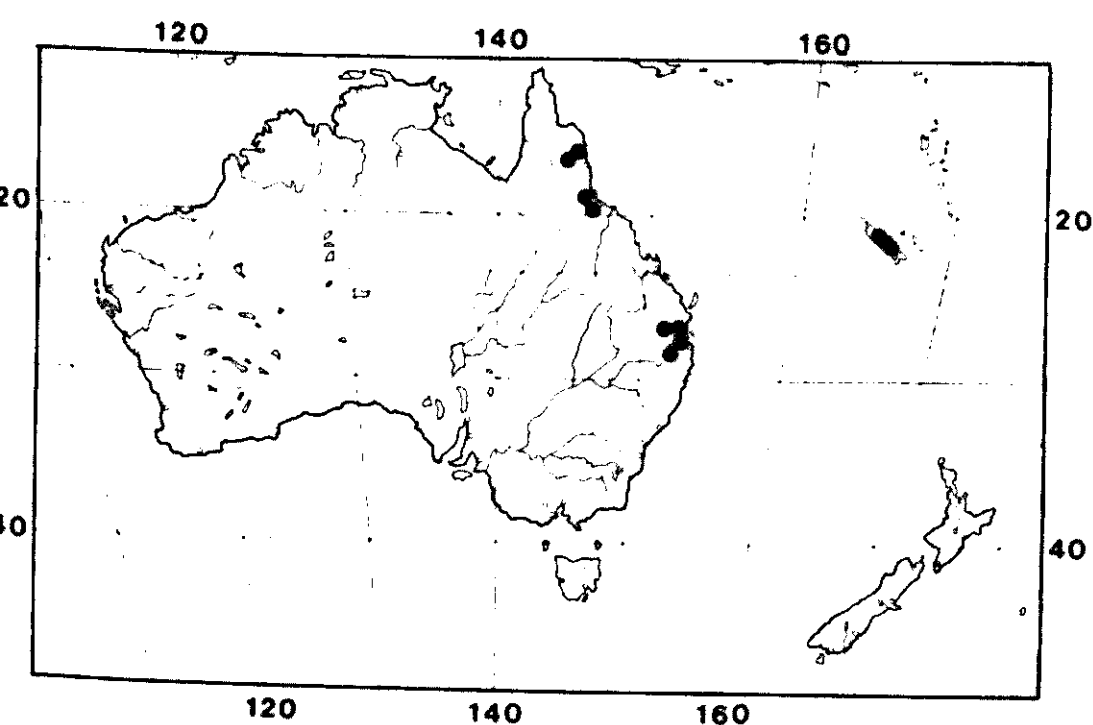




TABLE 9. (continued)

Country	Vernaculars	Language	Source
	Taubenerbsenbaum	German	Gerth v. Wijk 1911
Great Britain	Pigeonpea! etc. (see America)	English	—
Netherlands	Balische boon Duivenbonen*	Dutch Dutch	Rumphius 1747 Gerth v. Wijk 1911
Portugal	Tantaraca, Tantaraga	Portuguese	Kirtikar & Basu 1933
Spain	Guandu! Gandul Guisante de paloma etc. (see America) Guisante enano	Spanish Spanish Spanish	Terra 1966 Kay 1979
USSR	Golubnii Gorokh (pigeonpea)	Russian	Zhukovsky 1964

\* Also for *Vicia faba*

MAP 9. *Cajanus cajan* in Australia

Uses: In the Indian Subcontinent pigeonpea is mainly utilized in the form of dehusked split peas, commonly referred to as dhal. The dhal is either used as a protein-rich staple food in soups and stews flavoured with onions and spices or fried as a snack. Its use as a green vegetable, in lieu of peas, is on the increase in large cities. In the Caribbean area, Central America and some parts of the USA pigeonpea is commonly used as a green vegetable, fresh, frozen or canned. In Africa various uses are reported, the seeds being eaten as a green vegetable, usually where peas are not available, or as a dried pulse. In Benin a mash of the green unripe pods together with butter, milk and vanilla or lemon proved to taste very much like mashed chestnuts; while boiled and peppered seeds are used in dishes called Abobo or Zankpiti (BOISSEAUX 1967). The use of cooked pods as a vegetable is also mentioned by DALZIEL (1937). Rarely have pigeonpea



dishes names other than the vernacular for the crop and product. In Indonesia its young green pods are eaten in spiced dishes, as is also reported from Brazil and Thailand.

Pigeonpeas are also used for green manure, as a cover crop, as temporary shade, wind-break hedges and as fodder. By-products of dhal mills (chuni) provide useful rations for cattle and poultry. Grazing and supply of fresh or dried leaves to cattle of (ratoon) crops is practised but could be improved and more widely used.

Some uses as folk medicine are reported (KIRTIKAR & BASU 1933, MORTON 1976). Pigeonpea is, or has also been, used as a host for a silk worm and a lac insect (KRISHNASWAMI & SAIKIA 1959). Old stalks are valuable as fuel, even to the extent that a poorly yielding crop may fetch more money from stalks than from seeds. Basket making and roof-thatching materials are also provided by the pigeonpea. Further details on use are scattered through the literature. Reviews such as WATT (1889, 1908), PATHAK (1970), EL BARADI (1978), KAY (1979), DUKE (1980) give more details and references.

#### 10.5 *Cajanus cajanifolius* (Haines) van der Maesen comb. nov.

Fig. 5, p. 90, Map 10, p. 93, Plates 8, 9, p. 92, 94

*Cajanus cajanifolius* (Haines) van der Maesen comb. nov.

Basionym: *Atylosia cajanifolia* Haines, J. Asiatic Soc. Bengal 1919 new ser. 15: 312 (1920); Haines, Bot. Bihar & Orissa 3: 273 (1922); idem 2: 286 (repr. 1961).

Type: India, Forests of Orissa, Puri distr., Aran forest, Aitpur, *Haines 3867* (holotype: K; isotypes: BM, CAL).

Homotypic synonym: *Cantharospermum cajanifolium* (Haines) Raizada in Mooney, Suppl. Bot. Bihar & Orissa 53 (1950).

Erect *shrub*, open-branched, 0.5-2 m tall, perennial. *Branches* at various angles to horizontal or drooping, striate, white ridge-indicating vascular pattern. *Stipules* triangular-acuminate, 3-6 mm long, persistent. *Leaves* primately trifoliate, petiole 0.5-2.5 cm, rachis 5-8 mm. *Leaflets* coriaceous, glandular-punctate both sides, lower surface densely white pubescent, hairs short, criss-cross, veins prominent and densely pubescent, hairs longer (0.25 mm) adpressed, upper surface shortly pubescent, green, top leaflet elliptic, apex rounded, 3-7 cm long, 0.8-2.3 cm wide, side leaflets elliptic, 2.5-6 cm long, 0.7-1.9 cm wide; petiolules 1-3 mm long, stipellae minute, setaceous, pubescent, ca 1 mm, tip black. *Racemes* at the end of the branches, axillary and terminal, one per node, 6-12 flowers, peduncles 1-2.5 cm, pedicels 5-10 mm; flowers yellow, flag dorsally red veined.

FIG. 5. *C. cajanifolius*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X (1-9: van der Maesen 2739).



PLATE 8. *Cajanus cajanifolius*, two or three year old shrub near Dharawada, Dummakonda Reserve Forest, Andhra Pradesh, India (courtesy: Bot. Dept. Andhra Univ. Waltair).

*Bracts* triangular or rounded scales, ca 3-5 mm long, caducous. *Calyx* pubescent, hairs long and short; glandular; tube 3-4 mm, teeth triangular, acute, 2-3 mm, the upper ones almost entirely connate. *Vexillum* circular to obovate, ca 13-15 mm long, 12-13 mm wide, base clawed, biauriculate, two faint bulges on top of claw, apex emarginate. *Alae* elongate-obovate, ca 14 mm long, 4 mm wide, base auriculate, curved. Keel petals crescent-shaped, ca 14 mm long, 5 mm wide, ventrally joined. *Ovary* densely pubescent, ca 4 mm, 3-4 ovules, style ca 13 mm, halfway pubescent, persistent. *Stamens* ca 17 mm, free part upcurved, ca 5 mm long, anthers dorsifix. *Pods* oblong, ca 4 cm long, 8-10 mm wide, tapering at both ends, tipped by style grown sturdy, ca 1 cm long, brown, amount of purple variable, especially present on sutures and depressions, densely covered with grey hairs, glandular, transverse depressions at oblique angles to the sutures, 2-4 seeds. *Seeds* rectangular-rounded, black with grey mosaic, ca 5-6 mm long, 4-5 mm wide, 3 mm thick, strophiole large, 1 X 4 mm, divided, greenish white.

**Distribution:** India, S. Orissa and Bastar.

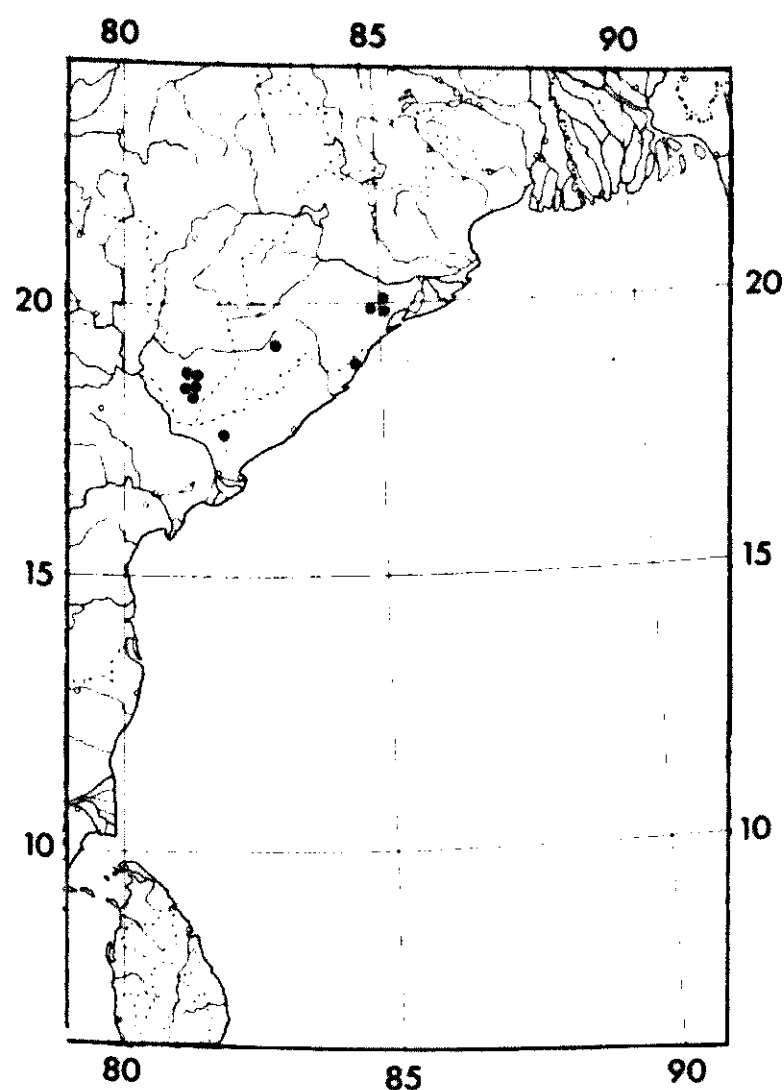
**Ecology:** Tropical dry deciduous forest, in half shade and open grassland.

**Altitude:** 500? – 1280 m.

**Flowering:** Nov-Apr.

**Fruiting:** Dec-Apr.

**Vernacular names:** Ban Arhar (= wild pigeonpea, Oriya), Adavi Arhar (= forest pigeonpea, Telugu).



MAP 10. *Cajanus cajanifolius*



PLATE 9. Habitat of *Cajanus cajanifolius*, Dharawada, E Godavari district, Andhra Pradesh, India, 1000 m (courtesy: Bot. Dept. Andhra Univ. Waltair).

### Specimens examined:

INDIA: Andhra Pradesh, E. Godavari distr.: Dharawada, Dummakonda Reserve Forest, *N.K. Rao 193* (ICRISAT); Dummakonda top, *S. Sudhakar 12160* (CAL). Madhya Pradesh, Bastar distr.: Bailadilla, Malingar Valley, road to Deposit 14 Float Ore near waterfall, *van der Maesen 2737* (ICRISAT, WAG); Bailadilla Hill top facing Malingar Valley near old IBM camp on road to Deposit 13, in iron ore (laminated haematite), *van der Maesen 2739* (CAL, ICRISAT, K, WAG); *ibid.*, *Remanandan 4868* (ICRISAT, WAG); Bailadilla Hill, in open grassland, *Mooney 380* (K); Bailadilla Range, in open grassy glades, *Mooney 911* (K); Bailadilla, *Panigrahi 6852* (CAL). Sidhi distr.: Barkadol, *Panigrahi 2165* (CAL).

Orissa: the Mals, Aran forest, Aitpur in Puri distr., *Haines 3867* (K, holo; BM, CAL, iso); Arang

forest, Ayatpur to Dhuakali near road, Puri distr., *Haines 4091* (K); Bajghola forest, *G.V.S. Rao 30020* (CAL); Arang Reserve forest 3-4 km from Aitpur Checkpost, *Remanandan 4876* (ICRISAT, WAG); Rastuguda valley, Kasipur, S. Kalahandi distr. (now in Koraput distr.) on Indra Giri hill, *Mooney 3251* (K, DD); Dhandakaryanja Project, *Thothatri, April 1967* (CAL).

Notes: This peculiar species is very similar to the pigeonpea, except that its seeds have a very pronounced seed strophiole, and are longer than wide. The pods contain only 3-4 seeds. It is the first pigeonpea truly occurring and collected in the wild in India. Although the Ban Arhar is known as such, the absence of strophioled seed in houses or markets points to only occasional contact with the wild populations. Its occurrence on hill tops might indeed point to human interference, but the large-seeded pigeonpeas available from the foothills would have been preferred for introduction. Since it was only collected on less than twenty occasions, it seems to be quite rare or confined to a few pockets.

The very rare occurrence in India of true pigeonpeas growing wild can be ascribed to the intense grazing by cattle. If spilled seed germinates and plants grow spontaneously these are likely to be eaten. In Cumbum (Kurnool district, Andhra Pradesh) the occurrence of pigeonpea in the wild state is reported in areas, from which illegal settlers of forests were evicted over sixty years ago. I collected pigeonpea along the road to Horsley Hills (Chittoor district, Andhra Pradesh), that were obviously perpetuated from seeds dropped while in transit to the hill top. Further samples should be found in forests, especially where grazing is prohibited. R.S. RAO (1964) reported pigeonpea from Gudem Valley, in East Godavari district, Andhra Pradesh, possibly growing from seeds dropped by passers-by. These plants, collected without fruits, might well be *C. cajanifolius*, as RAO suggested (pers. commun., 1981). More plants are likely to be located, if sought in places isolated from population and cattle.

In Africa remnants of cultivation or adventive occurrence are much more common. The occurrence of *Cajanus cajanifolius* is a strong point in favour of the Indian origin of the pigeonpea, if *C. cajanifolius* is considered a progenitor. In West Africa the less similar *C. kerstingii* is endemic, but it is the only related species, all the others occur in India or Australia.

Crosses between *C. cajan* and other species with *C. cajanifolius* have produced fertile hybrids, but considerable disparity exists between the rate of crossing success with different accessions of *C. cajanifolius*.

*C. cajanifolius* is attacked by pigeonpea pests to the same extent as the pigeonpea.

#### 10.6 *Cajanus cinereus* (F. v. Muell.) F. v. Muell. **Fig. 6, p. 96, Map 11, p. 98**

*Cajanus cinereus* (F. von Mueller) F. von Mueller, Census Austral. Pl. Suppl. 1-4:41 (1881); F. von Mueller, Second Census Austral. Pl. 1: 71 (1889).

Basionym: *Atylosia cinerea* F. v. Muell., Pl. Fitzalan 9 (1860); Bentham, *Agric. Univ. Wageningen Papers 85-4 (1985)*





Fl. Austral. 2: 264 (1864); Fitzgerald, J. Proc. Roy. Soc. W. Austral. 3: 156 (1918); Reynolds & Pedley, *Austrobaileya* 1-4: 424 (1981).

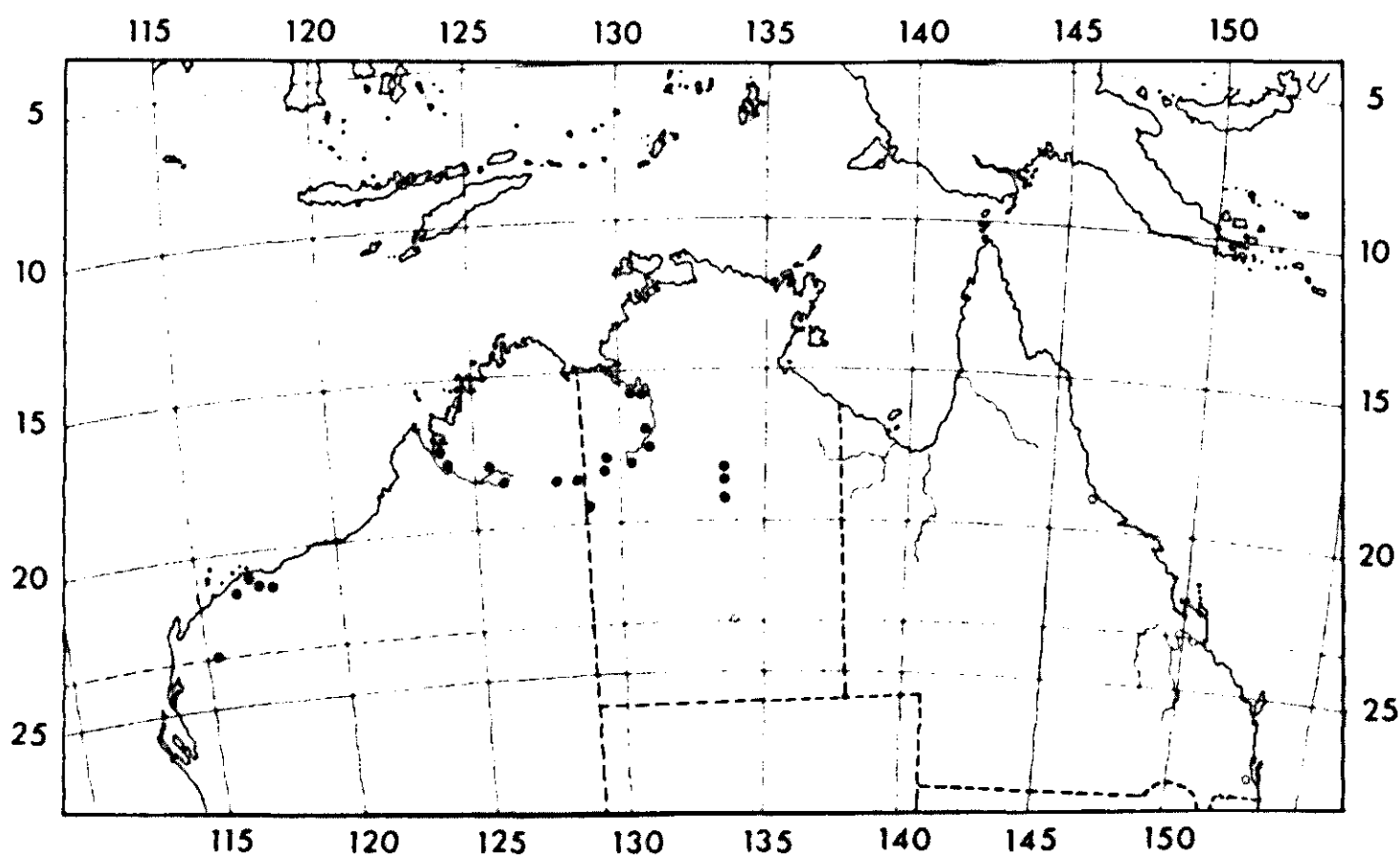
Type: Australia, Northern Territory, (Upper) Victoria River, *F. von Mueller s.n.* (holo: K; iso: K, MEL 47634, photograph seen).

Homotypic synonyms: *Cantharospermum cinereum* (F. v. Muell.) Taub. ex Ewart & Davies, Fl. N. Territory 152 (1914).

Erect greyish *shrub*, 1 to 2 m. *Stems* and leaves densely covered with very short, greyish velvety indumentum. Vesicular glands inconspicuous. *Branches* striate, especially young parts. *Stipules* small triangular or lanceolate scales, up to 1 mm. *Leaves* digitately trifoliolate, petiole striate (1-)1.5-3 cm, rachis striate, 2-6 mm, petiolules relatively long, 3-5 mm. Leaves velvety, glandular punctate both sides, greenish with very prominent white veins above, veins not sunken or raised, silvery grey below with raised midrib but scarcely raised veins, reticulations filled with short close pubescence. Top leaflet ovate to elliptic, (2-)2.5-5(-1.5) cm long, (1.2-)1.5-2.5(-3) cm wide, tip obtuse to acute, base cuneate to broad cuneate, side leaflets ovate, 2-4.5 cm long, 1-2(-3) cm wide, tip obtuse to acute, base cuneate. *Stipellae* absent. *Racemes* axillary, one per axil, ca 3-7(-10) flowered, peduncles striate, 2-4(-8) cm long, pedicels rather thick, ca 5-8 mm, flowers yellow, rather persistent, flag sometimes dorsally brown striate, at first flowers closely together at end of peduncle, ultimately 3-8 mm apart, nodes rather thick. *Bracts* rounded-mucronate, thick-velvety scales, up to ca 3 mm long, caducous. *Calyx* silvery pubescent, interior also on purplish base, tube ca 4-5 mm, teeth triangular to lanceolate-acuminate, 3-8 mm long, midribs prominent, the upper ones connate except at the tips, the lower one longest. *Vexillum* obovate, 15-19 mm long, ca 12-15 mm wide, top emarginate, base clawed, auriculate, two callosities near the base. *Alae* obovate, base biauriculate, ca 13 mm long, 4 mm wide. Keel petals oblique, ca 16 mm long, 7 mm wide, ventrally joined. *Ovary* densely white-pubescent with bulbous-based yellow glandular hairs, 4-5 mm long, ca 4-6 ovuled. *Style* ca 14 mm long, basal half pubescent, somewhat flattened in the curve, last 6 cm upcurved, stigma capitate. *Stamens* ca 17 mm long, free part upcurved, 5 mm, anthers dorsifix. *Pods* oblong, acute at both ends, tipped with base of style, closely covered with very short silvery hairs, glands yellow to brown, transverse depressions oblique, sutures thick, (3-)4-6 seeds. *Seeds* round-oblong, reddish brown with black mosaic, ca 4-5 mm long, 4 mm wide, 2.5-3 mm thick, strophiole divided, rather narrow.

Distribution: Australia, West Australia and Northern Territory.

FIG. 6. *C. cinereus*: 1. branch, 1X; 2. flag outline, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X (1-9: *E. Clement s.n.*).



MAP 11. *Cajanus cinereus*

**Ecology:** On shallow stony soils, siliceous and limestone rocks, with *Eucalyptus terminalis*, along river banks.

**Flowering:** Apr-Aug.

**Fruiting:** Apr, Jul-Aug.

**Specimens examined:**

AUSTRALIA, NORTHERN TERRITORY: Upper Victoria River, *Anon. s.n.* (MEL); Robinson River, *Armit 364* (MEL); 32 km E of Timber Creek, *Byrnes 745* (NT); Limbunya, *Dunlop 3536* (BRI); 107 km from Tanami to Gordon Downs, *Gittins 2389* (BRI, K); Powell Creek, *Holtze 981284* (MEL); Upper Victoria River, *F. von Mueller s.n.* (lectotype: K, iso: K, MEL, photograph seen); 82 km N of Tennant Creek, *Perry 643* (CANB, NT); 19 km of Victoria River Downs Station, *id. 2109 AD* (CANB, NT, US); 22 km S of Limbunya Station, *id. 2341* (BRI, CANB, NT); 5 km S of Timber Creek, *id. 2696* (AD, BRI, CANB, K, NT, US).

WEST AUSTRALIA: betw. Millstream and Yalleen, *Beard 2949* (PERTH); Mt Edgar Station SE from Marble Bar, *Burbidge 1118* (PERTH); Mullagine Road S from Mt Edgar, *id. 1141* (PERTH); betw. Ashburton & Yule Rivers, *Clement s.n.* (K); betw. Ashburton & De Grey Rivers, *id. s.n.* (K); *Harding River*, *Cusack 169* (MEL); 5 km N of Port Hedland, *Demara 7066* (PERTH); ca 83 km Port Hedland to Wittenoom, *Fairall & Lullfitz L 2719* (PERTH); Mt Anderson, W Kimberleys, *Fitzgerald 45* (CANB); 18°S, 126°10'E, *Forrest 79* (MEL); King's Sound, *Froggat 21* (MEL); Sherlock River, Tambrey Station, *Gardner 3118* (PERTH); Hall's Creek, Kimberley distr., *Giles s.n.* (MEL); Nichol Bay, *F. Gregory's Exp.* (MEL, photograph seen); Outcamp Hill nr Gogo Station, Fitzroy Crossing, *H.A. Johnson 5126* (CANB, NT); betw. Gascoyne & Fortescue Rivers, *King s.n.* (MEL); Wittenoom, *McGuirero s.n.* (PERTH); NW Division, *Mitchell s.n.* (K).

**Notes:** The very short protologue by VON MUELLER (1860) was amplified by BENTHAM (1864) on the basis of von Mueller's material and other specimens. One of Bentham's specimens quoted of *A. cinerea*, the (Upper) Victoria River collection of VON MUELLER was designated as lectotype for *A. cinerea*. One of the sheets at Kew is complete with flowers and fruits. The Nichol Bay specimen

has no fruits. In the 'Introduction' to the 'Flora Australiensis' BENTHAM (1864) mentioned that VON MUELLER frequently sent more complete material to HOOKER in Kew and sometimes only kept fragments in Melbourne.

The epithet *cinerea* was often used to label several of the species which are now separate.

*C. cinereus* and *C. pubescens* are closely related. Incomplete specimens of *C. cinereus* are sometimes difficult to distinguish, especially if the leaves are not fully expanded, leaving them reticulate above with veins not so conspicuously white as those of *C. pubescens*. *C. cinereus* always has more major secondary veins in its leaflets, long petiolules, and larger flowers and pods than *C. pubescens*.

#### 10.7 *Cajanus confertiflorus* F. v. Muell.

Fig. 7, p. 100, Map 12, p. 101

*Cajanus confertiflorus* F. von Mueller, Pl. Fitzalan 9 (1860); F. von Mueller, Census Austral. Pl. Suppl. 1-4: 41 (1881); F. von Mueller, Second Census Austral. Pl. 1: 71 (1889).

Type: Australia, Queensland, Burdekin Expedition, Magnetical Island, Fitzalan (holo: MEL, not seen, or K?).

Paratype: Australia, Rockhampton, Thozet 528 (MEL 91664, 91665, P).

Heterotypic synonym: *Atylosia pluriflora* F. v. Muell. ex Benth., Fl. Austral. 2: 264 (1864); Bailey, Queensland Fl. 2: 439 (1900); Reynolds & Pedley, Austrobaileya 1-4: 423 (1981). Nomen superfl.

Lectotype: Australia, Queensland, Burdekin Expedition, Fitzalan (lecto: K; iso: MEL), lectotypus novus.

Paratypes: Broad Sound, Robert Brown s.n. (E, K, MEL); R. Brown 4207 sine loc. (E, K); Rockhampton, Thozet (MEL, P); nr Princhester, Bowman 46 (MEL, photograph seen); Thozet's River, Dallachy (only Dallachy specimens indicating Queensland seen, at K, at MEL Thozet's River without mention of Dallachy, photograph seen).

Erect branched *shrub*, 0.5-1.2 m. *Branches* and leaves rather densely covered with silvery hairs and yellow vesicular glands, branches striate. *Stipules* none or indistinguishable in the indumentum. *Leaves* digitately trifoliolate, petiole 8-12 mm, petiolules 1.5-3 mm. *Leaflets* coriaceous, glandular punctate both sides, dull greyish green, reticulate above, with silvery hairs of short and medium length, veins reticulately prominent with medium long silvery hairs below. Top leaflet obovate to elliptic, 2-5.5 cm long, 1-2.5 cm wide, apex acute to obtuse, sometimes twisted, mucro inconspicuous, base cuneate, side leaflets more or less elliptic to obliquely ovate, 1.6-3.2(-4) cm long, (0.7-)1-1.5 cm wide, tip obtuse or acute, base cuneate. *Stipellae* absent. *Racemes* long, axillary or terminal, one per axil, elongating during pod development, ca 5-10 flowered, hairs dense, golden-brown, peduncles (2-)3-8 cm long, flowers clustered on last 1-2 cm, almost

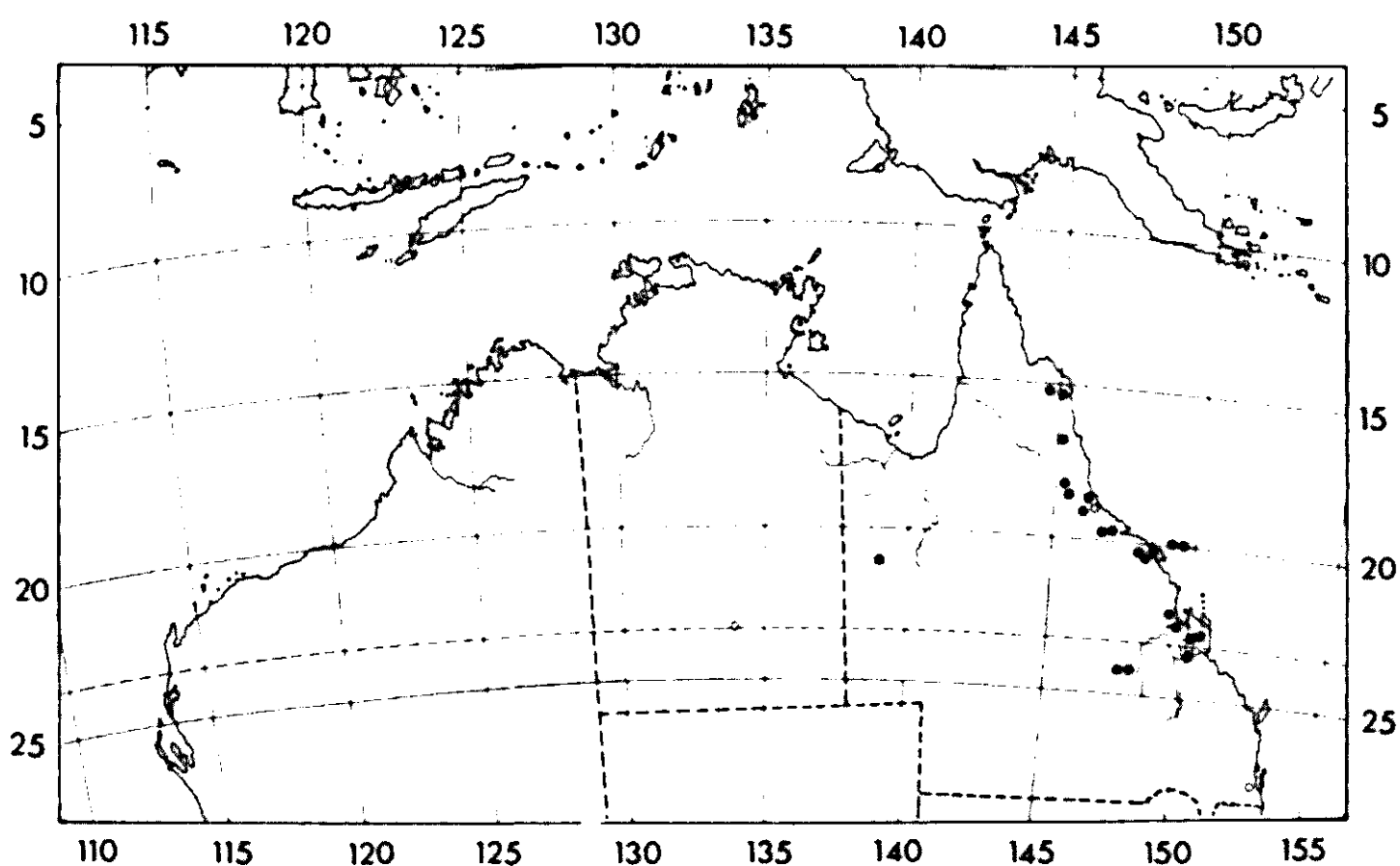


sessile in bud, pedicels 5-8 mm in fruit, flowers yellow, flag dorsally purplish, nodes of raceme slightly thickened. *Bracts* ovate scales, ca 3 mm long, 2 mm wide, glabrous inner side, very pubescent outer side, caducous. *Calyx* pubescent, interior also, tube 2-4 mm, teeth triangular-acuminate, the upper ones almost entirely connate, 3-6 mm long, the lower one longest. *Vexillum* rounded-obovate, ca 13 mm long, 12 mm wide, base clawed, auricled, margin of lobes introflexed, two faint callosities near the base. *Alae* obovate, biauriculate, ca 12 mm long, 4 mm wide, keel petals oblique, ca 13 mm long, 5 mm wide, ventrally joined. *Ovary* densely white-pubescent, ca 4 mm long, 4-ovuled. *Style* ca 11 mm, last 5 mm upcurved, glabrous except near the base, curve somewhat flattened, stigma capitate. *Stamens* ca 15 mm long, free part 5 mm, upcurved, anthers dorsifix. *Pod* oblong, acute at both ends, densely covered with long and short silvery hairs, glands yellow, transverse depressions more or less oblique, (2-)3-4(-5) seeds. *Seeds* oblong, dark or greyish brown speckled with black or cream, 3-5 mm long, ca 3 mm wide, ca 3 mm thick, strophiole prominent, divided, 1.8 mm long.

**Distribution:** Australia, Queensland.

**Ecology:** Undershrub in (open) *Eucalyptus* forest, grazing land, open exposed hillsides, on stony or coarse sandy alluvial soils.

**Flowering:** Dec-Apr, Jun, Jul, Sep, Nov. **Fruiting:** Mar-May.



MAP 12. *Cajanus confertiflorus*

FIG. 7. *C. confertiflorus*: 1. branch, 1X; 2. leaflet, 2X; 3. two-seeded fruit, 1X; 4. seed, 3½X; 5. detail upper leaflet surface, 2X; 6. detail lower leaflet surface, 2X (1-6: WTJ 1849).

### Specimens examined:

AUSTRALIA, Queensland, Montrose Creek, *Anon. s.n.* (MEL 91590); Rockhampton, *Anon. 154* (MEL); Thozet's Creek, *Anon. s.n.* (MEL); Cashmere, *Armit 58* (MEL); Don River, Edgumbe Bay, *Birch s.n.* (MEL); Many peaks, Townsville N slopes, *id. s.n.* (BRI); Canoona 48 km NNW of Rockhampton, Port Curtis distr., *Blake 15320* (BRI); Broad Sound, Queensland sine loc., *Bowman s.n.* (K, MEL, photograph seen); nr Princhester, *id. 46* (MEL, paratype of *A. pluriflora*, photograph seen); *R. Brown s.n.* (E, K, MEL); sine loc., *id. 4207* (E, K); Endeavours River, *Cunningham 392* (BM, K); Glen Geddes, ca 40 km NW of Rockhampton, *Everist 8001* (BRI, K); Burdekin Expedition, *Fitzalan s.n.* (K, MEL 2 sheets, lectotype of *A. pluriflora*); Port Denison, *id. s.n.* (MEL, 3 sheets); Normanby Station, *Higgins s.n.* (BRI); Burdekin, Valley of Lagoons, *Leichhardt s.n.* (P); Summit of Mt Stuart, *MacGarlane s.n.* (BRI); Hayman Island, N of Whitsunday Island, *MacGillivray s.n.* (BRI); Herberton, *Rev. Michael 386* (BRI); nr Springsure, *O'Shanassy 40018* (MEL); Mt Stuart, Hill Top nr TV Tower, Townsville, *Remanandan 4193* (ICRISAT, WAG); Herberton, *Ringrose s.n.* (BRI); Mt Wheeler, Rockhampton, *Thozet 528* (MEL, P, paratype of *A. pluriflora*); Hayman Island, *C.T. White 10118* (BRI).

Notes: Typification of *Cajanus confertiflorus* was rather difficult, as several type specimens could not be inspected. Comparison of protologues clarified von Mueller's *C. confertiflorus* as conspecific with Bentham's *Atylosia pluriflora*. The second specimen listed by VON MUELLER, *Thozet 528*, can be regarded as paratype, and is one of the syntypes noted by BENTHAM.

Several specimens collected by Fitzalan, obviously from the same species but different plants, are lodged in MEL and K. None I saw bears the location Magnetic Island, or the epithet '*confertiflorus*' in von Mueller's hand. He wrote either '*Cajanus pluriflorus*' or '*Atylosia pluriflora*' on all of them. It is safe to designate these as isotypes. The Fitzalan specimen in K (no detailed location) is the best choice for the lectotype, since better inflorescences are present than in MEL 91593 (Port Denison, Fitzalan). Another sheet, MEL 91588 (1863 or 1883, Fitzalan) has more acute leaflets similar to Robert Brown's specimen from Broad Sound, the first of Bentham's *A. pluriflora* syntypes. All the specimens collected by FITZALAN originate from the Burdekin Expedition in 1860, the only collection he made (Index of Collectors, 1957, LANJOUW & STAFLEU). The (handwritten) date 1863 or 1883 must therefore be a date of receipt and not collection. Apparently VON MUELLER saw the material before it was sent to the other herbaria.

*R. Brown 4207* sine loc. was mounted on the syntype sheet at K and therefore BENTHAM probably also considered this as a type, while he published Broad Sound as location. BENTHAM based his description on specimens with ovate-obtuse as well as elliptical, almost acute leaflets, which I also consider to belong in one species.

On first inspection the specimens with obovate-obtuse leaflets look similar to *C. pubescens*, but the indumentum differs. In *C. confertiflorus* the hairs obscure the reticulations on the lower surface much less, and the leaves are always palmately trifoliolate, this only occurs in *C. pubescens* when the leaves are not fully expanded.

Many specimens are rather poor and fruits could only be seen on 3 sheets, collected by MACGARLANE (1963), REMANANDAN (1980), and RINGROSE (1904).

The fruit(s) BENTHAM saw must therefore belong to a duplicate of BROWN, THOZET or DALLACHY which I did not see. VON MUELLER saw material without fruits from FITZALAN and THOZET. In his publications VON MUELLER never announced the synonymy of *A. pluriflora* with his own *C. confertiflorus*, but he did not list *A. pluriflora* separately, and maintained *C. confertiflorus* in his lists.

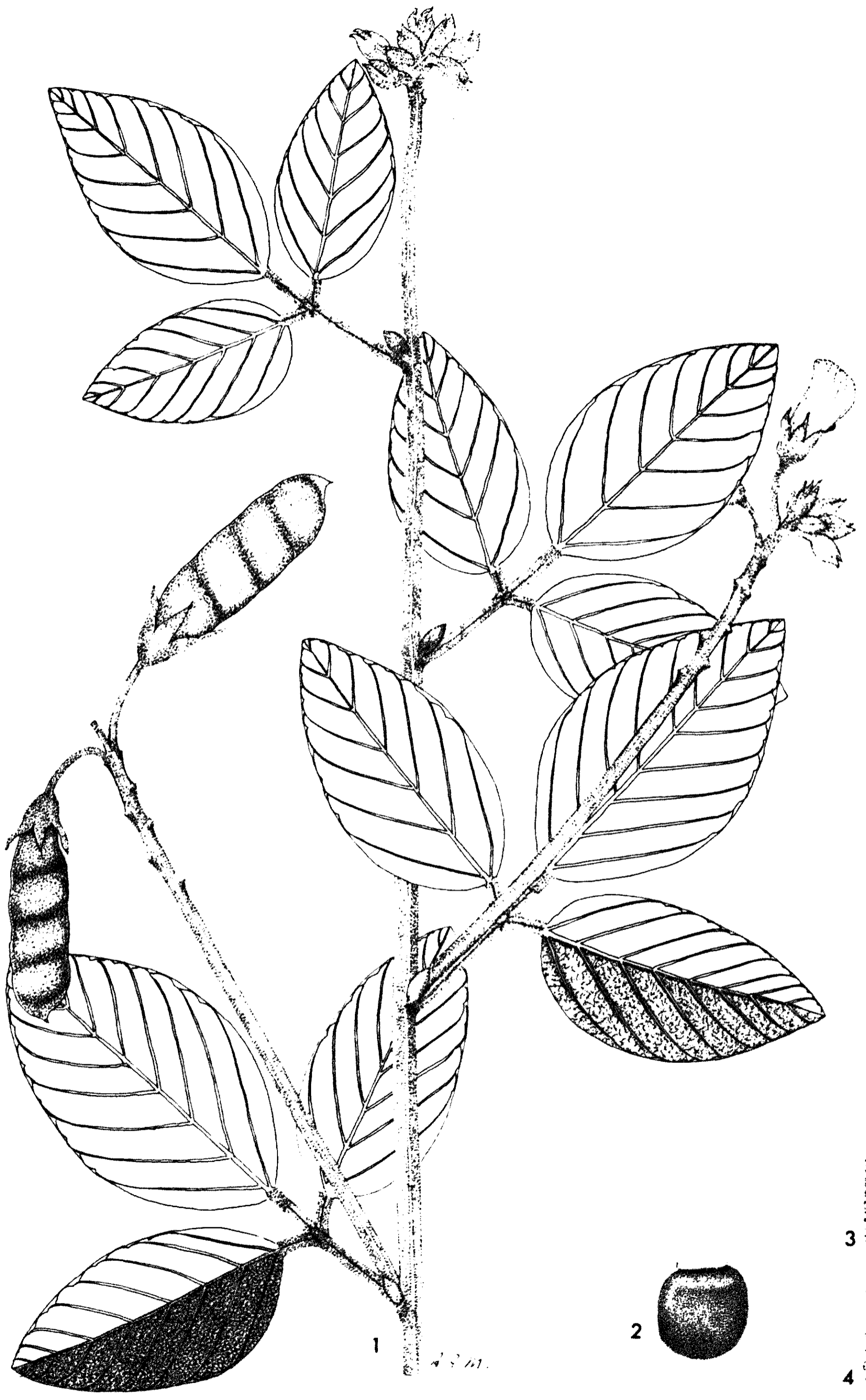
10.8 *Cajanus crassicaulis* van der Maesen sp. nov.      Fig. 8, p. 104, Map 4, p. 63

*Cajanus crassicaulis* van der Maesen sp. nov.

Type: Australia, Northern Territory, 53 km SW Victoria River H/S, 16° 38'S, 130° 42'E; P.K. Latz 5307 (holo: NT; iso: K. Also in CANB, DNA, not seen).

*Frutex ad 1.5 m, caulis distalis crassus; indumentum dense niveo-velutinum, folia trifoliolata, pinnata, foliola ovata valde crassa, glandulae inconspicuae. Calyx dense pubescens, dentibus lanceolatis, pilis glandulosis et glandulis visibilibus. Corolla aurea, caduca. Ovarium dense niveo-pubescens. Legumen firmum, oblongum, indumentum quam indumentum foliae brevius, strophiola seminum divisa. Species affinis C. latisepalo, C. lanuginoso et C. reticulato, differt ab eis caulibus et foliolis crassis, indumento niveo-velutino. In Australia Septentrionale et Occidentale distributa.*

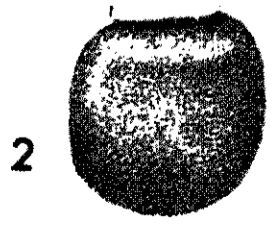
Erect shrub, up to 1.5 m high. *Indumentum* short, very dense, whitish-velvety. *Branches* thick also at the end, striations obscured by hairs. Vesicular glands obscured, only visible on calyx and pods. *Stipules* ovate-acuminate, hairy, ca 3-5 mm long, 2 mm wide. *Leaves* pinnately trifoliolate, petiole thick, 1.5-2 cm long, rachis thick, 4-5 mm long, petiolules thick, 3-5 mm long. *Leaflets* very thick, coriaceous, dense-velvety, vesicular glands obscured, whitish green both sides, veins hardly sunken above, hardly raised and white below. Top leaflet ovate, 3-5 cm long, 2-2.5 cm wide, tip acute, base rounded. Side leaflets (obliquely) ovate, 3-4 cm long, 1.3-2.2 cm wide, tip acute, base rounded. *Stipellae* not seen. *Racemes* axillary, not branched, one per axil, 10- to 25-flowered, peduncles long, up to 14 cm, thick, pedicels 1-1.5 cm in fruit, flowers yellow, caducous. *Bracts* rounded-mucronate, ca 5 mm long and wide. *Calyx* pubescent with glandular hairs and vesicular glands, interior also pubescent, tube 4 mm, teeth lanceolate, 3-6 mm long, upper ones almost connate, lower one longest. *Vexillum* obovate, ca 14 mm long, 11 mm wide, base clawed, shortly auriculate, margin of lobes inflexed, two callosities near the base, apex emarginate. *Alae* obovate, ca 13 mm long, 3 mm wide, base auriculate, keel petals oblique, ca 13 mm long, 5 mm wide, ventrally formed. *Ovary* densely white pubescent, ca 5 mm long, 6-ovuled, style ca 12 mm, base pubescent, last 6 mm upcurved, glabrous, stigma capitate. *Stamens* ca 16 mm long, free part 5 mm, upturned, anthers dorsifix. *Pods* sturdy, oblong, ca 3.5 cm long, 0.9 cm wide, base tapering, apex obtuse, with base of style, pubescence not so dense as on leaves, vesicular glands present, transverse depressions oblique, 4-5 seeds. *Seeds* rectangular-rounded, ca 4 mm



3



4



2



long, 3 mm wide, 1.5 mm thick (not fully mature), blackish, strophiole horse-shoe-shaped, greenish.

**Distribution:** Australia, Northern Territory and West Australia.

**Ecology:** In skeletal soil, sandstone hill.

**Flowering:** May-Jun. **Fruiting:** Jun.

**Specimens examined:**

AUSTRALIA, NORTHERN TERRITORY: 53 km SW of Victoria River H/S, P.K. Latz 5307 (holo: NT, iso: K. Also in CANB, DNA, not seen).

WEST AUSTRALIA: 17° 30'S, 128° 10'E, Forrest 79 (MEL); 18° 20'S, 126° 20'E, *id.* 79 (MEL); 13 km SE of Hall's Creek, Gardner 7163 (PERTH).

**Notes:** The whitish green foliage, thick stems, petioles and peduncles separate the newly-described *C. crassicaulis* from other *Cajaninae*. *C. reticulatus*, *C. latisepalus*, *C. pubescens* and *C. lanuginosus* are presumably its closest allies. More specimens are likely to be found since it occurs in apparently botanically underexplored areas. The species, as LATZ also noted on his label, so far appears to be rare.

#### 10.9 *Cajanus crassus* (Prain ex King) van der Maesen

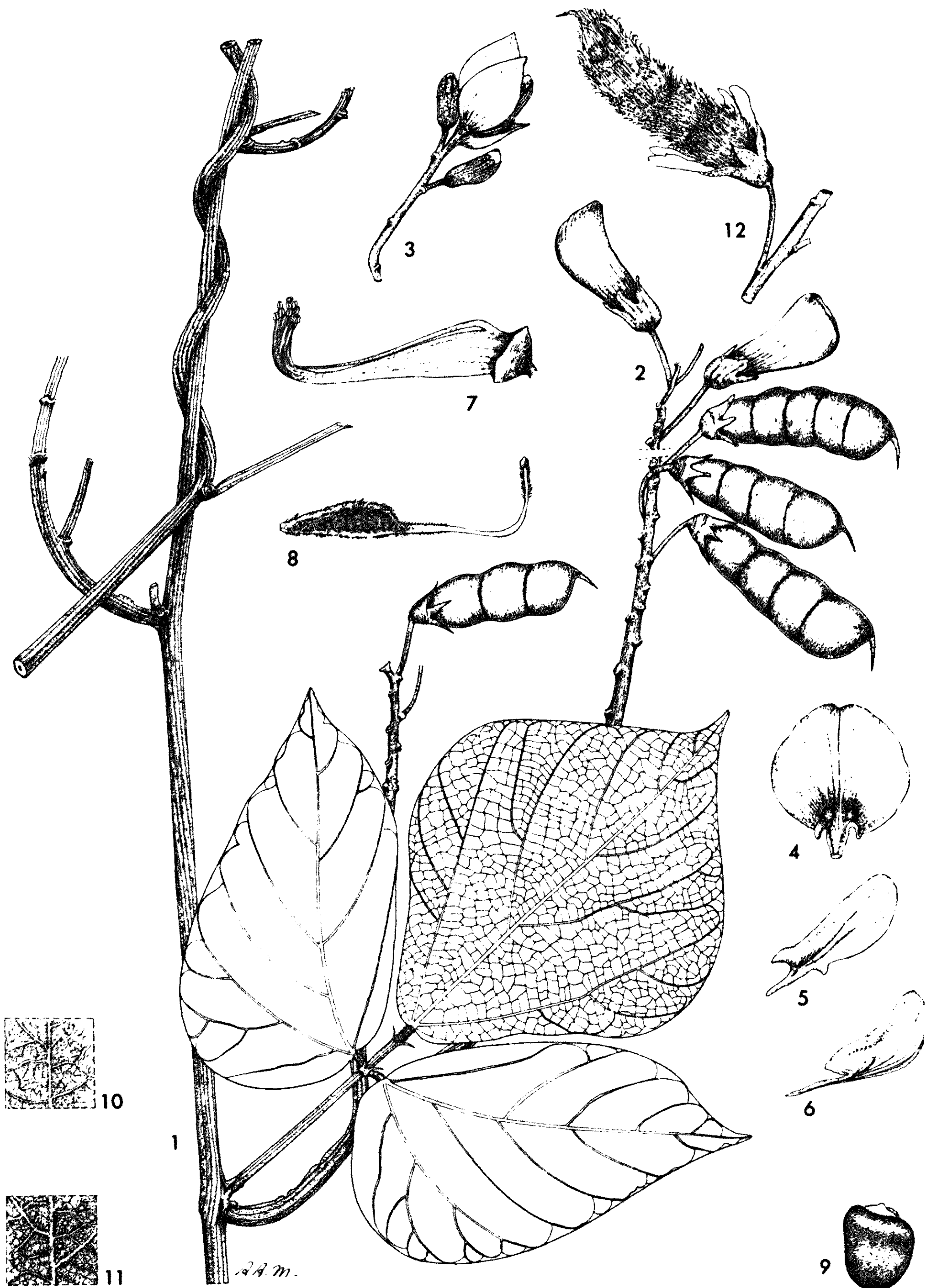
**Fig. 9, p. 106, Maps 13, 14, p. 107, 108**

*Cajanus crassus* (Prain ex King) van der Maesen comb. nov.

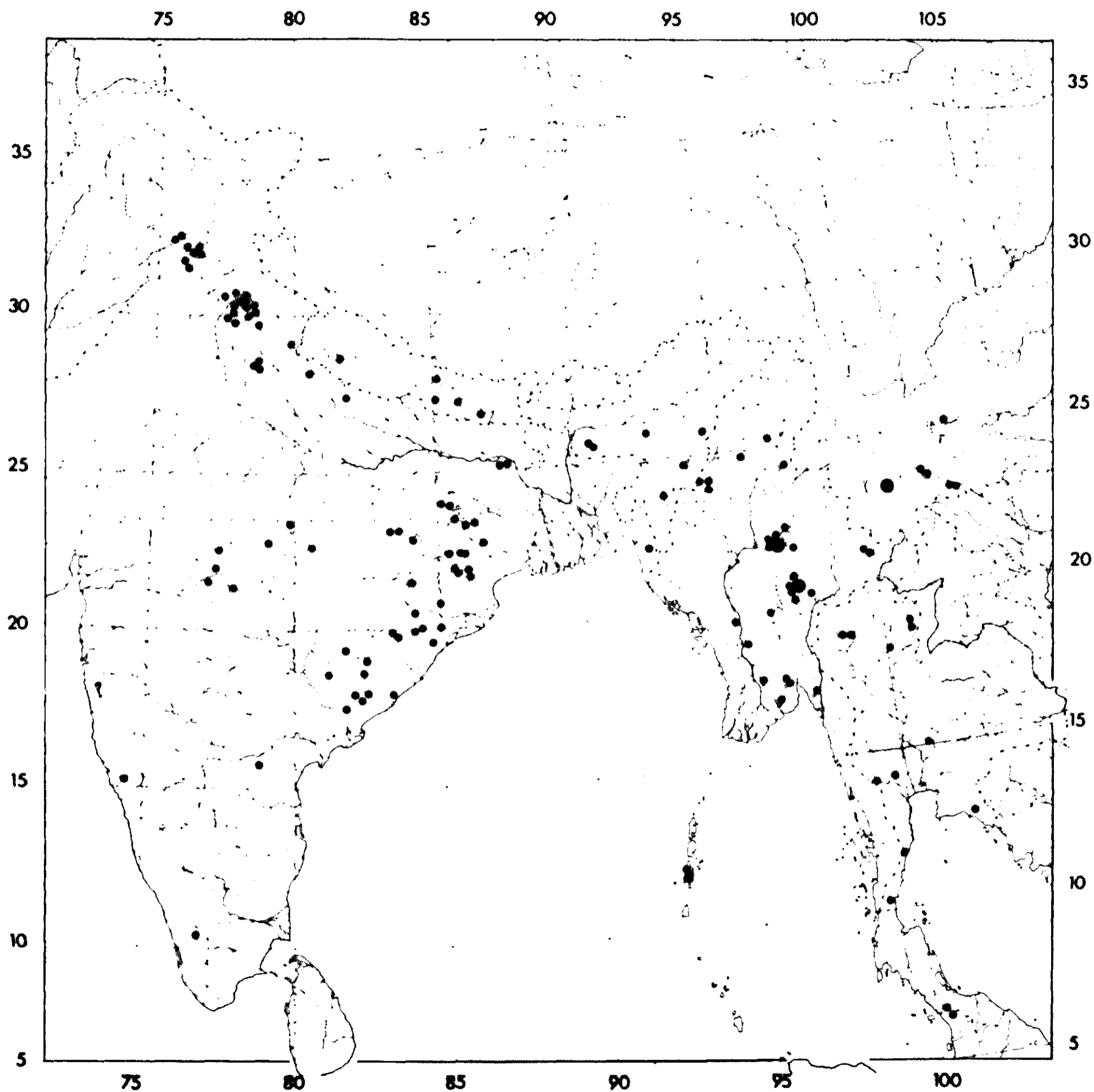
For literature, typification and synonyms see under varieties.

Climber, perennial, supported by trees. *Branches* brownish pubescent (hairs very short), terete, firm, length up to 10 m. *Stipules* minute, ca 1 mm, triangular, caducous. *Leaves* pinnately trifoliolate, petiole 4-11 cm, rachis 0.3-1 cm. *Leaflets* coriaceous, thick, lower surface brownish pubescent, also on the thick prominent ribs, glandular-punctate, upper surface dark green, thinly puberulous especially on the veins; top leaflet subtrapezoid, acuminate, 3.5-10 cm long, 3-9.5 cm wide, below the middle narrowing to the rounded or cordate base, apex acuminate-cuspidate, side leaflets obliquely so, 3.5-10 cm long, 2.5-7.5 cm wide, petiolules 2-3 mm. *Stipellae* setaceous, 2-4 mm. *Racemes* crowded, 3-6 cm, up to ca 20 flowers, 1-2 flowers per node, corolla yellow, marcescent, pedicels 4-10 mm, in fruit firm. *Bracts* large, elliptic-ovate, apex obtuse, fringed or acute, 10-15 mm long, 6-12 mm wide, thinly pubescent, caducous. *Calyx* pubescent (interior also), hairs short, not bulbous-based, tube 4-6 mm, teeth triangular, shorter than the tube, 3-5 mm, apex quite obtuse, upper teeth almost entirely connate.

FIG. 8. *C. crassicaulis*: 1. branch, 1X; 2. seed, 6X; 3. detail upper leaflet surface, 2X; 4. detail lower leaflet surface, 2X (1-4: P. K. Latz 5307, holo).



*Vexillum* obovate, 15-21(-27) mm long, 12-20 mm wide, apex emarginate, base clawed, auricles reinforced. *Alae* obovate, base biauriculate, 15-17 mm long, 6-7 mm wide. Keel petals rounded-oblique, 16 mm long, ventrally joined. *Ovary* ca 6 mm, covered with yellow glandular bulbous hairs and white setae in varying density, but not crowded, ca 6 ovules. *Style* ca 12 mm, about the middle up-curved, pubescent except in the curve, stigma capitate. *Stamens* ca 19 mm, free

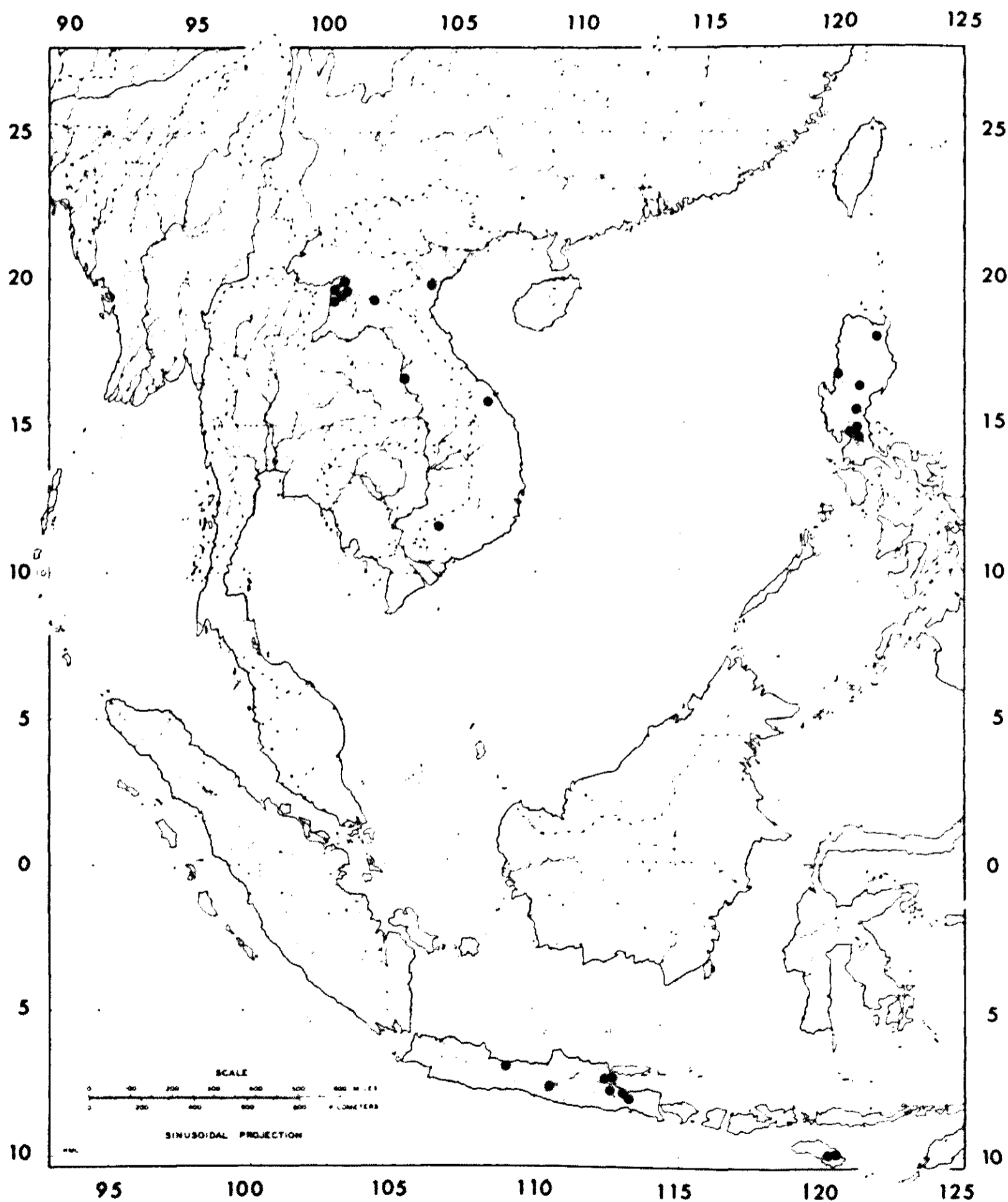


MAP 13. *Cajanus crassus* in South Asia: ● var. *burmanicus*, • var. *crassus*

Fig. 9. *C. crassus* var. *crassus*: 1. branch, 1X; 2. flowers, 1X; 3. part of inflorescence with bracts, 1X; 4. flag, 1X; 5. wing, 1X; 6. keel, 1X; 7. stamens and stigma, 2X; 8. pistil, 2X; 9. seed, 2X; 10. detail upper leaflet surface, 2X; 11. detail lower leaflet surface, 2X; 12. var. *burmanicus*: pod, 1X (1-11: van der Maesen 2721; 12: van der Maesen 4208).

part 3-6 mm, upcurved, anthers dorsifix. *Pods* sturdy, oblong, ends rounded-acuminate, 2.5-5 cm long, 0.8- 1.4 cm wide, (4-)5-6 seeds, shortly puberulous, (long indumentum in var. *burmanicus*), sticky, reticulate or not, transverse depressions oblique or straight, deep when fully developed. Sutures often undulate. *Seeds* rectangular-rounded, ca 4-5 mm long and wide, 3 mm thick, black with cream mosaic, or cream, strophiole 1 X 2.5 mm, divided, yellowish white.

**Distribution:** N W Himalaya Foothills, Central India, Assam, Eastern Ghats, Andamans, Nepal, Burma, Thailand, Vietnam, Java, Philippines, Malay Peninsula.



MAP 14. *Cajanus crassus* in South East Asia

Ecology: Climber in trees of dry forests (Sal, teak, pine) or shrub vegetation, along streams or on dry soils, on alluvium, loam schists, granite rocks.

Altitude: 0-800 m, sometimes up to 2000 m (var. *burmanicus*).

Flowering: (Dec) Jan-Mar (India, Burma, Malay Peninsula, Philippines, Vietnam), Apr-Aug (Java).

Fruiting: (Feb) Mar-Apr (India, Philippines), Jan (Vietnam).

Vernacular names: Bharat (Garhwal, N. India); Bir Malhan (Santali, Bihar); Hamur (Punjab, India); Jungli Baler (C India); Ram Kurti (Chota Nagpur, N C India); Bir malhan (Santali, Chota Nagpur); Pe yaing, Taw pe (Burma)

Key to the varieties:

Pods shortly puberulous (India, SE Asia) . . . . . var. **crassus**  
Pods with long semi-caducous golden hairs (Burma, Yunnan) . var. **burmanicus**

10.9 a **Cajanus crassus** (Prain ex King) van der Maesen var. **burmanicus** (Collett & Hemsley) van der Maesen comb. et stat. nov. **Fig. 9, p. 106, Map 13, p. 107**

Basionym: *Atylosia burmanica* Collett & Hemsley, J. Linn. Soc. 28: 49 (1890).

Type: Burma, Shan Hills, 5000 feet, *Collett 95* (K, holotype; isotype: CAL).

Homotypic synonym: *Cantharospermum burmanicum* (Collett & Hemsley) Raizada in Mooney, Suppl. Bot. Bihar & Orissa 53 (1950).

Specimens examined:

BURMA: Shan Hills, *Collett 95* (K, holotype; isotype, CAL); Maymyo hill, *D. Khan 310* (CAL); Forest edge just E of Taunggyi, *van der Maesen 4208* (ICRISAT, WAG); backyard, Taunggyi, *Vogt BU-146* (US).

CHINA: Yunnan, *H.T. Tsai 55808* (A).

Notes: Var. *burmanicus* cannot be maintained as a species, since it differs markedly from var. *crassus* only in the indumentum of the pod. Few specimens have been collected and these have their distribution within the area of the species as a whole. In cultivation at ICRISAT Center var. *burmanicus* (*van der Maesen 4208*) tends to have larger buds, bracts, flowers and pods, than several accessions of var. *crassus*.

10.9 b *Cajanus crassus* (Prain ex King) van der Maesen var. *crassus*

Fig. 9, p. 106, Maps 13, 14, p. 107, 108

Basionym: *Atylosia crassa* Prain ex King, J. As. Soc. Beng. 66: 45 (1897); Cooke, Fl. Presid. Bombay 1: 408 (1903, repr. 1958, 1967); Prain, Bengal Pl. 272 (1903, repr. 1963); Koorders-Schumacher, Syst. Verz., Fam. 128: 68 (1911); Bolding, Zakflora Landb.str. Java 115 (1916); Gagnepain, Fl. Gen. Indo-Chine 2-3: 280 (1916); Haines, Forest Fl. Chota Nagpur 320 (1920); Fischer, Survey Pl. Anaimalai, Rec. Bot. Surv. India 9-1: 1-218 (1921); Haines, Bot. Bihar & Orissa 3: 273-275 (1922), 2: 286-287 (repr. 1961); Ridley, Fl. Malay Penins. 1: 564 (1922); Osmaston, Forest Fl. Kumaon 177 (1927); Lindburg, J. Bombay Nat. Hist. Soc. 73-2: 261-269 (1976).

Type: India, Wallich 5553, *Dolichos crassus* Grah. nom. nud., *Glycine crassa* H. Ham. nom. nud., e Kalkapur 18 Dec. 1810 (type of var. *crassus*, holo: K).

Heterotypic synonyms: *Atylosia volubilis* (Blanco) Gamble, Fl. Presid. Madras 2: 369 (1918), 1: 260 (repr. 1967); Backer & Bakhuizen van den Brink, Fl. Java 1: 636 (1964); Arachi, Pict. Present. Indian Fl. 57 (1968); Nguyen Van Thuan, Fl. Cambodge, Laos, Viet-nam 17: 111-113 (1979). Based on *Cytisus volubilis* Blanco, see notes.

*Dolichos reticulatus* Ham. (non Ait.) nom. nud., Wall. Cat. 5552 (1831), based on India, Bagdwar 11 Jany 1809, Wallich 5552 A, and Nepal, Neokote, Nopalia, Wallich 5552 B (K).

*Collaea? cinerascens* Grah. nom. nud., Wall. Cat. 5575 (1831), based on India, Hardwar, climber on trees, April 1825 (CAL, G, K).

*Atylosia mollis* Benth. pro parte in Miq., Pl. Jungh. 2: 243 (1852), (excl. syn. *Collaea mollis* Grah. nom. nud. 1831). Baker in Hooker, Fl. Brit. India 2: 213 (1876); Parker, Forest Fl. Punjab, Hazara, Delhi 164-165 (1924), 161-162 (repr. 1973).

*Cantharospermum volubile* (Blanco) Merr., Philipp. J. Sci. Bot. 5: 127 (1910), (based on Phil. Pl. 15, Elmer 5612, see notes); Merrill, Fl. Manila 255 (1912, repr. 1968); Raizada in Mooney, Suppl. Bot. Bihar & Orissa 52 (1950).

**Specimens examined:**

BANGLADESH: Rainkhyang valley, Chittagong Hill Tracts, *M.S. Khan* 996 (K).

BURMA: Kantha, *Anderson s.n.* (CAL); Bhamo, *id. s.n.* (CAL, K); Inle Lake, S Shan States, *Annan-dale* 168 A (CAL); Li Lon Reserve no. 6, Tha Ton distr., *Boln* 4659 (DD); above Tamu, *Bor* 61 (DD, L); Pantha forest, Mawlaik distr., *Chin* 212, 236 (DD); Shan Hills Tarai, *Collett* 79 (K); Maro Kmai, Oloponzoh, S Shan States, *Gamble* 224 (K); Singan, Shwebo distr., *Haines s.n.* (K); Fort Stedman (Mong Hsawk), *Abdul Huk s.n.* (CAL, US); Kabaung Reserve, Thikangbauk stream, *Gilbert Rogers* 226 (DD, CAL); Saga, S Shan States, *Abdul Khalil* (CAL); Madoe Hill, *King's collectors s.n.* (P); Pellowa Zeik, Karen country, *Kurz* 1705 (CAL); Tonkye ghat, Pegu, *id.* 1705 bis (CAL); Waing, Tharrawaddy distr., *Lace* 2758 (CAL, DD, E, K); Lawa, Ruby Mines distr., *id.* 5073 (CAL,

DD, E, K); Maymyo Plateau, *id.* 6135 (E, K); King Tung, S Shan States, *MacGregor* 231 (E); *ibid.*, *id.* 1272 (CAL, E); 10 km W of Maymyo, *van der Maesen* 4220 (ICRISAT, WAG); Rangoon, *McClelland s.n.* (K); Sittaung, Chindwin distr., *Meebold* 7699 (E); Naungkangyi Reserve, Maymyo distr., *Mg Kan* 18323 (DD); Taunggyi crags, *Robertson* 162 (K); Mawbimai, S Shan States, *id.* 224 (K); nr Kalewa, Chin Hills, upper Chindwin distr., *Rock* 782 (US); betw. the Thai border, Ban Meh Huak and Pang Mah Ki Hat, *id.* 1924 (US); Naut-tagun Reserve, Mansi Div., *Su Koe* 8920 (DD); Prome, *Wallich* 5554 A (K); Yeranghuen, *id.* 5554 Cb (K); Trang Dong, *id.* 5554 Ca (K);

CHINA: Yunnan: Manhao prope fines Tonkinensis, *Handel-Mazzetti* 5771 (W, WU); Manpau, Red River valley, *Henry* 11056 (CAL, US); E Mount Poo Peng, middle part, *McLaren's collectors* (E, K); Gandshuauba nr Yuenkiang, *von Wissmann* 315 (W); on Babien-Ho between Talang and Puorl, *id.* 593 (W); Yuenkiang, *id.* 673 (W).

INDIA: Andamans, S Andaman Island; Goplakabang valley, *Heinig s.n.* (CAL, E, FI, W); Mt Harriet hill jungle, *King's collector s.n.* (CAL, G, L); Anikhet, *id. s.n.* (CAL); *ibid.*, *King s.n.* (CAL); Mani Bay, *King's collectors s.n.* (CAL); Bindraban, *id. s.n.* (CAL); Port Mouat, *id. s.n.* (CAL); *ibid.*, *King s.n.* (BM, CAL); Horn Grav's Ghat, *Kurz s.n.* (CAL).

ANDHRA PRADESH: Gilundate hills, Vishakapatnam distr., *Beddome* 125 (K); Kurnool, Nallamallay hills, *id.* 2287, 2288 (BM); Way to Ramanapenta, Nallamallais, *Ellis* 23814 (MH); Rumpa, Godavari distr., *Gamble* 16027 (CAL, K); Peddavalaa, Vishakapatnam distr., *Gamble* 21775 (CAL, K); Jamberkota reserve forest, Vishakapatnam distr., *Jacob* 17227 (MH); 3.5 km SE of Chintapalli, Vishakapatnam distr., *van der Maesen* 2717 (K, ICRISAT, WAG); from Chintapalli 51 km to Sileru, *ibid.*, *id.* 2721 (K, ICRISAT, WAG); rd to Yarlagadda nr Nulakammadi, E Godavari distr., *Narayananaswami & party* 330 (CAL); Rampa Agency, E Godavari distr., *id.* 674 (CAL).

ARUNACHAL PRADESH: Jegaon, Kameng Frontier Division, *Panigrahi* 15959 (ASSAM, CAL).

ASSAM: Lunka, *Gill* 103 (CAL, G); 71 km W of Dimarpur along NH 36, *van der Maesen* 3128 (ICRISAT, WAG).

BIHAR: Bicha, Singbhum distr., *Gamble* 90 H (CAL); West Duars forests, Singbhum, *Haines* 300 (CAL, DD, K); Rajpur Soheria, *id.* 1976 (DD, K); Varu hills above Rajmahal, Santal Parganas distr., *Madden* 146 (E); 3 km S of Hundru Falls, NE of Ranchi, *van der Maesen* 1984 (K, ICRISAT, WAG); Iundi hills, Santals, *Watt* 824 (E); Parasnath hill, Hazaribagh distr., *id.* 14418 (CAL); Silli, Ranchi distr., *Wood* 79 (K).

HIMACHAL PRADESH: Kotlehr, Kangra distr., *GSH* 506 (E); Kangra distr., *GSH* 524 (E); Bhadwar, Kangra distr., *Koelz* 4131 (G, US); *id.* 4350 (US); 7 km E of Bharwain, Kangra distr., *van der Maesen* 2864 (K, ICRISAT, WAG).

KARNATAKA: 2 km N of Supa, *N.K.Rao & Chandra* 73 (ICRISAT, WAG);

MADHYA PRADESH: Jashpurnagar, Bilaspur distr., *Arora* 7234 (CAL); way to Kutamsar caves, Bastar distr., *Balakrishna* 12048 (CAL, MH); nr Bee falls, Pachmarhi, Hoshangabad distr., *Duthie* 10372 (CAL, DD, K); Jabalpur, *Hole s.n.* (DD); Hishangawala, Hoshangabad distr., *id.* 676 (DD); Malingar valley, Bailadilla Hill, nr waterfall, *van der Maesen* 2738a (K, ICRISAT, WAG); Mandla distr., *Marten s.n.* (DD); Ramnighat, Raigarh distr., *Rathakrishnan* 19283 (BSA, CAL); Matighat, Ambikapur, *Sengupta* 15933 (CAL); E Satpura Hills, *Thompson s.n.* (K); Melghat, Gugamal range, *Witt* 8025 (DD); Surguja, Chota Nagpur, *Wood* 195 (K).

MAHARASHTRA: Konkan, *Stocks, Law s.n.* (CAL, K, P, W).

MEGHALAYA: E Poothimari, Garo hills, *Clarke* 43126 (CAL, FI, G); Garo hills, *Watt* 12167 (CAL).

MIZORAM: Aijal Station Reserve, *Deka s.n.* (ASSAM); Aijal, Lushai hills, *Parry* 630 (K).

NAGALAND: E of Kohima, *Kingdon Ward* 11126 (BM); Shibang, Naga hills, *Meebold* 7491 (K).

ORISSA: Sambalpur, *Anon. s.n.* (CAL); Dasingabadi, Ganjam distr., *Barber* 1411 (K); Jeypore hills, Koraput distr., *Beddome s.n.* (BM); Goomsur hills, *id.* 2269 (BM); Dohn Ghat, Ganjam distr., *Gamble* 13658 (CAL, K); Baliguda to Phulbani, Baudh-Khondmals, *Kapoor s.n.* (LWG); Karlapat, Kalahandi distr., *Mooney s.n.* (K); Pustiguda, Kalahandi hills, *id.* 1244 (K); Gochha, Nayagarh, Puri distr., *id.* 1672 (K); Arang Reserve Forest, Puri distr., *Remanandan* 4877 (ICRISAT, WAG).

PUNJAB: Kiyarda Dun, Sirmor, *Drummond s.n.* (E, G, U); Kalesar plains, *Lace* 41 (BSI, E, U); 57 km S of Dalhousie, Gurdaspur distr., *van der Maesen* 2885 (ICRISAT, WAG); Mairi, Hoshiarpur distr., *Misra* 47017 (BSD); Dalhousie Road, Gurdaspur distr., *Stewart* 1178 (K, RAW).

TAMIL NADU: Anaimalai hills, *Beddome* 2271 (BM).

UTTAR PRADESH: Rispana, Dehra Dun, *Babu 34688* (BSD, L); Kotdwara, Garhwal distr., *Burke 8190* (DD); Kumaon, *Bhabul s.n.* (CAL); above Kaitsi, Dehra Dun, *Duthie s.n.* (DD); Mohan Pass, *id. 278* (DD); Mohamd Pass, Saharanpur Siwaliks, *id. s.n.* (DD); Barkala, Saharanpur distr., *Gamble 25659* (DD, K, OXF); Kansani, Kumaon distr., *Gill 504* (CAL); Gola, Uheti distr., *Inayat 21465* (CAL, DD, K); Putanikhal, Corbett Nat. Park, *Janardhanan 51457* (BSD); Kalsi forest, Jaunsar, *Keshavanand 36* (OXF); Mussoorie, Dehra Dun distr., *King s.n.* (CAL); Paundha, Dehra Dun, *Sohan Lal s.n.* (DD); Dogari, Haldwani div., Naini Tal distr., *Mukarjee 83* (DD); Behind Bungalow 7, New Forest, Dehra Dun, *Naithani 3958* (DD); Ramgarh, Gonda distr., *Osmaston 710* (DD); *Kanda, Corbett Nat. Park, Pant 43341* (BSD); Bhalu Pani, Dehra Dun, *Raizada s.n.* (DD); Jhajri, *ibid., id. 15616* (DD); Tezil, *ibid., id. 15628* (DD); Dudhli, *ibid., id. 15852* (DD); Rajpur, Dehra Dun, *Saxena 1629* (DD); 15th mile Dalhousie rd, *Stewart 1178* (A, K, RAW); Burapoor, Rohilkhand, *Thomson s.n.* (CAL); Hardwar, *Wallich 5575* (CAL, G, K).

WEST BENGAL: Purwah Maldah, Purulia distr., *Clarke 26977* (BM, CAL, FI, K); Labangir forest, Angul, Dhenkanal distr., *Haines 4037* (DD, K); Ponadhia to Karanjia, Mayurbhanj distr., *Panigrahi 12362* (ASSAM, CAL); Dudruchampa, *id. 12634* (ASSAM, CAL); Barhupani, *id. 12672* (ASSAM); Lulung to Kachudahan, *id. 12747* (ASSAM, CAL).

INDONESIA: Java: S of Surabaya, *Herb. Boschproefstation 2650* (WAG); E Tegal Teak forest, *id. 4319* (WAG); Krian, resid. Surabaya, *Dorgelo 1974* (L); between Mojokerto and Lumajang, *id. 1829* (L); Surakarta, *Horsfield 127* (BM, K, U); Gendro, Gunung Tengger, *Mousset s.n.* (L, WAG); Hort. Bot. Bogoriensis, *Teysmann s.n.* (L). Celebes: Sideureng-Kapang nr bridge across Putjuh river, *Eyma 331* (L). Sumba: E Sumba, *de Voogd 1985* (L); Waingapu, *Walstra s.n.* (BM).

LAOS: nr Xieng-Khouang, Tranninh prov., *Mieville 37140* (P); km 20 of rd Savannakhet to Quang Tri, *Poilane 11727* (P); Ban Na Son, km 10 of rd 4 Luang Prabang to Nan-Muite, *id. 20178* (P); Ban Long O, Luang Prabang prov., *Pottier 28C* (P); Luang Prabang, *id. 619* (P); *ibid., Spire 821* (P); *ibid., Vidal 697B* (P).

MALAYSIA: Telor Gamba, Perlis, *Anon. 15124* (K); Padang Besar, *Kerr 13165* (BM, E, K). Indication Fl. Malay Penins.: Perlis nr Kanga, *Ridley* (1922).

NEPAL: Churia range, E Nepal, *Banerji 1984* (DD); Narma Khola near Narma, *Polunin, Sykes & Williams 3803* (BM); Kamla Khola, C Nepal, *Stainton 5652* (BM); Sorkhet, Sheri valley, W Nepal, *id. 6138* (BM); Neokote (Nuwakot), *Wallich 5552 B* (CAL, K).

PAKISTAN: Poonch, *Rashid Khan 27003* (RAW); Rajgarh, Reserve Kulthea, Rawalpindi distr., *Parker 6504* (DD); Karot, S of Panjar, *McVeau s.n.* (RAW).

PAPUA NEW GUINEA: ? Sarao Leyal, *Murphy s.n.* (G), location not ascertained.

PHILIPPINES: Bosoboso, Rizal prov., Luzon, *Ahern's collector 2157* (P, US); Manila, *Cuming 1014* (E, G, L, MEL, P); Bauang, Union prov., Luzon, *Elmer 5612* (P, PNH, US); San Francisco del Monte, Luzon Central, nr Manila, *Loher 2299* (US); nr Dupax, Nueva Vizcaya prov., Luzon, *McGregor 11267* (P, US); Antipolo, Rizal prov., Luzon, *Merrill 15* (F, G, US); Manila, *Perrottet s.n.* (P); Lepanto, Luzon, *Ramos 7025* (P, US); Penablanca, Cagayan prov., Luzon, *Ramos & Edano 46559* (C); Luzon, *Vanoverbergh 2620* (P).

THAILAND: Mae Khaem stream, Phrae distr., N Prov., *van Beusekom et al. 4632* (K); Chieng Mai, plains behind Bau Djam, *Hosseus 368* (K); Doi Sootep, Chieng Mai, *Kerr 945* (BM, CAL, K, L); Ban Hue Sai, Nan, *id. 2410* (BM, C, E, K); Bun Zun, Nan, *id. 4869* (BM, K); Chaibadan, Saraburi, *id. 7981* (BM, E, K); Jap Sai, Chantaban, *id. 9690* (BM, K); Ban Pak Klang, Chumphun, *id. 11393* (C, E, K, BM); Padang Besar, *id. 13615* (BM, E, K); NW of Sai Yok, *Kai Larsen 9045* (C, K); Kanchanaburi betw. Tham Pha and Mae Nam Noi, *Phengklai 360* (K); Padang village, Maung distr., Phrae prov., *Pundir 471* (ICRISAT, WAG); Pung Su Nuk village, Tha Wang Pha distr., Nan prov., *id. 486* (ICRISAT, WAG); 16 km from Nan on Chiangrai rd, *id. 496* (ICRISAT, WAG); 56 km *ibid., id. 498* (ICRISAT, WAG); Lasu village, Mae Poan distr., Chiangrai prov., *id. 518* (ICRISAT, WAG); Bungtapan, *Put 1340* (BM, K); Kau Kradai, Prachuap, *id. 2287* (BM, K).

VIETNAM: Tonkin, hills nr Dong-Tom, near the rocks of Notre Dame, *Balansa 2234* (K); An-loc, Bienhoa prov., *Chevalier 29966* (P); Annam, Post 6, Quang Nam prov., 5-600 m, *Poilane 2938* (P).

Notes: *Cajanus crassus* resembles *C. mollis* quite closely (for discussion see notes under *C. mollis*).



Some of the Philippine material determined by MERRILL (1918, Species Blancoanae) as *Cantharospermum volubile* (Blanco) Merr., basionyms *Cytisus volubilis* Blanco and *Cajanus volubilis* (Blanco) Blanco, is not conspecific with other Philippine plants and those found in India, Burma, Thailand, Java and the Andamans hitherto mostly named *Atylosia crassa*. Merrill 5399 and Merrill's Species Blancoanae 142 are not conspecific with *Phil. Pl. 15*, and *Elmer 5612*, while all four were included in *Cantharospermum volubile* (Blanco) Merrill. I consider the first two to belong to a separate species and have kept Merrill's (1918) epithet, *volubilis*, for this. Species Blancoanae 142 is one of the specimens to replace the material collected or seen by BLANCO. MERRILL more or less designated neotypes, though the term did not exist then (1918). When possible, MERRILL tried to collect 'topotypes'. In our case BLANCO saw his specimen in Ilocos, but the plant 'y es desconocida', is unknown there. Species Blancoanae 142 was collected in Antipolo.

Since typification of the species described by BLANCO is difficult (see MERRILL 1918) we may not come closer to the truth unless a type collected by BLANCO is found. All indications point to the fact that BLANCO never made a herbarium, and his successor's material was destroyed in a fire at the Guadalupe Convent near Manila in 1899. The well known next oldest name from India, *Atylosia crassa* Prain ex King, is the basionym for *Cajanus crassus*.

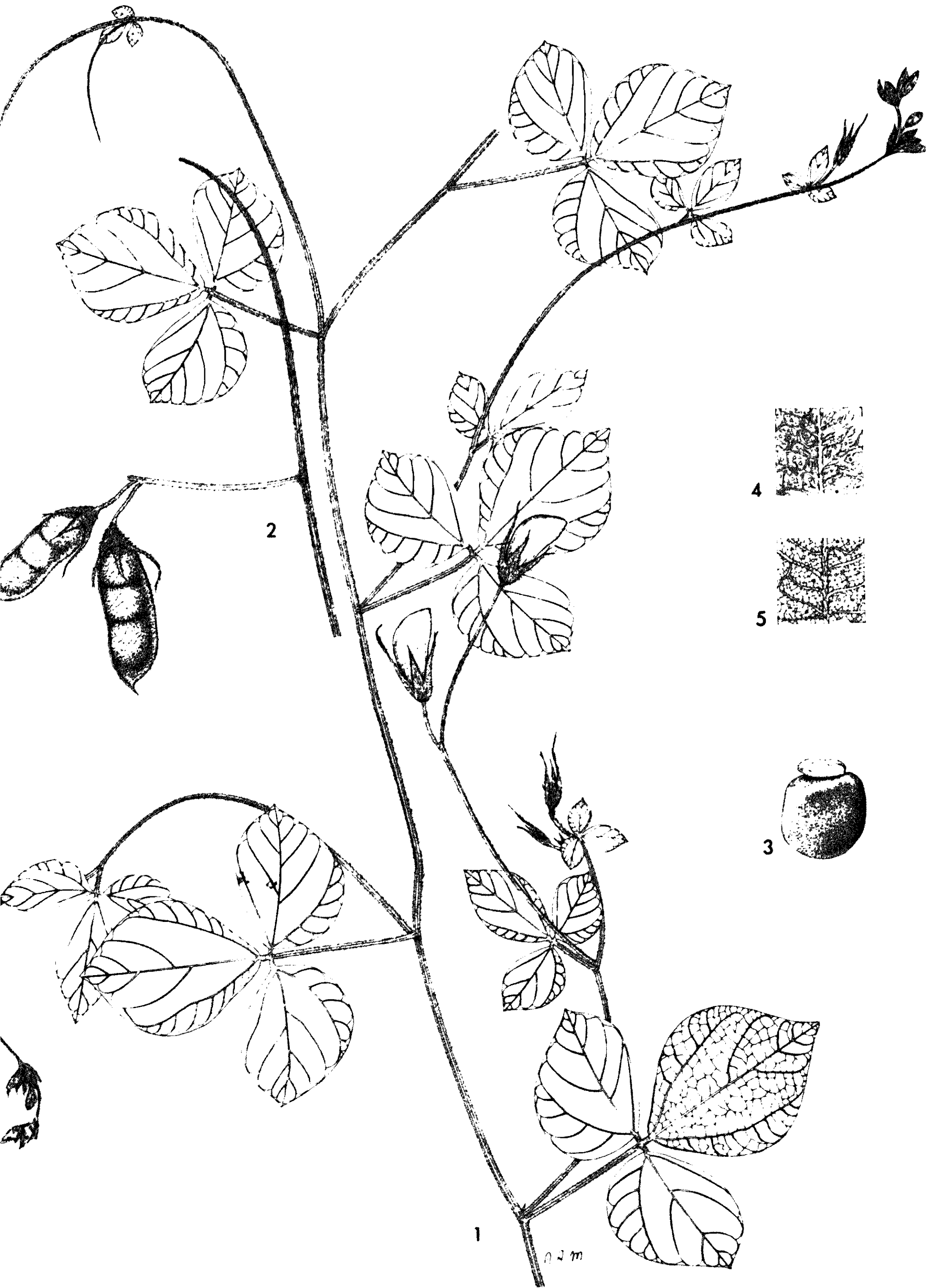
The Philippine material of *C. volubilis* is incomplete, either flowers or fruits are present. A pod of medium age (Merrill 5399) shows the transition between the very hairy ovary and the thinly clad full-grown pod. More material, preferably living, is needed to elaborate the separate status.

Leaves should be compared only when fully expanded. Leaves of *Cajanus crassus* in India are thicker and more pubescent than the other Southeast Asian material, and have ovate-rounded rather than elliptic-acuminate bracts. Backer's description of *A. volubilis* mentions the occasional long hairs on the pod. *Cajanus volubilis* has thin, less pubescent leaves, not narrowing towards the middle but rounded at the margin.

The ovary of *C. volubilis* is densely covered with exclusively long white hairs, similar to *A. grandiflora* Benth. ex Baker from Sikkim and Assam s.l. Flower size, bulbous hairs on the calyx, pods with > 6 seeds, and thinly spread, caducous hairs, the rachis and the texture of the leaves approximate *A. grandiflora*, but the lower calyx tooth is not so long, although longer than in the Indo-Malayan *C. crassus*; buds and bracts are smaller (possibly an ecological factor), and the vexillum is narrower. *C. crassus* has both yellow bulbous glandular hairs and white hairs.

*Dolichos blandus* Grah. nom. nud. (Hb. Finlay, Wallich 5568) is given by BAKER as a synonym for *C. crassus* (as *A. mollis*). This specimen has long racemes with many purplish flowers unlike *Cajanus*, but no developed fruits. It may be a *Rhynchosia*. Wallich 5568 Suppl. is a *Butea*. The other synonyms listed by BAKER, *A. glandulosa* Dalz. and *Cajanus glandulosus* Dalz. & Gibs., belong to *Dunbaria glandulosa* (Dalz.) Prain.

LINDBURG (1976) reported that rhesus monkeys (*Macaca mulatta* Zimmer-



mann) eat the leaves of *C. crassus* in the Siwalik forests of North India, and around Dehra Dun.

A specimen collected in Bangladesh flowered on 24-10-1964 (*Khan 996*). This falls outside the normal flowering period. No other collected specimen was in flower earlier than December.

#### 10.10 *Cajanus elongatus* (Benth.) van der Maesen comb. nov.

**Fig. 10, p. 114, Map 15, p. 116**

*Cajanus elongatus* (Benth.) van der Maesen comb. nov.

Basionym: *Atylosia elongata* Benth., *Miq.*, *Pl. Jungh.* 1: 243 (1852); Baker in Hooker, *Fl. Brit. India* 2: 215 (1876); Kanjilal, Kanjilal & Das, *Fl. Assam* 2: 96 (1938); Maheswari, *Fl. Delhi* 134 (1963); Nguyen Van Thuan, *Fl. Cambodia, Laos, Viet-nam* 17: 112-113 (1979).

Type: Nepalia 1821, Wallich 5543 (holotype: K; isotypes: BM, CAL, E, G, K, L). *Dolichos elongatus* Grah. ex Wall., nom. nud., Wallich Cat. 5543 (1831 & 32).

Homotypic synonyms: *Dolichos elongatus* Graham ex Wall., nom. nud., Wallich Cat. 5543 (1831).

*Cantharospermum elongatum* (Benth.) Raizada in Mooney, *Suppl. Bot. Bihar & Orissa* 53 (1960).

Climber-creeper, perennial with woody rootstock and slender, herbaceous branches, with long and short spreading hairs, terete. *Stipules* triangular-acuminate, ca 1-3 mm long, pubescent, striate, very caducous. *Leaves* digitately trifoliolate, petiole 0.5-4(-6) cm, rachis 0-2 mm. *Leaflets* membranaceous, glandular-punctate below, lower surface thinly pubescent on the ribs, upper surface thinly pubescent, top leaflet obovate-cuspidate, often quite rhomboid, base rounded, 20-42 mm long, 20-32 mm wide, side leaflets obliquely obovate-cuspidate, 22-36 mm long, 17-23 mm wide. *Stipellae* none, petiolules 1 mm. *Racemes* very slender, 2-5 flowered, peduncles 2-12 cm, pedicels 4-10 mm, recurved. *Bracts* tiny, elliptical, pubescent, 0.5-5 mm very caducous. *Calyx* densely pubescent, hairs brown, tube 3-5 mm, teeth linear-lanceolate, upper ones connate except the tip. *Vexillum* hardly exerted, obovate, ca 12 mm long, 10 mm wide, base clawed, auricles reinforced. *Alae* narrowly obovate, ca 11 mm long, 4 mm wide, base clawed, a short auricle. Keel petals oblique, ventrally joined, ca 11 mm long. *Ovary* ca 4 mm long, 1 mm wide, covered with long whitish hairs and short (pale yellow?) bulbous hairs, style glabrous, ca 10 mm, in the middle flattened and upcurved. *Stamens* ca 13 mm long, free part ca 4 mm, upcurved.

FIG. 10. *C. elongatus*: 1. branch, 1X; 2. pods, 1X; 3. seed, 3X; 4. detail upper leaflet surface, 2X; 5. detail lower leaflet surface, 2X(1-5: *Hooker & Thomson 1408*).

*Pods* oblong, 20-25 mm long, 5-8 mm wide, thinly pubescent, surface reticulate, transverse depressions at right angles to the sutures, beaked with base of the style, 3-4 seeds. *Seeds* rectangular rounded, ca 3-4 mm diameter, 2 mm thick, brown or black, strophiole large, divided.

**Distribution:** Bhutan, Burma: Meiktila distr., India: Meghalaya, W. Himalaya, Assam; Nepal, Vietnam.

**Ecology:** Grasslands amongst dwarf scrub, open hillsides.

**Altitude:** 1300-2100 m.

**Vernacular name:** Taungdwin-pe (Burma).

**Flowering:** Jul-Nov.

**Fruiting:** Oct-Nov.

#### Specimens examined:

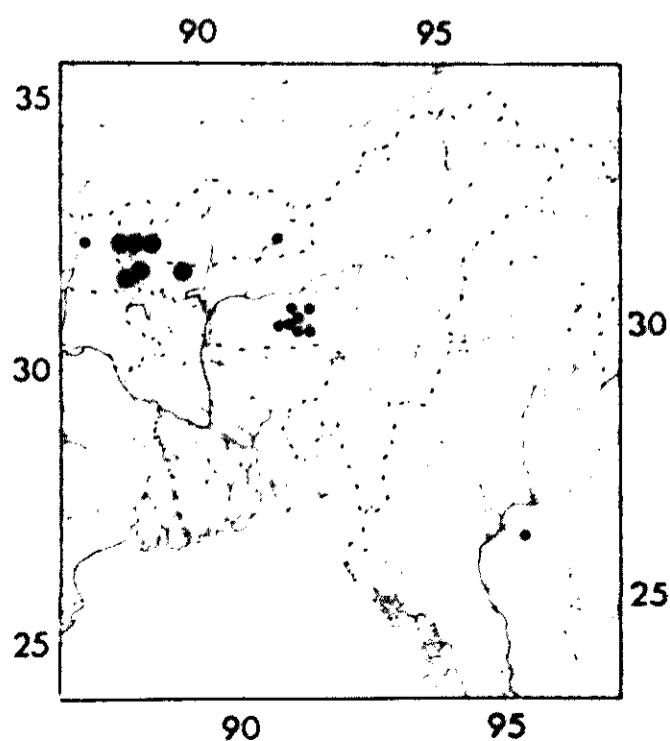
**BHUTAN:** Dangma Chu Valley, *Cooper 4585* (BM, E).

**BURMA:** Yedwungtaung, Meiktila distr., *H.C. Smith 16292* (K).

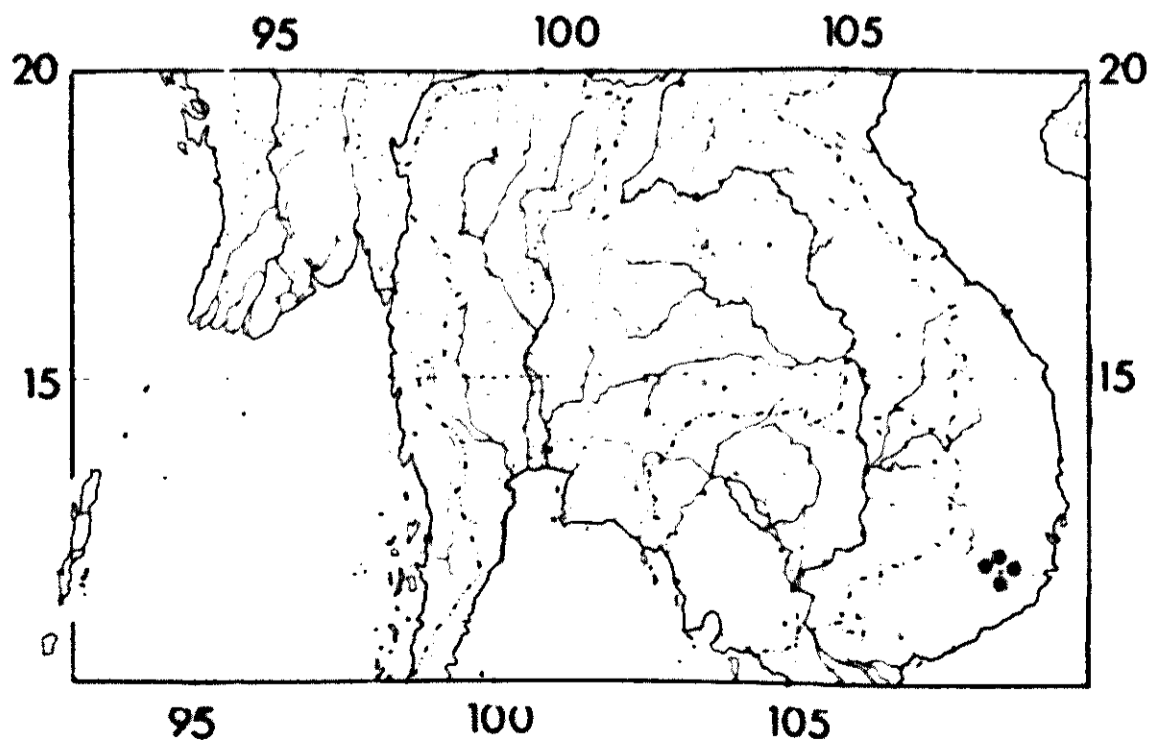
**INDIA:** Meghalaya, Khasi Hills (Khasya): Iseira Riv., Khasi. *Anon. 6261* (CAL); Mairung, *Anon. 16074* (CAL); Monai, *Clarke 15911* (FI, K); Nyrmai, *id. 19261* (BM, CAL); Sorjung, *id. 38968* (CAL, FI); Jowai, *id. 44720* (BM, US); Mowphlang, *G.K. Deka s.n.* (ASSAM); *ibid.*, *id. 22677* (ASSAM); Nongpoh, *id. 22954* (ASSAM); Khasia Regio temp., *Hooker & Thomson s.n.* (BM, BR, BRI, C, CAL, E, FI, G, GH, K, L, MEL, MH, OXF, P, STU, U, US, W); Mowphlang, *Kingdon Ward 18733* (BM); Mairung (Myrang), *Lobb s.n.*, (K); Nunkloes, *Lobb s.n.* (K); Khasia Hills, *G. Mann s.n.* (ASSAM, CAL); Khasia Hills, *Native Collectors of Bot. Gard. Calcutta* (L); Khasia, *Oldham s.n.* (CAL); Laitlyngkot, 27 km from Shillong, *G. Panigrahi 3157* (ASSAM); 5 km from Kynshi, *id. 16346* (ASSAM). West Bengal: Nilpara, *Haines 511* (K). W. Himalaya: Mussoorie (Massuri), *Hügel 396* (W).

**NEPAL:** Gothe Hill, Phulchoki, *Manandase et al. 7373* (BM); Arun Valley, Sabhaya Khola N. of Chainpur, *Stainton 1549* (BM); Nopalia, *Wallich 5543* (K, holo; BM, CAL, G, K, L, iso).

**VIETNAM:** Dalat, ravine S of Langbian palace, *D'Alleizette s.n.* (P); Dalat, *Evrard 1116* (P); Dalat, ravine S of Langbian palace, *id. 1780* (P); nr Dalat, *Schmid 1261* (P).



MAP 15. *Cajanus elongatus* •, *Cajanus villosus* ● in South Asia



MAP 16. *Cajanus elongatus* in Vietnam

Notes: *Maheswari 409* from the Delhi University Grounds and the specimen collected on 8-9-1948 from the Delhi Ridge, albeit difficult to determinate, belong to *C. platycarpus*, not to *C. elongatus*.

The red-flowered *Flemingia vestita* Hook., labelled as *R.* (for *Rhynchosia*) *vestita* Benth. from the collections by HOOKER and THOMSON, is sometimes mistaken for *C. elongatus*. The Wallichian name *R. vestita* is a synonym of *C. goensis*, but the vouching material in Herb. Wallich (K) is absent.

#### 10.11 *Cajanus goensis* Dalz.

Fig. 11, p. 118, Maps 17, 18, p. 121, 122

*Cajanus goensis* Dalzell (as 'Goensis') in Hooker's Kew J. 2: 264 (1850); Dalzell & Gibson, Bombay Fl. 73 (1861, repr. 1973).

Type: India, ad pedem jugi Syhadrensis in prov. Goa, *Dalzell s.n.* (holotype: K). The Western Ghats are named Sahyadry Mts in Sanskrit. Dalzell's locality obviously appeared with a typographical error.

Homotypic synonym: *Atylosia goensis* (Dalz.) Dalz., J. Linn. Soc., Bot. 13: 186 (1873); Cooke, Fl. Presid. Bombay 1: 409 (1903, repr. 1958, 1967); Gamble, Fl. Presid. Madras 2: 369 (1918), 260 (repr. 1967); Kanjilal, Kanjilal & Das, Fl. Assam 2: 96 (1938); Backer & Bakhuizen f., Fl. Java 1: 636 (1963); Ramaswami & Razi, Fl. Bangalore 297 (1973).

Heterotypic synonyms: *Dolichos barbatus* Wall., Cat. 5548 (1831-32) nom. nud.

Based on: Burma, Kogun ad ripas Saluan in Martabania 1827 (Kogun on Salween river), *Wallich 5548* (K).

*Dolichos ornatus* Wall., Cat. 5561 (1831-32) nom. nud., based on: Burma, Phoroe, Needoun, Martabania *D. glutinosum* Roxb. (K).

*Rhynchosia vestita* Wall., Cat. 5505 nom. nud. (cf. Baker in Hooker, Fl. Brit. India 2: 216 (1876).

Based on: Burma, Kogun in Martabania 1827, *Wallich 5505* (sheet missing in Herb. Wallich at K).

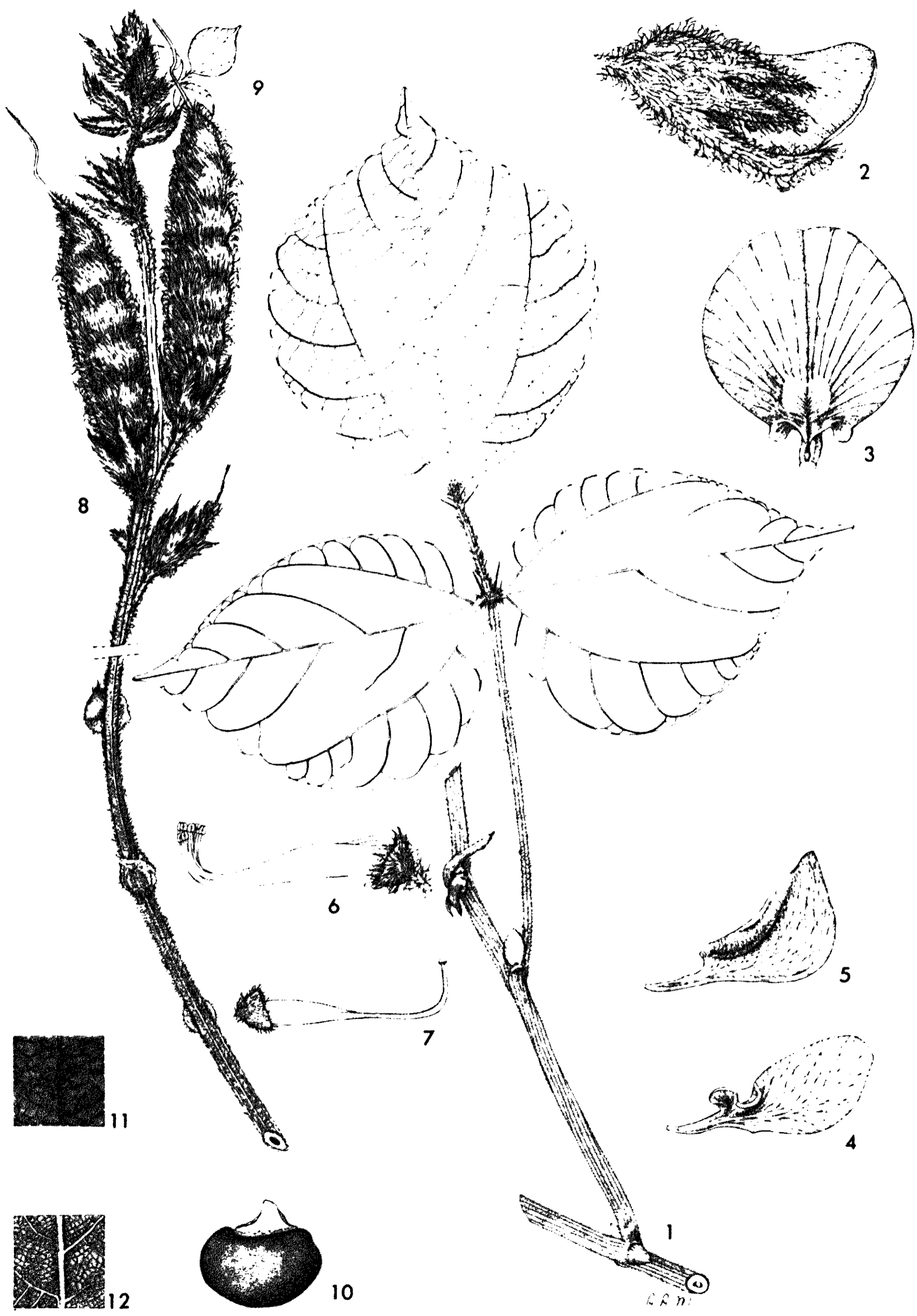
*Dunbaria barbata* Benth. in Miq. Pl. Jungh. 1: 242 (1852).

Type: Burma, Kogun ad ripas Saluan in Martabania 1827, *Wallich 5548* (K, holo) (*Dolichos barbatus* Wall. nom. nud.).

*Dunbaria calycina* Miq., Fl. Ind. Bat. 1: 180 (1855).

Type: Java, Surakarta, Horsfield L 123 (BM, CAL, K, U).

*Atylosia calycina* (Miq.) Kurz, J. As. Soc. Bengal 43: 186 (1874), based on *Dunbaria calycina* Miq.



*Atylosia barbata* (Benth.) Bak. in Hooker, Fl. Brit. India 2: 216 (1876); Collett & Hemsley, J. Linn. Soc. 28: 48 (1890); Prain, Bengal Plants 272 (1903, repr. 1963); Craib, Contrib. Fl. Siam 667 (1912); Backer, Schoolflora 381 (1911); Boldingh, Zakflora Landb. streken Java 115 (1916); Gagnepain, Fl. Gen. Indochine 2-3: 279 (1916); Nguyen Van Thuan, Fl. Cambodge, Laos, Viet-nam 17: 110-111 (1979).

Based on *Dunbaria barbata* Benth.

*Endomallus pellitus* Gagnep., Not. Syst. 3: 185 (1914); Gagnep., Fl. Gen. Indochine 2: 267-268 (1916); Lackey, Synopsis Phaseoleae 26-30, 169, 206, 238 (1977); Nguyen Van Thuan, Fl. Cambodge, Laos, Viet-nam, 17: 128 (1979).

Type: Vietnam, Song-lu, prefecturate (province) Bienhoa, *Pierre s.n.* (holotype: P; isotypes: P).

*Endomallus spirei* Gagnep., Not. Syst. 3: 186 (1914); Gagnep., Fl. Gen. Indochine 2: 268-269 (1916); Lackey, Synopsis Phaseoleae 26-30, 206, 238 (1977); Nguyen Van Thuan, Fl. Cambodge, Laos, Viet-nam 17: 128 (1979).

Type: Laos, Luang Prabang, *Spire 1561* (holotype: P; isotype: P).

*Cantharospermum barbatum* (Benth.) Koorders, Meded. Proefstat. Thee 90: 15 (1924); Heyne, Nuttige Pl. Nederl. Indië 1: 831 (1927); id., Nuttige Pl. Indonesië 1: 831 (1950), based on *Dunbaria barbata* Benth.

*Atylosia siamensis* Craib, Kew Bull. 19: 65 (1927).

Type: Thailand, Saraburi-Muak Lek, 200 m, *Kerr 10004* (holotype: K; isotype: BM).

*Dunbaria thorelii* Gagnep., Not. Syst. 3: 194 (1914), pro parte see notes.

*Dunbaria stipulata* Thuan, Adansonia ser. 2, 16-4: 514 (197x).

Type: Thailand, Doi Pae Poe, 1400 m, *Hansen & Smitinand 12895* (holo: P, not seen; iso: C)

Climber, perennial, except corolla very hairy, hairs often bulbous based except on leaflets. *Branches* covered with long sticky brown hairs, almost terete, specially in young stages, several meters long. *Stipules* triangular to lanceolate, papery, 3-10 mm long, 1-3 mm wide, striped, pubescent, caducous. *Leaves* pinnately trifoliolate, petiole up to 8 cm, rachis 7-17 mm. *Leaflets* subcoriaceous, glandular-punctate below, surface below shortly pubescent, dull green, ribs prominent, upper surface shortly pubescent, green, top leaflet ovate to lanceolate, tip acuminate-mucronate, base rounded or slightly cordate, 2.5-11 cm long, 2-6 cm

FIG. 11. *C. goensis*: 1. branch, 1X; 2. flower, 2X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens, 2X; 7. pistil, 2X; 8. inflorescence with pods, 1X; 9. top of flowering branch, 1X; 10. seed, 3X; 11. detail upper leaflet surface, 2X; 12. detail lower leaflet surface, 2X(1-12: *van der Maesen 3501*).

wide, side leaflets obliquely ovate, 1.8-10 cm long, 1.5-5 cm wide, petiolules 1-3 mm long. *Stipellae* setaceous, (1)2-5 mm long. *Racemes* lax, very pubescent, up to ca 25 flowered, often 2 flowers per node, peduncle up to 25 cm, pedicels 0.5-1.4 cm, corolla yellow or orange-yellow, not persistent. *Bracts* ovate-lanceolate, tip acuminate, dorsally very pubescent, ventrally not so dense, 5-12 mm long, 3-5 mm wide, very caducous. *Calyx* very pubescent, interior sparsely so, tube 3-4 mm long, teeth lanceolate, the upper ones halfway connate, 5-6 mm long, the lower one linear-acuminate, 7-11 mm long. *Vexillum* obovate-orbicular, base clawed, auricles reinforced, top deeply emarginate, 15-28 mm long, 13-25 mm wide, two callosities close to the auricles. *Alae* obovate, base clawed, strongly and broadly auricled, 15-28 mm long, 5-10 mm wide. Keel petals oblique, ventrally joined, 14-24 mm. *Ovary* 7-10 mm, densely covered with long white hairs, 4 mm, 5-9 ovules. *Style* 12-18 mm, base pubescent, upcurved about the middle, curve thickened, top glabrous. *Stamens* ca 15 mm long, free part ca 5 mm, upcurved. *Pod* linear-acuminate, curved or straight, narrowed to both ends, 35-55 mm long, 9-11 mm wide, densely covered with long brown hairs, transverse depressions at right angles to the suture, entire style quite persistent, ca 5-8 seeds. *Seeds* broader than long, 3 mm long, ca 4 mm wide, 2 mm thick, light brown with grey to black mosaic, strophiole acuminate, divided.

#### Distribution:

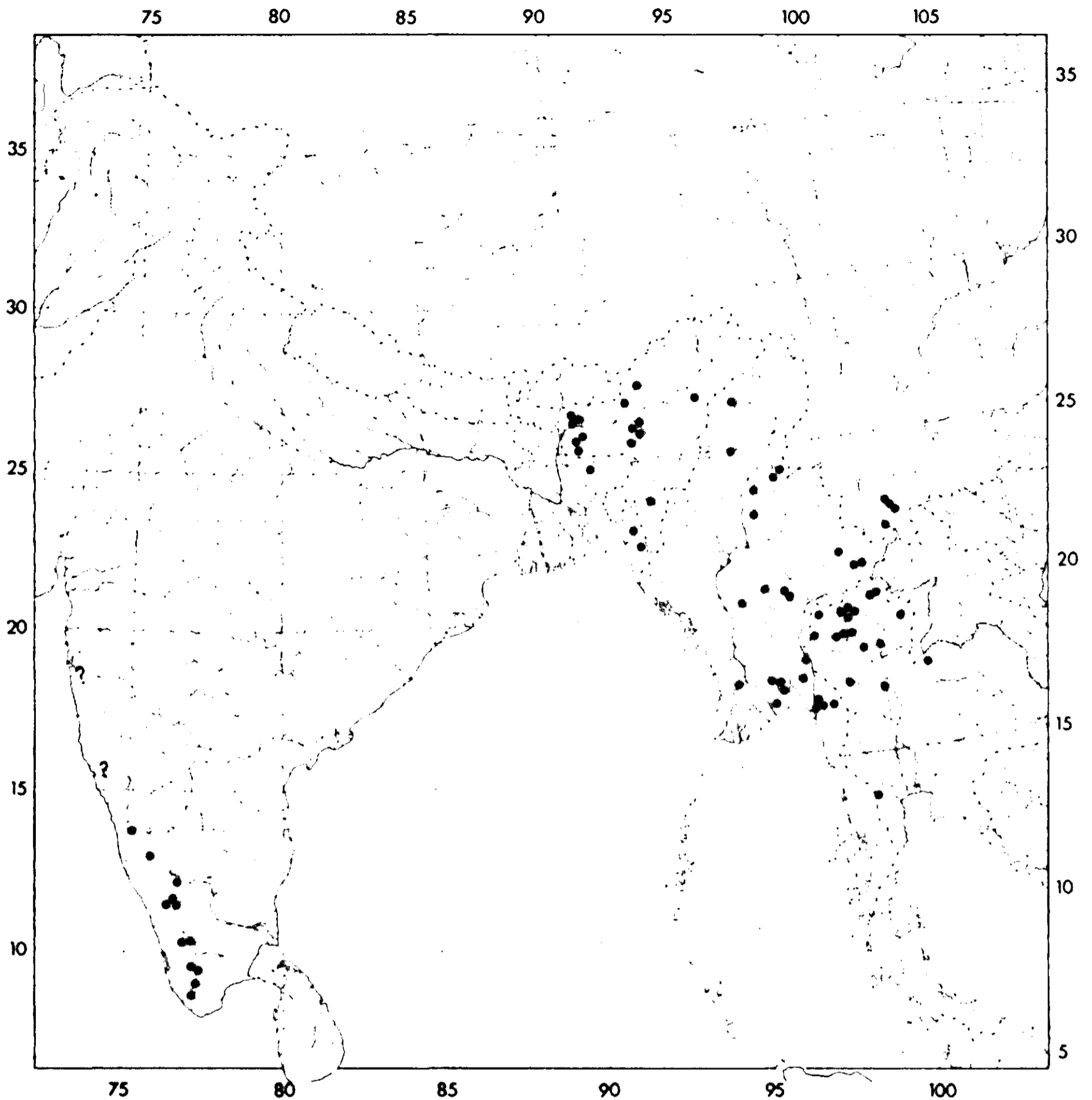
Country	Altitude (m)	Flowering	Fruiting
Bangladesh	0?- 500	Nov-Feb	Nov-Mar
Burma	0?-1600	Dec-Mar	Jan-Apr
China: Yunnan	1000-1300	Sep	Nov?
India: W Ghats	800-1200	Jan-Mar	Febr-Mar
NE States	100- 800	Aug-Mar	Aug-Mar
Indonesia: Java	5- 850	Jul-Sep	Aug-Nov
Laos	300-1500	Jan-Mar	Apr
Malaysia: Kedah		Jan	Jan
Thailand	150-1500	Dec-Mar	Dec-Mar
Vietnam	400-1500	Jan-Apr, Nov	Feb-Apr

**Ecology:** Climbing in shrubs and trees, tropical dry deciduous or slightly wet forests.

**Vernacular names:** Ioe htun (Burmese); Mashaparni (Sanskrit, India); Kattuzhunnu (Malayalam, Kerala, India); Peruvidukol (Tamil, S India); Balukbrin, Ginashibrin (Garo, Meghalaya, NE India); Aleuabi (Casseres, Garo hills, NE India); Katjangan (Javanese); Thua pi (Thai); Thoua nhe (Khua mak, Laos).

**Uses:** A decoction of powder from the roots is given for rheumatism, biliousness, impure blood, fever, heat, consumption and swellings. It improves vitality, increases phlegm and constipates bowels (Rama Rao, 1914).



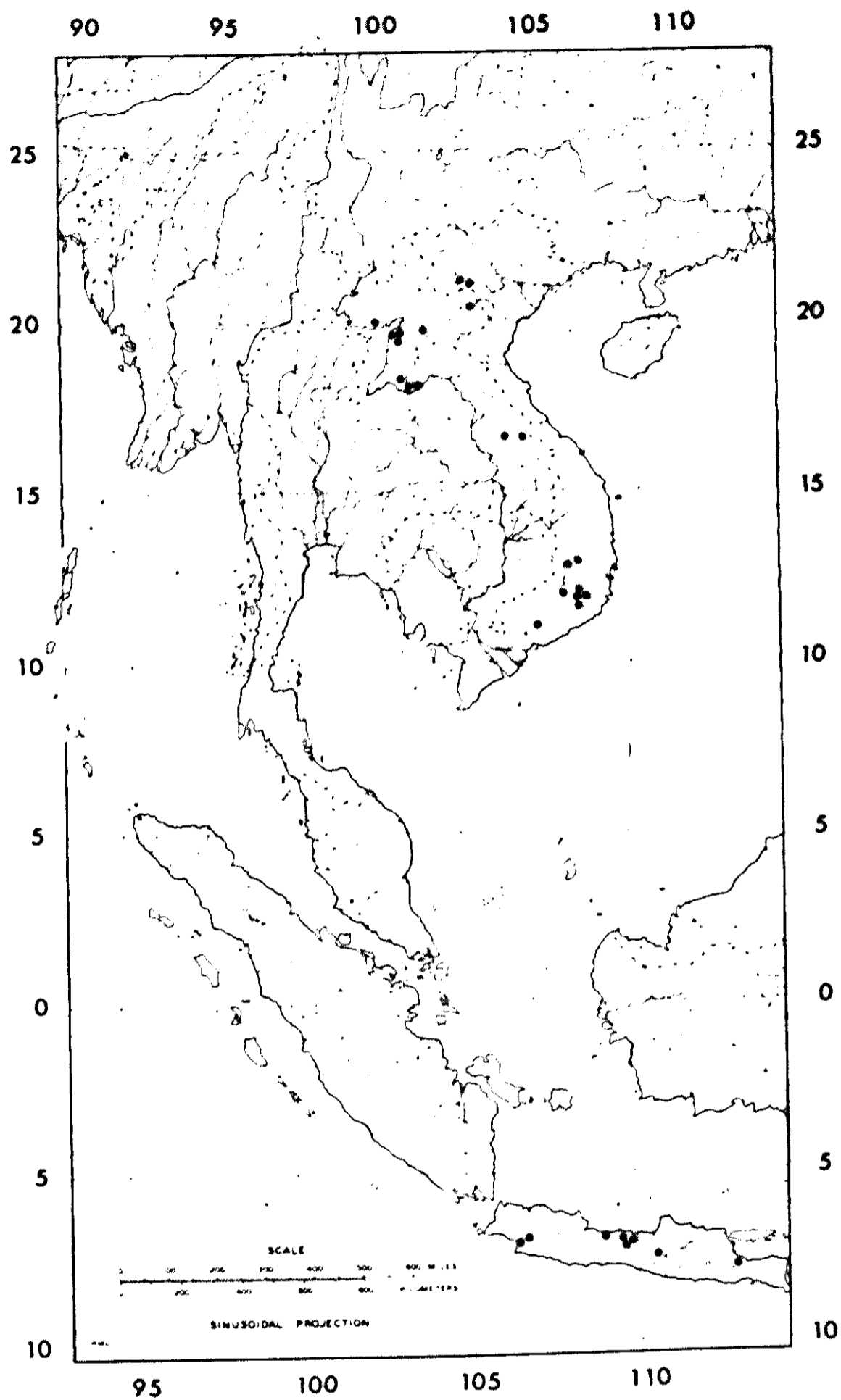


MAP 17. *Cajanus goensis* in South Asia

### Specimens examined:

**BANGLADESH:** Chittagong Hill Tracts, Utturcheira, *Clarke 19860* (BM, US, CAL); Shanduchiri Hill, 40 miles from Chittagong, *Badul Khan 241* (King's collector; CAL); Rainkhyang valley, *M.S. Khan 997* (K). Mymensingh: Kanikari, *Clarke 7982* (CAL, K).

**BURMA:** Bhamo, *Anderson s.n.* (CAL); Inle Lake, S Shan States, *Annandale 265* (CAL); Banks of Thongyuens, Tenasserim, *Beddome 2285* (BM); Kyondo to summit of Dawna hills, from Kawkar-eik to Thingannhi-naung, Amherst distr., *Burkill 30316* (CAL); Phonghi valley, Wouet Chang, Rangoon, *McClelland s.n.* (K); Pindet Pass, Shan Hills Terai, *Collett 80* (CAL, K); Iaping valley, *Forrest 9548* (E); Moolget, Tenasserim, *Gallathy 209* (CAL, G); Dynagebin Mts, Mt Moulmein, *Helper 84* (G); Monay, S Shan States, *Abdul Khalil* (CAL); Madoe hill, upper Burma, *King's collector 171* (CAL); Makhaye hill, Shan State, *id. s.n.* (CAL, DD); Tonkeye ghat, Seven Pagodas, *Kurz 1705* (CAL); Pegu, Jomah, Myodone, *id. 1705'* (CAL); Pegu, *id. 2547, 2549* (CAL); Kadu hill, Katha distr., *Lace 5094* (CAL, DD, E, K); Nanton Saing Chaung, Wa States, *Maung Po Khant 15240*



MAP 18. *Cajanus goensis* in Southeast Asia

(DD, K); Nankyin reserve, Mansi div., upper Chindwin, *Su Koe 9030* (DD); Lawa to Mabein, Ruby Mines distr., *Lace s.n.* (E); Nganzar, Yamethin distr., *id. 4543* (CAL, E, K); Keng Tung, S Shan States, *MacGregor 1275* (BSI, CAL, E); Mone, Shan States, *Manden s.n.* (CAL); 31 km S of Bhamo, along Ledo road, *McMillen 166* (MICH, US); Papunoe, *Meebold 17197* (CAL); Kadaingti, *Meebold 17198* (CAL); Kachin hills, *Shaik Mokim s.n.* (BM, CAL, P, FI, G, L, P, U, US, W, WU); Henzada, Nahmedaung, *id. 1350* (CAL); Meh Lau valley, betw. Pang Sop Lao and Ban Yang Kha, Keng Tung territ., SE Shan States, *Rock 2163* (A, K, US); Shweli valley, Mogok, Ruby Mines div., *Rodger 148* (CAL); Pomwyn, upper Burma, *Gen. Sataire s.n.* (CAL); Kogun, Martaban, on Salween river, *Wallich 5505, 5548* (type of *Dunbaria barbata*)(K); Needoun, Phoroe, Martaban, *id. 5561* (K); Ma Ken village, nr Salween river, *Wood s.n.* (CAL).

CHINA: Yunnan: Szemao Mts, Yu Lo Mts, *Henry 12861* (CAL, E, K, US); W Szemao Mts, *id. 12861 A* (CAL); nr Menghal, Szemao Mts, *id. 12861 B* (CAL, K); Haba Snow Range, NW Yunnan, *Feng 2245* (A); betw. Manua and Mantung nr Tshelo/Kenghun on Mekong river, *Wissmann 1153* (W).

INDIA: Arunachal Pradesh: Aka hills, *Bor 15309* (ASSAM); Gigaon to Rupa, Kameng Frontier Div., *Panigrahi 16032* (ASSAM).

ASSAM: Banks of Kullung (Kalang) river, *Anon. s.n.* (CAL); Brahmaputra plains, *Anon. s.n.* (CAL 128914); Chirauz Duar, Goalpara plains, *King, King's collectors s.n.* (CAL); Garampani to Rahang road, Karbi Anglong distr., *Balakrishnen 46954* (ASSAM); Orang, *Chatterjee s.n.* (BSI, MPU, P); Hojai plantation, Nowgong distr., *De 18469, 19352* (ASSAM); Bijni reserve, Goalpara, *Kanjilal 5063, 7605* (ASSAM); 11 km from Koharea to Amimora, Sibsagar distr., *Kataki 41700* (ASSAM).

KARNATAKA: 6 km of Someshwar, Shimoga distr., *Kameswara Rao & Chandra 120* (ICRISAT, WAG); 21 km W of Sakleshpur, Hassan distr., *id. 136* (ICRISAT, WAG); Nandi, Mysore distr., *Govindu 96003* (MH); Gundiar, S Kanara, *Meebold 8610* (CAL).

KERALA: Travancore, *Calder & Ramaswami 1409* (CAL); Thekkadi, nr Periyar House, *van der Maesen 3501* (ICRISAT); nr Tamil Nadu border on Quillon-Tenkasi rd, *Remanandan 4835* (ICRISAT, WAG); nr Periyar House, Thekkadi, *id. 4848* (ICRISAT, WAG); Kottayam distr., *Vivekananthan 46157* (MH).

MAHARASHTRA: Bombay, in jugus Syhadrensis, prov. Goa, *Dalzell s.n.* (K, holotype of *Cajanus goensis*); Konkan, *Stocks s.n.* (P).

MEGHALAYA: Dorabandagiri, Garo hills, *Parry 950* (K); Cheran, Garo hills, *id. 1278* (K).

MIZORAM: Aijal station Reserve, *Deka s.n.* (CAL).

TAMIL NADU: Nr Ariankavu, Tirunelveli distr., *Bourdillon 47* (CAL, K, MH); Tenia (Perya?) Shola, Nilgiris, *Beddome 28* (K); Nr Perya Shola Estate, Ouchterlony valley, *id. 2286* (BM); SE Wynad, Nilgiris, *Lawson s.n.* (K); Tramline to Mt Stuart, Anaimalai hills, Coimbatore distr., *Narayananaswami 54803* (MH); Top Slip nr Coimbatore, Anaimalai hills, *Vaid 23295* (DD).

TRIPURA: Sekhansermon to Dasda Bazar, *Deka 27472* (ASSAM).

INDONESIA: Java. Rawah Lakbok, Priangan, *Backer 4277* (BM, BR, CAL, E, K, L, P, W); between Sukaradja and Singaparna, *id. 8497* (L); Gunung Kate nr Sukabumi, *id. 15047* (L, P, U); Weleri, betw. Kendal and Pekalongan, *id. 16500* (L, U); Weleri Sebak, *id. 16541* (L); S of Weleri, *id. 16614* (L); Pelabuhan Ratu, *Boerlage s.n.* (L); E Tegal, *Herb. Boschproefstation 4366* (WAG); Surakarta, *Horsfield L 123* (BM, CAL, K, U, type of *Dunbaria calycina*); Sukapura, Umbulan ravine, res. Pasuruan, *Jeswiet 1015* (WAG).

LAOS: Xieng-Khouang, *Delacour s.n.* (P); Mahaxay village, Cammon prov., *Petelot s.n.* (P); Muong, Poilane 19991 (P); between Muong Soui and Muong You, *id. 20120* (P); Ban Na Son, 10 km of road nr 4 Luang Prabang to Nam Minh, *id. 20184* (P); Ban Long O, Luang Prabang prov., *Pottier 45C* (P); Luang Prabang along river, *id. 707 A* (P); Cabin Trap, *Spire 1119* (P); Luang Prabang, *id. 1561* (P, type of *Endomallus spirei* Gagnep.); Bassac, Mekong expedition, *Thorel s.n.* (P, 3 sheets part of type of *Dunbaria thorelii* Gagnep.); Vientiane Bo O, *Tixier 05* (P); environs de Vientiane, *Vidal 1163 B* (P); Nong Thevada, Vientiane prov., *id. 2661* (P).

MALAYSIA: Nirugiri, Malay Peninsula, *Griffith 98* (K); Kwan, Kuah, Langkawi isl., Kedah, *HWR(idley?) CC 8287* (CAL).

THAILAND: Doi Chiang Dao, N. Chiangmai, *Anon. 771* (L); Huae Rong, Phrae distr., N. Prov., *van Beusekom et al. 4683* (K); Loei, Phu Luang, NE, *Bunchuai 1344* (C, E, K, L, P); SW Kanchanaburi, Sangklaburi, *Kantha Chai 25* (L); Doi Sutep, Chiangmai, *Collins 1213* (K, US); Me Kawn, E of Chiangmai, *Garrett 265* (BM, C, E, K, L); Nu Palang or Ma Pa Tang, foot of Dai Chiengdao, *id. 1228* (E, K, P); Doi Chong, *Hansen & Smitinand 12616*, paratype of *Dunbaria stipulata* (E); Doi Pae Poe, ca 90 km NW of Tak, *id. 12895*; type of *D. stipulata* (C, E); Chiengdao, *Kerr 1050* (BM, CAL, K, P); Doi Sutep, *id. 3530* (BM, K, P); Khun, Chiangmai prov., *id. 4739* (BM, K); Muak Lek, Saraburi, *id. 10004* (BM, K, type of *Atylosia siamensis*); Baw Noi, Kanburi (Saraburi?), *id. 10262* (BM, K); Kao Kroding, Jai, *id. 20040* (BM, K); 25 km to Pha Yao on Pong rd, Nam prov., *Pundir 506* (ICRISAT, WAG); Chainat, *Put 2669* (A, BM, C, K, L, US); Doi Chiengdao, *Put 4535* (BM, C, K, L); Nr Hue San, Doi Chang mt slopes, Chieng Rai region, *Rock 1725* (US); Mae Hong Son, Khum Yuam, N Prov., *T.S. 11442* (C, K); Yala, Bannary Sata, Peninsula, *Sangka-chand 40795* (AAH, C, E, K, P); nr tea factory, Chiangmai, *Smitinand 3731* (L); Wang Tao, Sørensen, *Larsen and Hansen 1033* (K); Pa Sing village, 25 km W of Nan, *Walker 7907* (CANB); Lampang Mi Lu, *Winit 1614* (K).

VIETNAM: Annam, Lang-Bian Mts, between Danhim and Djuring, *Chevalier 30967* (P); *ibid.*, *id. 30928* (P); Dalat, concession O'Neil vers Mauline, *Evrard 1917* (P); on Songlu in Bienhoa prov.,

*Pierre s.n.*, 2-1877 (P, type of *Endomallus spirei* Gagnep., 4 sheets); Annam, Ka Rom, Phaurang prov., *Poilane 9991* (P); km 125 of route coloniale no ?, Song La valley, *id.* 19963 (P); Moc Chan, Sou La prov., Tonkin, *Petelot 7842* (P); S of Planb. Laru 850 m, *Schmid s.n.* (P); Ban Me Thuot region, rd to Plao Sieng, *id.* 103 or 718 (P); Kram, rd Lac to Plae Sieng, Darlac, *id.* 718 (P); Dalat and vicinity, S Annam, *Squires 852* (BM, P, sheet in MO not seen).

Notes: CRAIB no doubt described *A. siamensis* as a different species from *C. goensis* since many Thai specimens are firm, with large leaves, bracts and flowers. However, more slender specimens are also found in Thailand (e.g. *Garrett 265*, *Put 2669*) which are closer to the type from western India. The long flower bracts distinguishing *A. siamensis* from *C. goensis* I found to be a variable character of no value in separating species. In all areas of occurrence the stature varies, presumably because of season and ecology. The Yunnan and Burmese specimens are mostly quite firm and fully developed, but similar specimens can be found in India's Western Ghats.

It should be possible to collect *C. goensis* specimens from additional locations in the Malay Peninsula, Indo-China, Sumatra, Java and other Indonesian islands.

GAGNEPAIN in 1914 described *Endomallus* as a new genus with two species. He denied it had glands on the lower surface of the leaves. HUTCHINSON (1964) wrongly placed it in his Phaseoleae tribe (= subtribe Phaseolinae). LACKEY (1977) correctly classified *Endomallus* in Cajaninae but mentioned the probable congenericity with *Dunbaria*. GAGNEPAIN described both *E. pellitus* and *E. spirei* only on the basis of the type material, which had no developed fruits. The auricles of the vexillum were described as almost absent in *E. spirei* and long in *E. pellitus*, leaves were hairy in *E. spirei* and glabrescent in *E. pellitus*, while the calyx teeth were acuminate in *E. pellitus* and obtuse in *E. spirei*. Nguyen Van Thuan decided in 1978 (notes in Herbarium P) that both species were one and the same. Dissection of a more fully developed *E. spirei* flower revealed longer auricles. THUAN published the conspecificity in 1979 and retained *E. pellitus*. In fact no *Endomallus* material in P had developed fruits, and all specimens fall in the range of *Cajanus goensis*. Therefore both *E. pellitus* and *E. spirei* are herewith reduced to the synonymy of *C. goensis*.

The type material of *Dunbaria thorelii* Gagnepain at P (GAGNEPAIN, 1914, p. 194), *Thorel s.n.* from Bassac, Laos, consisted of four sheets, three of which were before or in early flowering, and belong to *C. goensis* Dalz. One sheet, in fruit, is a *Dunbaria*. It remains to be seen whether this is a separate *Dunbaria* species, as the protologue of *D. thorelii* is apparently drawn from the flowering specimens of *C. goensis* and the fruiting *Dunbaria* sheet. GAGNEPAIN (1914) in summing up the differences between *D. thorelii* and *Cajanus goensis* (as *Atylosia barbata*), mentioned the close affinity of *Atylosia* and *Dunbaria*. A decision regarding the status of the epithet *thorelii* must be postponed until *Dunbaria* is studied in detail. Apart from the type material, THUAN (1979) did not quote any other specimens from this species.

In old specimens the golden brown indumentum may turn grey.

10.12 *Cajanus grandiflorus* (Benth. ex Bak.) van der Maesen comb. nov.

Fig. 12, p. 126, Map 19, p. 127

*Cajanus grandiflorus* (Benth. ex Baker) van der Maesen comb. nov.

Basionym: *Atylosia grandiflora* Benth. ex Bak. in Hook., Fl. Brit. India 2: 214 (1876).

Lectotype: India, Bagesar, Kumaon 3000 ft (U. P.), Strachey & Winterbottom (lectotype: K; isolectotypes: BR, GH, K).

Paratype: India, Upper Garhwal (U.P.), *Madden 150* (E, K).

Heterotypic synonyms: *Dunbaria pulchra* Benth. ex Bak. in Hook., Fl. Brit. India 2: 218 (1876).

Type: India, lower hills of Sikkim, 1-2000 ft, Hooker fil. (holotype: K; isotypes: K, P).

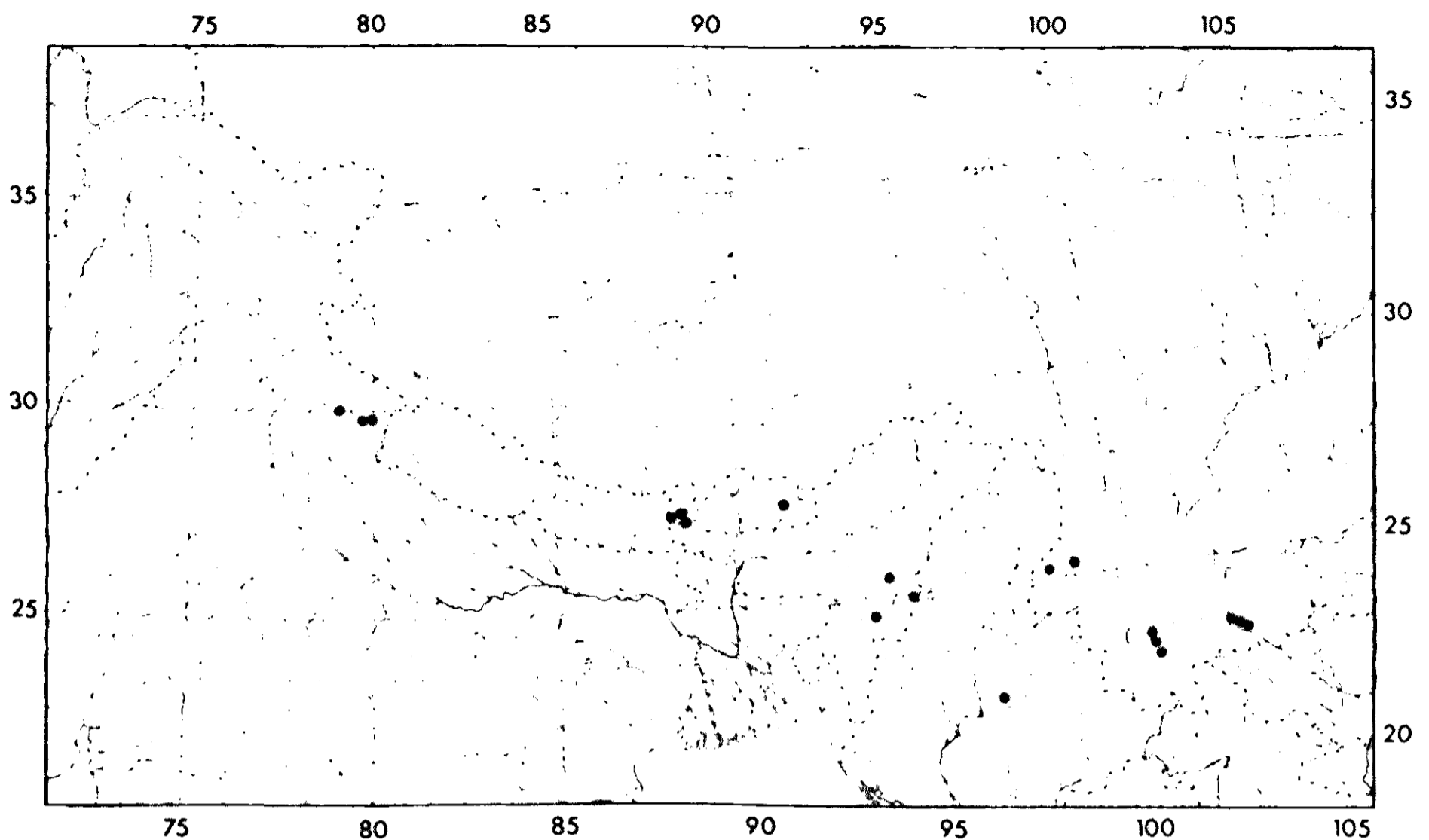
*Pueraria seguini* Léveillé, Bull. Soc. Bot. France 55: 426 (1908); Léveillé, Fl. Kouy-Tcheou 241 (1914); Gagnep. in Lecomte, Not. Syst. 3: 205 (1916).

TYPE: China, prov. Kouy-tcheou, nr Hoang-ko-chou, herbaceous liana trailing on the rocks, *J. Seguin 2446* (holo: P; iso: E,P).

Climber, (probably) perennial. *Branches* covered with short hairs, terete, several meters long. *Stipules* ovate-lanceolate, ca 8 X 2 mm, striate, pubescent caducous. *Leaves* pinnately trifoliolate, petiole up to 5 cm, rachis 1.5-2 cm. *Leaflets* membranous, glandular-punctate below, ribs pubescent below, upper surface thinly pubescent, top leaflet rhomboid to ovate, tip acuminate, base rounded, 7-10 cm long, 4.5-7 cm wide; side leaflets obliquely ovate, tip acuminate, base rounded; 6-10 cm long, 3.5-6 cm wide; petiolules ca 3 mm, stipellae setaceous, 2-3 mm. *Racemes* lax, up to 12-flowered, peduncle 8-20 cm, pedicels finally 12 mm, recurved, flowers probably yellow, marcescent. *Bracts* very large, elliptic-acuminate, shortly pubescent, finally up to 25 X 13 mm, caducous. *Calyx* pubescent with bulbous-based hairs, tube ca 6 mm long, teeth lanceolate, the upper ones connate, 6-10 mm long, the lower one linear-acuminate, 10-18 mm long. *Vexillum* obovate-orbicular, base clawed, biauriculate, top emarginate, 25-30 mm long, 20-25 mm wide. *Alae* obovate, clawed, 15-25 mm long, 7-10 mm wide. Keel petals oblique, ventrally joined, 15-25 mm. Ovary 9 mm, densely covered with long hairs (up to 3 mm). Style ca 18 mm, in the middle upcurved, pubescent, in curve less hairs. *Stamens* ca 28 mm long, free part ca 5 mm, upcurved. *Pod* 3.5-5 cm long, 8-12 mm wide, sparsely covered with long, silky hairs, tipped with the base of the style, transverse depressions at right or almost right angles to the suture; seeds ca 6, rounded-compressed, ca 6 mm long, 6 mm wide, 4 mm thick; strophiole divided.

Distribution: Bhutan, Burma, China: Yunnan, Kweichow, Anhwei. India: Himalayas. Probably also in Nepal, but no data are available.





MAP 19. *Cajanus grandiflorus*

Ecology: climber on shrubs, rocks, at riversides, on low hills.

Altitude: 1000-2700 m.

Flowering: Jul-Oct.

Fruiting: Sep-Nov.

Vernacular names: Siao Cho Ten or Siao Ko Ten (China, *Seguin 2446*).

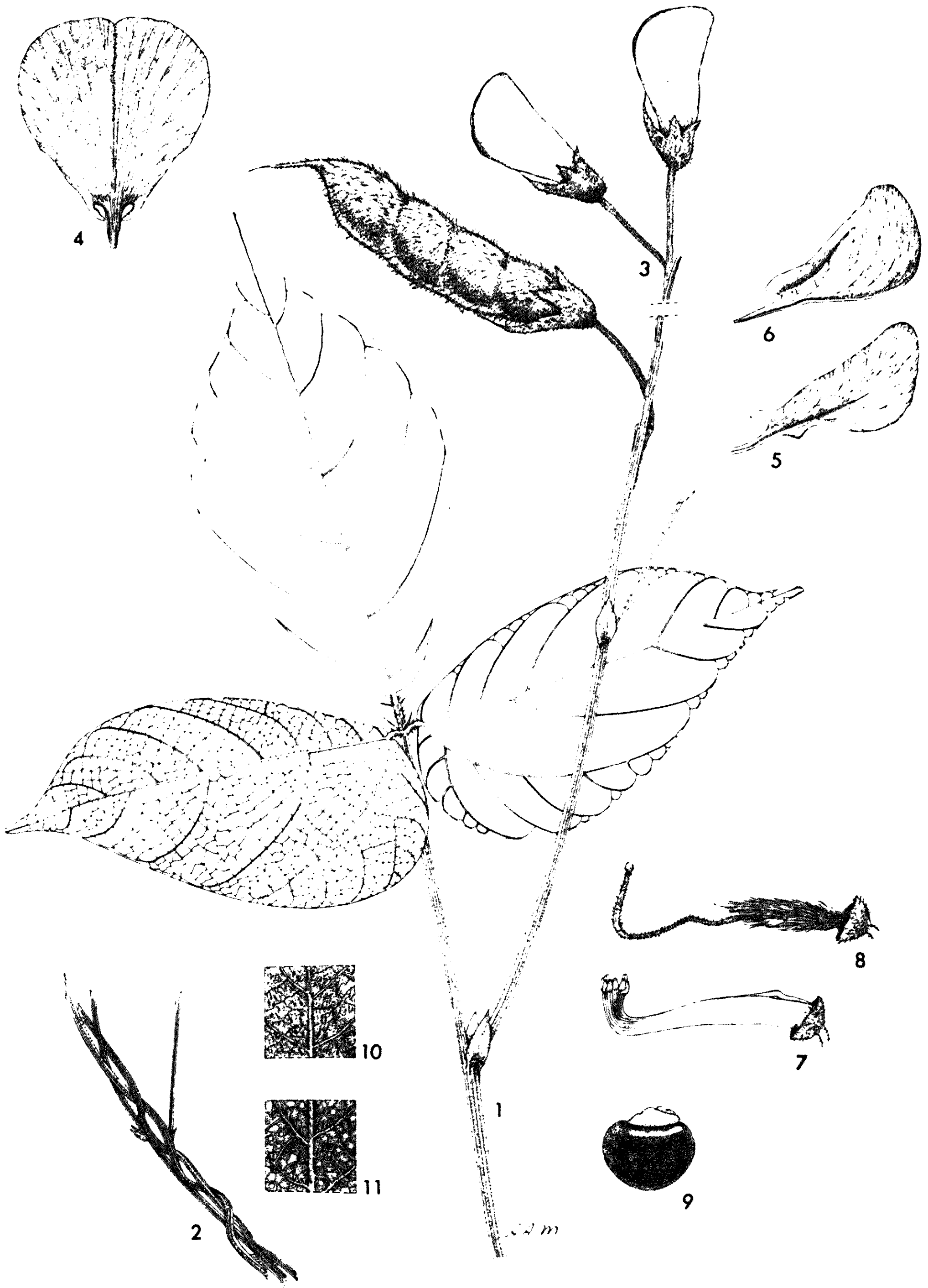
#### Specimens examined:

BHUTAN: Kuru Chu valley, *Cooper 4726* (E).

BURMA: Maymyo plateau, *Lace 5214* (K).

CHINA: Yunnan, *Bons d'Arty 133* (P); Kouy-Tcheou (Kweichow) prov., *Cavalerie 3639* (P); Hinyu-hien, Yunnan-sen distr., *id. 4289* (E, K); Hwang Shan Mt, Anhwei Prov., W. Chelem, *Ching 8810* (US); les halliers de Tapin Tze, Yunnan, *Delavay s.n.* (P); les bois de La Long Tan, Yunnan, *id. 3076* (P); Lava bed W of Tengyueh (now Tengchung), Yunnan, *Forrest 8869* (E); W flank of Shweli-Salween divide, lat. 25.20, Yunnan, *id. 9091* (E); Yunnan, *id. 16019* (BM); *ibid.*, *id. 18602* (A, K); Mengtze Mts, Yunnan, *Henry 9664 A* (BM, K); *ibid.*, *id. 9664 B* (A, US); *ibid.*, behind Pantzu Hua village, *id. 9664* (CAL, K, L, US); Szemao W Mts, Yunnan, *id. 12558* (CAL, FI, K); *ibid.*, *id. 12948* (CAL); *ibid.*, *id. 13369* (BM); environs de Hoang-Ko-Chou, prov. Kouy-tcheou (Kweichow), *Seguin 2446* (E, P, type of *Pueraria seguini*).

FIG. 12. *C. grandifolius*: 1. branch, 1X; 2. inflorescence, 1X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens and stigma, 2X; 7. pistil, 2X; 8. pod, 1X; 9. seed, 3X; 10. detail upper leaflet surface, 2X; 11. detail lower leaflet surface, 2X(1-11: *A. Henry 9664*).





INDIA: W. Himalaya: U. P.: Upper Garhwal, *Maaden 150* (E, K); Bagesar, Kumaon, *Strachey & Winterbottom* (BR, GH, K, type of *Atylosia grandiflora*). E. Himalaya: Sikkim, Little Rungeet, *Clarke 12607 A* (K); Sikkim, lower hills, *Hooker s.n.* (K); Manipur, Laimatak, *Meebold 5960* (K); Manipur, Huining, Naga hills, *Mukerjee 3472* (CAL); *Wight 769, 770* (P).

10.13 ***Cajanus heynei*** (W. & A.) van der Maesen comb. nov.

Fig. 13, p. 128, Map 20, p. 130

*Cajanus heynei* (Wight & Arnott) van der Maesen comb. nov.

Basionym: *Dunbaria heynei* W. & A., Prodr. 1: 258 (1834); Bentham in Miq., Pl. Jungh. 1: 242 (1852); Miquel, Fl. Ind. Batav. 1-1: 178 (1855); Baker in Hooker, Fl. Brit. India 2: 217 (1876); Prain, J. As. Soc. Bengal 66-2: 433 (1897); Trimen, Hand-Book Fl. Ceylon 2: 80 (1894, repr. 1974); Cooke, Fl. Presid. Bombay 411 (1903, repr. 1967); Rama Rao, Flow. Pl. Travancore 127 (1914); Gamble, Fl. Presid. Madras 2: 370 (1918), 261 (1967); Gunawardena, Gen. Sp. Pl. Zeyl. 69 (1968); Khoi & Yakovlev, Bot. Zh. 67: 1541 (1982).

Type: India, 28 Dec. 1816 *Wallich 5572 A* (K: holotype, isotypes).

Homotypic synonym: *Collaea (Glycine) gibba* Grah. in Wall., Cat. 5572 A (1831), nom. nud.

Heterotypic synonyms: *Dunbaria oblonga* Arn., Nov. Act. Nat. Cur. 18: 333 (1836); Baker in Hooker, Fl. Brit. India 2: 218 (1876) (as *D. oblonga* Wight ex Arn.).

Type: Walker-Arnott, Ceylon No. 207 (E, holo).

*Cajanus kulnensis* Dalz., Hook. Kew J. 2: 264 (1850); Dalzell & Gibson, Bombay Fl., 72 (1861)

Type: India, prope vicum Kulna, in provincia Warree, rara, *Dalzell s.n.* (holotype: K?, not seen; isotype: probably CAL, sheet of Dalzell without location data).

*Atylosia kulnensis* (Dalz.) Dalz., J. Linn. Soc. 13: 185 (1873); Prain, J. As. Soc. Bengal 66-2: 433 (1897).

*Climber*, perennial, branches green pubescent with long spreading hairs, terete, faintly striate, up to about 4 m long. *Stipules* large, ovate-acuminate, papery, persistent, 5-10 mm long, 2-4 mm wide. *Leaves* almost digitately trifoliolate, petiole 2-7 cm, rachis 1-3 mm, stipellae setaceous, 1-4 mm long. *Leaflets* membranaceous, dark green above, dull green below, shortly pubescent above, veins sparsely pubescent below. Top leaflet rhomboid-acuminate, 3-7(-9) cm long, 2-4(-5)

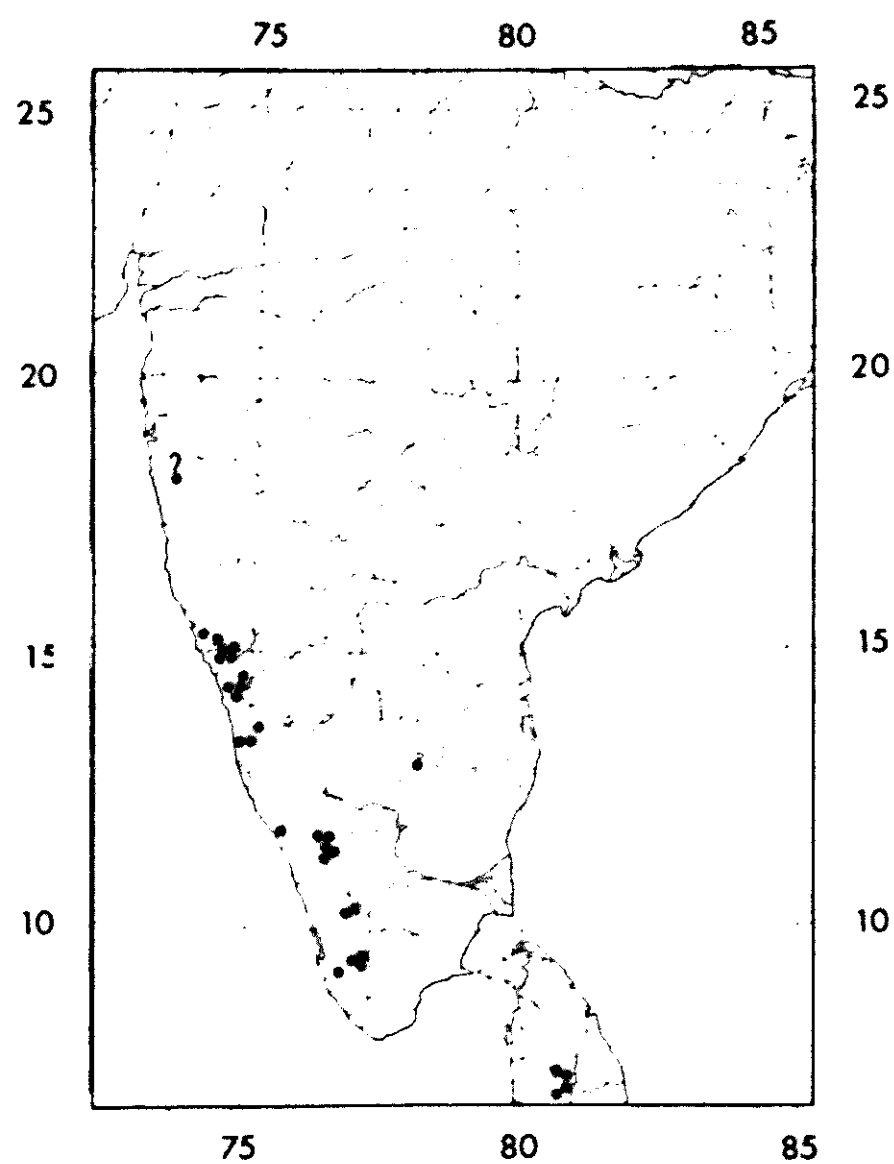
FIG. 13. *C. heynei*: 1. branch, 1X; 2. twisted branches,  $\frac{1}{2}$ X; 3. Flowers, 1X; 4. flag, 2X; 5. wing, 2X; 6. keel, 2X; 7. stamens, 2X; 8. pistil, 2X; 9. seed, 3X; 10. detail upper leaflet surface, 2X; 11. detail lower leaflet surface, 2X (1-11: *Kameswara Rao 95*).

cm wide, base rounded or faintly cordate, top acuminate. Side leaflets obliquely obovate, 2.5-7(-8) cm long, 2-3.5(4) cm wide, base rounded, tip acuminate. *Racemes* lax, sometimes branched, 3-13 cm, 6-12 flowers, 1-2 per node, corolla yellow, flag dorsally reddish tinged, marcescent, pedicels 5-10 mm. *Bracts* as the stipules, opposite, at some distance from the base of the peduncle and at base of peduncle branches, caducous. *Calyx* tube 3-4 mm, teeth triangular-acuminate 2-5 mm, lower one longest, elongate, upper ones almost entirely connate. *Vexillum* obovate, ca 20 mm long, 18 mm wide, top rather deeply emarginate, base clawed, biauriculate, two callosities. *Alae* obovate, ca 19 mm long, 7 mm wide, base clawed, biauriculate. Keel petals oblique, ca 16 mm long, 9 mm wide, ventrally adnate. *Ovary* densely hairy, hairs white, ca 7 mm long, 4-5(-6) ovules. *Style* sparsely hairy all along, ca 13 mm, upturned about midway, stigma globular. *Stamens* ca 25 mm long, free part 5 mm, upturned, anthers almost basifix. *Pods* oblong, ca 4 cm long, ca 1 cm wide, tipped with the style (ca 12 mm), sticky, with fine spreading hairs, hairs up to 2 mm, many bulbous-based, depressions between the seeds developing late, at oblique or almost right angles to the suture. *Seeds* 4-5, ovoid, 4-5 mm long, 3-4 mm wide, 2-3 mm thick, brown with black mottles to almost entirely black, strophiole around hilum rather thin, divided.

**Distribution:** India, Western Ghats; Sri Lanka, Vietnam.

**Ecology:** Climber in trees or shrubs, open places in forests, along roadside in hedges (e.g. *Lantana*), or grassy hillsides.

**Altitude:** 0-1000 m (?)



MAP 20. *Cajanus heynei*

Flowering: (Dec) Jan-Feb (Mar).

Fruiting: Feb-Mar.

Vernacular names: not recorded.

### Specimens examined:

INDIA: without location, *Wallich 5572 A* (K, types); Ichwallee, *Anon. s.n. Nov. 1896* (LIV). Andhra Pradesh: Sunkarimeta, Visakhapatnam distr., *Anon. s.n.* (BSI). Goa: Nadquim, *Kanodia 88294* (BSI). Karnataka: Ayyur, Bangalore distr., *Bor 7523* (DD); S Kanara, *Beddome 1806* (MH); 6 km NE of Kumbarwada, N Kanara distr., *Kameswara Rao & Chandra 75* (ICRISAT, WAG); Anshi Ghat, *ibid., id. 79* (ICRISAT, WAG); 19 km N of Siddapur, *ibid., id. 95* (ICRISAT, WAG); 5 km W of Jog, *ibid., id. 98* (ICRISAT, WAG); 22 km E of Gersoppa, *ibid., id. 102* (ICRISAT, WAG); 3 km E of Gersoppa, *ibid., id. 104* (ICRISAT, WAG); 6 km N of Someshwar, Shimoga distr., *id. 123* (ICRISAT, WAG); Aglatti, Mysore, *Meebold 8277* (CAL); N. Kanara, Castle Rock Railway, *Nana 5624* (K); N Kanara, *Talbot 1835* (BSI); SW Kanara, Hadwali, Hadali nr Coondapoor? *Raizada 21100* (DD); Shimoga distr., Gudikare, 4 km from Agumbe, *Sundara Raghavan 69455* (BSI); N. Kanara distr., Hulekal Range, base of hill, *id. 79612* (BSI); N. Kanara distr., Anshi on rd to Supa, *Anon. s.n.* (BSI). Kerala: Wynad, *Anon. 16615* (MH); Karhore Ghat, Malabar, *Anon. 1143* (MH); Wynad, *Beddome 2292* (BM); Koni, Travancore, *Bourdillon 1308* (CAL); Vandiperiyar, 10 km W of Kumali, Kottayam distr., *van der Maesen 3081* (ICRISAT, WAG); *ibid., id. 3499* (ICRISAT, WAG); 10 km E of Vandiperiyar, *id. 4844* (ICRISAT, WAG); approach rd of Aranya Nivas Hotel, Thekkadi, *id. 4850* (ICRISAT, WAG). Maharashtra: Bombay (Ghats?), *Dalzell s.n.* (CAL, probably type of *C. kulnensis*); sine loc., *Gibson* (CAL); Concan, *Stocks s.n.* (BM, G, L, P, W); Wudde Ghaut, *Talbot 317* (CAL). Tamil Nadu: Nilgiri distr., Pandalur to Cherambade, *Barber 5588* (MH, CAL); 8 km S of Gudalur, *van der Maesen 3100, 3372* (ICRISAT, WAG); Devala, Rockwood Forest, *Vajravelu 43466* (MH); distr. Kannath, Tellicherry, *Vaid 23368* (DD); Coimbatore distr., Anaimalai Hills, *Beddome 24* (CAL).

SRI LANKA: Nr Bibile, Uva prov., *Anon.*, Jan. 1888 (PDA); Lady Horton's Drive, Kandy, *Alston 1238* (PDA); Kandy, Hantane, *Gardner 243* (BM, PDA); Guru Oya, Kandy dt, *Jayasuriya et al. s.n.* (PDA); sine loc., *Anon. s.n., 23* (E); *Thwaites 1478* (BM, CAL, G, MH, P); *Walker s.n.* (E); *id. 207* (E, type of *Dunbaria oblonga*); *id. 1320* (E).

Notes: In my opinion this species also belongs to *Cajanus*, as the pods have real depressions (similar to *C. platycarpus*) and are not flat. The flat versus undulated pod is a key character used to distinguish *Dunbaria* from other *Cajaninae* with more than 3 seeds. Probably WIGHT and ARNOTT (1834) did not see mature pods, or depressions since these develop quite late. The type material (*Wallich 5572 A*) only has young fruits. Apparently neither BENTHAM nor BAKER (1876) had additional material at their disposal, since they did not refer to it. PRAIN (1897) did see *Cajanus kulnensis* material from DALZELL (1850), who described the constrictions clearly, but did refer it to the synonymy of *D. heynei*. GAMBLE has seen mature *C. heynei* pods (*Meebold 8277*), when he prepared the Flora of Madras, as testified by his stamp and signature. He did not refer this species to *Atylosia*, but left *C. kulnensis* in synonymy with *Dunbaria heynei*.

Unripe seeds of *C. heynei* have large strophioles, which shrivel at maturity to small but not inconspicuous ones, unlike most *Dunbaria*'s which have substrophiolate seeds. *Dunbaria ferruginea* W. & A., a true *Dunbaria*, has small strophioles. It is closer to *Cajanus* than other *Dunbaria*, and has the facies of *Cajanus crassus*.



RAM 7

NGUEN DANG KHOI & YAKOVLEV (1982) reported the presence of this species in Vietnam: from Dac Lac, Krongpac, 23-12-1979, collected by T.D. Ly, no. 844 (HN, not seen).

#### 10.14 *Cajanus kerstingii* Harms

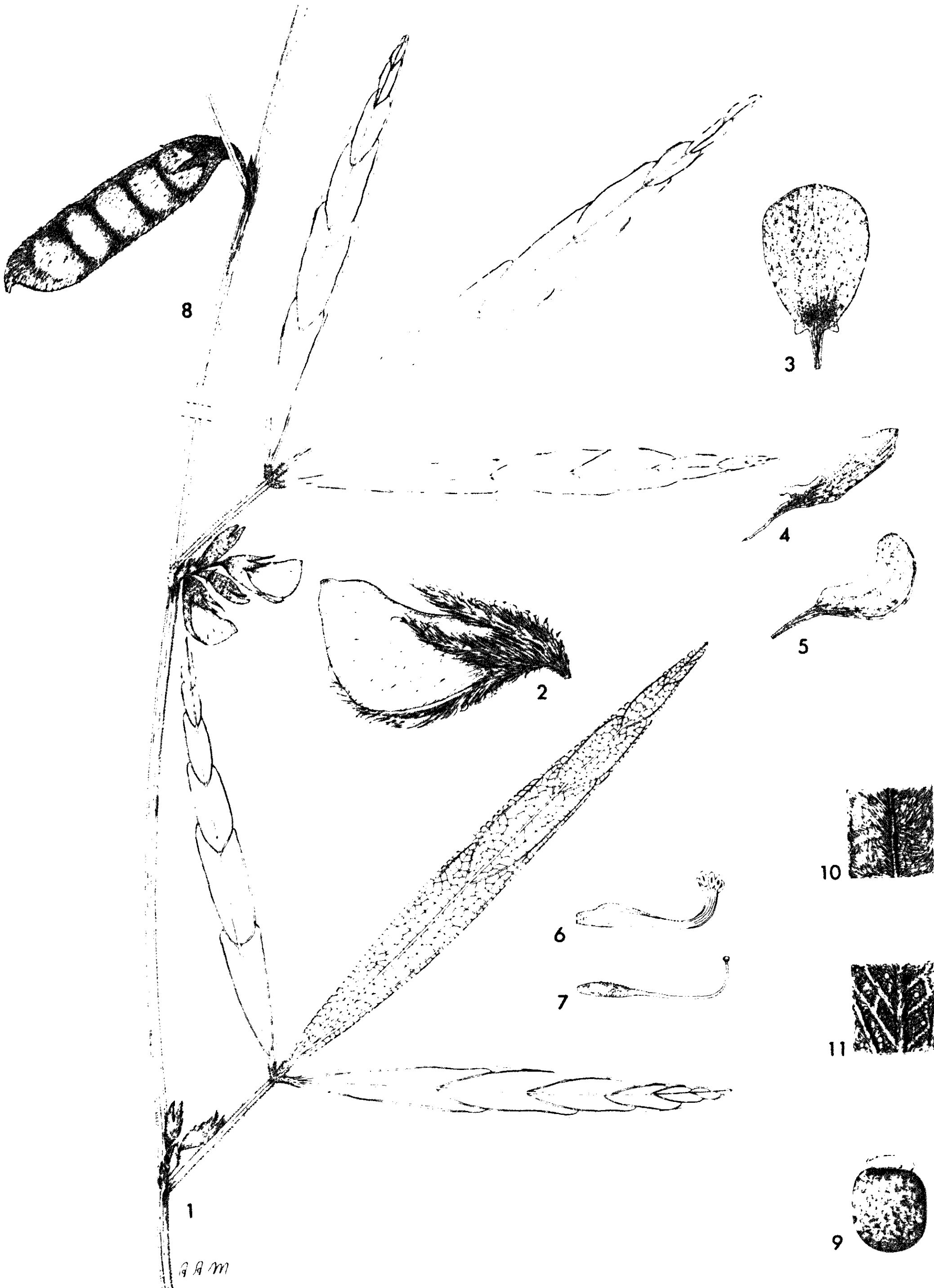
Fig. 14, p. 132, Map 21, p. 135

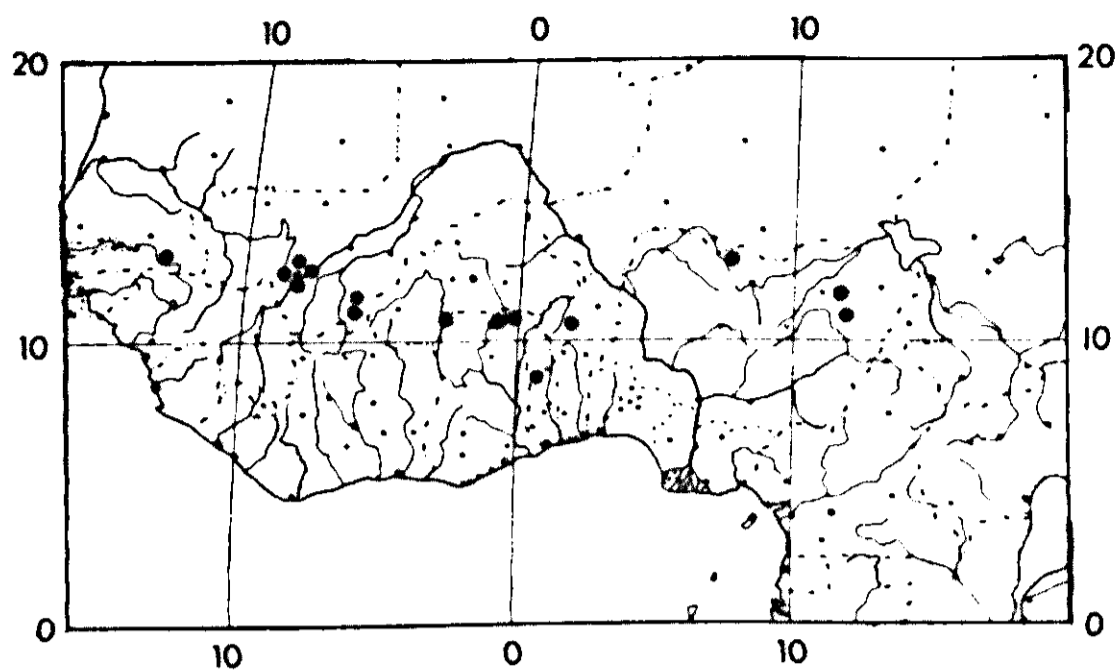
*Cajanus kerstingii* Harms, Feddes Repert. 14: 196 (1915); Baker, Legumin. Trop. Afr. 460 (1926); Verdcourt, Fl. Trop. E. Afr. ed. 2; 4-2: 711 (1974); Hepper, Fl. W. Trop. Afr. ed. 2. 1: 215 (1958); Berhaut, Fl. Senegal ed. 2: 30 (1967); id., Fl. Illustr. Senegal 5: 76-77 (1976).

Type: Togo, Sokode-Basari, open savanna, *Kersting 570* (holotype: B? not seen, most likely burnt; no isotypes traced).

Erect *shrub*, perennial, up to 2 m. *Branches* green to brown-purple, whitish pubescent, faintly striate, glandular-punctate. *Stipules* linear-lanceolate, 2-3 mm long, pubescent, early caducous. *Leaves* pinnately trifoliolate, petiole 1-2 cm, rachis 2-5 mm. Leaflets coriaceous, glandular-punctate both sides, lower surface silvery-pubescent with short adpressed hairs, rib prominent; upper surface green, pubescent with very short erect hairs; top leaflet elliptic or slightly obovate, apex obtuse, with a small mucro, base rounded, 20-45 mm long, 10-25 mm wide, side leaflets slightly obliquely elliptic, top acute, mucronate, base truncate-rounded, 14-35 mm long, 8-22 mm wide. *Stipellae* barely visible pubescent lobes, minute, petiolules ca 2 mm. *Racemes* short, crowded, 1-2 per axil, ca 4 (-10)-flowered, peduncle 15-35 mm, pedicels 5-10 mm, flowers yellow, probably now and then reddish striped. Bracts very minute, rounded, pubescent, early caducous. *Calyx* pubescent (interior also), hairs uniform, short, tube 3-4 mm, teeth triangular, ca 2-3 mm long, the upper ones connate, the lower one longest. *Vexillum* obovate, base clawed, auriculate, apex emarginate, no callosities (*Vigne 4578*) ca 20 mm long, 14 mm wide. *Alae* elongate-obovate, base long and narrow, auriculate, ca 18 mm long, 5 mm wide. Keel petals rounded-oblique, ca 17 mm long, base long and narrow, ca 5 mm, ventrally adnate. *Ovary* densely grey-pubescent, with short hairs, ca 5 mm long, 3-4 ovules, style ca 13 mm long, base pubescent, top upcurved, stigma globular. *Stamens* ca 19 mm long, last 4 mm free, upcurved, glabrous, anthers dorsifix. *Pods* oblong, densely pubescent, hairs short, adpressed, transverse depression at right or oblique angles to the sturdy sutures, 2.5-3.5 cm long, ca 1 cm wide, base of style remains as a tip of 1-2 mm, (2-)3-4 seeds. *Seeds* rectangular rounded, ca 4-5 mm long, 3-4 mm wide, 2 mm thick, brown with or without black mosaic, with a large divided strophiole.

FIG. 14. *C. kerstingii*: 1. fruiting branch, 1X; 2. flowering branch, 1X; 3. calyx with glands, 3X; 4. flag, 2X; 5. wing, 2X; 6. keel, 2X; 7. stamens and stigma, 2X; 8. pistil, 2X; 9. seed, 3X; 10. detail upper leaflet surface, 2X; 11. detail lower leaflet surface 2X (1, 9-11: *P. N. de Leeuw 1316*; 2-8: *N'Gola Diarra 1389*).





MAP 21. *Cajanus kerstingii* in West Africa

**Distribution:** Senegal, Togo, Benin, Ghana, Mali, Nigeria.

**Ecology:** Open savanna or underscrub in forest of e.g. *Isoberlinia*.

**Altitude:** ± 50-500 m.

**Flowering:** Aug-Sep.

**Fruiting:** Oct-Nov.

**Specimens examined:**

**BENIN:** Atakora Mts from Konande to Konkobiri betw. Quetecou and Firou (P).

**GHANA:** Dahile Forest Reserve near Billaw, *Adams 4125* (K); Zowse Hill near Bawku, *Enti & Hall GC 35999* (EAH, K); Nangodi, N. Territ., *Vigne 4578* (BM).

**MALI:** Lido, hill, *Cisse 627-c* (WAG); Klela, *Demange 2529* (P); betw. Doumanaba & Dossodo (Sikasso), *N'gola Diarra 279* (P); hills behind & NW of Lido nr Bamako, *id. 1389* (WAG); 4 km N of Bamako, road to Koulouba, *Garnier 5* (P); Cercle de Bamako, *Waterslot 1291, 1292, 1383* (P).

**NIGERIA:** Yankura, Katsina Prov., Kogo distr., *Daggash FHI 35025* (FHI, IBADAN, K); Buratai Cattle Reserve, W. Bornu, *de Leeuw 1316* (WAG); Damatura, Bornu, distr. Damaturu, *Magaji FHI 55944* (K).

**SENEGAL:** Kanemere, *Fotius K 382* (P).

**Specimens indicated:**

**SENEGAL:** Parc du Niokolo-Koba, *Berhaut 1218* (cf. Berhaut 1967); E. Senegal, *Fotius 12298* (Berhaut 1976).

**TOGO:** Sokode-Bassari, *Kersting 570* (cf. Harms l.c.).

**10.15 *Cajanus lanceolatus* (W.V. Fitzg.) van der Maesen comb. nov.**

**Fig. 15, p. 134, Map 4, p. 63**

*Cajanus lanceolatus* (W.V. Fitzgerald) van der Maesen comb. nov.

FIG. 15. *C. lanceolatus*: 1. branch, 1X; 2. flower, 3X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens, 2X; 7. pistil, 2X; 8. portion of stem with pod, 1X; 9. seed, 3X; 10. detail upper leaflet surface, 2X; 11. detail lower leaflet surface, 2X (1-11: *Lazarides 6447*).

Basionym: *Atylosia lanceolata* W.V. Fitzg., J. Proc. Roy. Soc. W. Austral. 3: 156 (1918); Reynolds & Pedley, *Austrobaileya* 1-4: 423 (1981).

Type: Western Australia, Mt Broome, W.V. Fitzgerald s.n. (PERTH, holo; photograph seen).

Erect slender *shrub*, 1-3 m. Indumentum of short silvery to pale golden brown hairs. *Branches* erect, striate except at the apex. *Stipules* triangular-ovate, 3-5 mm long, 1-2 mm wide, persistent. *Leaves* digitately trifoliolate, unifoliolate at the apex of branches, petiole 1-2 cm. *Leaflets* thick-coriaceous, glandular-punctate both sides, greyish green above, dull green below with veinlets raised. *Leaflets* lanceolate, tip acute mucronate, base cuneate, top leaflet 5-10 cm long, 0.4-0.9 cm wide, side leaflets 3-6 cm long, 0.3-0.6 cm wide, petiolules thickened, 2 mm long. *Stipellae* absent. *Racemes* short, axillary, 1-12-flowered, peduncles 1-12 mm long, pedicels up to 4-5 mm in fruit, flowers yellow caducous, flag dorsally purple streaked. *Bracts* small, hairy caducous scales. *Calyx* densely pubescent, interior also, tube ca 3 mm, teeth lanceolate, the upper ones connate, 3-8 mm long, the lower one longest. *Vexillum* obovate, ca 12 mm long, 10 mm wide, base clawed, auriculate, margin firm from base of claw to tip of auricles, with two callosities near the base. *Alae* obovate, biauriculate, ca 12 mm long, ca 4 mm wide, keel petals rounded-oblique, ca 12 mm long, ca 5 mm wide, ventrally adnate. *Ovary* densely white-pubescent, ca 6 mm long, hairs ca 2 mm, ca 5-6 ovules, style ca 9 mm, last 5 mm upturned, somewhat flattenend, hairy at the base. *Stamens* ca 13 mm long, free part 3-4 mm, upturned, anthers basidorsifixed. *Pod* oblong, rounded-acute at both ends, covered with yellow glands and soft hairs of 1 mm long, transverse depressions oblique, base of style caducous, (2-)3-6 seeds. *Seeds* globose to compressed, 3-4 mm long, ca 3 mm wide, ca 2 mm thick, greyish brown with black mottles, black when old. *Strophiole* divided, conspicuous, greenish grey.

**Distribution:** W Australia, very rare.

**Ecology:** Wooded slopes, on rocky red loam, basaltic loam, red earth on sandstone, on wooded slopes.

**Altitude:** not indicated, probably below 800 m.

**Flowering:** Apr?, Jul, Aug.

**Fruiting:** May, Jul, Aug.

**Specimens examined:**

W AUSTRALIA: Prince Regent River, *Bradshaw & Allen s.n. 1891* (MEL); Mt Bell, *Byrnes 2262* (NT); Mitchell River, Kimberley, *Gardner 965* (PERTH); Bushfire Hill, Prince Regent River Reserve, *George 12291* (NT); 15 km W of Mt House Station, Kimberleys, *Lazarides 6447* (CANB, K).



10.16 *Cajanus lanuginosus* van der Maesen sp. nov. Fig. 16, p. 138, Map 4, p. 63

*Cajanus lanuginosus* van der Maesen sp. nov.

Type: Australia, Queensland, nr Mary Kathleen, 22 km from Rosebud turning off Barkly Highway en route to Fountain Springs, P. Catt 9138 (holo: CANB).

*Frutex ad 2 m, caulis distalis crassus; indumentum lanuginosum; folia trifoliolata, pinnata, foliola crassa, elliptica, glandulae parvae, inconspicuae. Calyx pubescens, dentibus lanceolatis, glandulae visibiles. Corolla aurea, persistens. Ovarium dense niveo-pubescens. Legumina oblonga, indumentum lanuginosum, strophiola seminum divisa. Species affinis C. latisepalo, C. pubescenti, C. crassicauli et C. reticulato, differt ab eis indumento lanuginoso, foliolis ellipticis. Species in Queenslandia (Mt Isa) endemica.*

Erect shrub, 1.2-2 m high, indumentum rather long, woolly, yellowish on young parts to whitish. Branches thick also at the end, striations still visible. Vesicular glands, visible on calyx and pods, on leaves difficult to see under low magnification. Stipules very caducous, lanceolate dorsally hairy, ventrally brown and glabrous ca 7 mm long, 3 mm wide. Leaves pinnately trifoliolate, petiole thick, ca 1-2 cm, rachis thick, 5-8 mm, petiolules thick, ca 3-4 mm. Leaflets thick, coriaceous, rather dense-short woolly, vesicular glands both sides, greyish green both sides, veins sunken above, whitish and raised below. Top leaflet elliptic, 3.5-6 cm long, 2-2.5 cm wide, apex acute to obtuse, base rounded. Side leaflets obliquely elliptic, 3-4.5 cm long, 1.8-2.2 cm wide, apex acute to obtuse, base rounded. Stipellae not seen. Racemes axillary, not branched, 1(-2) per axil, up to ca 15-flowered, peduncles short in flower, up to 9 cm in fruit, flowers yellow, corolla persistent. Bracts hairy ovate scales, 5-8 mm long, 4-7 mm wide, apex rather acute. Calyx pubescent, tube ca 6 mm, teeth lanceolate, 6-8 mm long, upper ones almost connate, lower one longest. Vexillum broadly obovate, ca 17 mm long, 15 mm wide, base clawed, auricles small, margins of lobes introflexed, tip emarginate, callosities near the base rather inconspicuously bulged. Alae obovate, ca 16 mm long, 7 mm wide, ventrally adnate. Ovary densely white-pubescent, ca 5 mm long, ca 6 ovules, style ca 13 mm long, glabrous except near the base, last 6 mm upturned, stigma capitate. Stamens ca 17 mm long, free part ca 5 mm, upcurved, anthers dorsifix. Pods oblong, ca 2.5-3.5 cm long, ca 0.8 cm wide, apex and base acute, base of style hardly persisting, woolly pubescent, transverse depressions almost at a straight angle to the suture, 4-6 seeds. Seeds obovoid-rounded, ca 4-5 mm long, 3-4 mm wide, 2 mm thick, brown with black mosaic, strophiole divided.

Distribution: Australia, W Queensland.

Ecology: not reported.



H.A.M.

Flowering: Jul-Aug. Fruiting: Aug-Sep.

**Specimens examined:**

AUSTRALIA, QUEENSLAND: nr Mary Kathleen, 22 km from Rosebud turning off Barkly Highway en route to Mountain Springs, *P. Catt* 9138 (holotype: CANB); ca 80 km SE of Mount Isa, *Ollershaw, Kratzing & Hain* PO 1245 (BRI, NT; orig. at CANB and dupl. in A. L. PERTH not seen).

Notes: *C. lanuginosus* differs from other species in its elliptic, woolly-pubescent thick leaves and thick stems. Although *C. crassicaulis* has similar stems, its indumentum is totally different. *C. reticulatus* is probable a close ally. Since it has been collected only twice, more material is required, and may be available in undetermined specimens of Phaseoleae.

**10.17 *Cajanus latisepalus* (Reynolds & Pedley) van der Maesen comb. nov.**

**Fig. 17, p. 140, Map 22, p. 141**

*Cajanus latisepalus* (S.T. Reynolds & L. Pedley) van der Maesen comb. nov.

Basionym: *Atylosia latisepala* Reynolds & Pedley, *Austrobaileya* 1-4: 425 (1981).

Type: Australia, Northern Territory, (upper) Victoria River, F. von Mueller (holo: K, iso: MEL, photograph seen).

Homotypic synonym: *Atylosia grandifolia* (F. v. Muell.) Benth. var. *calycina* Benth., *Fl. Austral.* 2: 264 (1864); Reynolds & Pedley, *Austrobaileya* 1-4: 425 (1981).

Erect *shrub*, perennial, 0.6-1.5 m. *Branches* grey pubescent, striate. *Stipules* triangular, very pubescent and almost hidden in indumentum of branches, ca 2 mm long. *Leaves* pinnately trifoliolate, petiole 0.5-3(-4.5) cm, rachis (0.2-)0.5-1.5 cm. *Leaflets* thick-coriaceous, glandular-punctate below, densely grey-pubescent, upper surface reticulate with sunken veins, lower surface with strongly raised veins, top leaflet ovate to rhomboid, (2-)3-7.5 cm long, 1-3(-4) cm wide, top acute, mucronate, base rounded to cuneate, side leaflets obliquely ovate, 1.4-4 cm long, 0.9-3.5 cm wide, top acute, mucronate, base rounded, petiolules 2-3 mm, stipellae absent. *Racemes* simple, ca 4-7 flowered, peduncle 1-6 cm, pedicels 4-7 mm, flowers yellow (flag dorsally red veined in Perry 3008). *Bracts* hairy, ovate-acuminate, ca 4 mm long, ca 3 mm wide, caducous. *Calyx* densely grey-pubescent, interior also, tube 3-5 mm, teeth broad-elliptic-acuminate, 6-12 mm long, 3-5 mm wide, with (inconspicuous or not) middle vein, upper ones connate except at the tip, lower one longest. *Vexillum* obovate, base clawed, auriculate, margin of auricles winged, top emarginate, ca 13-22 mm long, ca

FIG. 16. *C. lanuginosus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface 2X; 10. detail of stem hairs, 4X (1-10: *P. Catt* 9138).



10-14 mm wide, with two pubescent callosities near the base. *Alae* obovate, auriculate, ca 12-18 mm long, ca 4-5 mm wide, tip obliquely emarginate. Keel petals rhomboid, ca 12-19 mm long, ca 5-6 mm wide. Ovary densely white-pubescent, ca 5 mm long, 2-4 ovules, style ca 10-15 mm, last 5-6 mm upcurved, somewhat flattened in the curve, base pubescent, stigma capitate. *Stamens* ca 15-19 mm long, free part upcurved, 4-5 mm, anthers dorsifix. *Pods* broad-oblong, obliquely obtuse at both ends, 1.6-3 cm long, 0.7-1.2 cm wide, base of style not always persistent, 2-3(-4) seeds. *Seeds* flattened-globose, black with pinkish brown mosaic, ca 4-5 mm long, 4 mm wide, 2 mm thick, strophiole divided.

**Distribution:** Australia, West Australia and Northern Territory.

**Ecology:** Rocky slopes, open grassland, near rivers or in watercourse, in sand or (red) volcanic soil or brown clay.

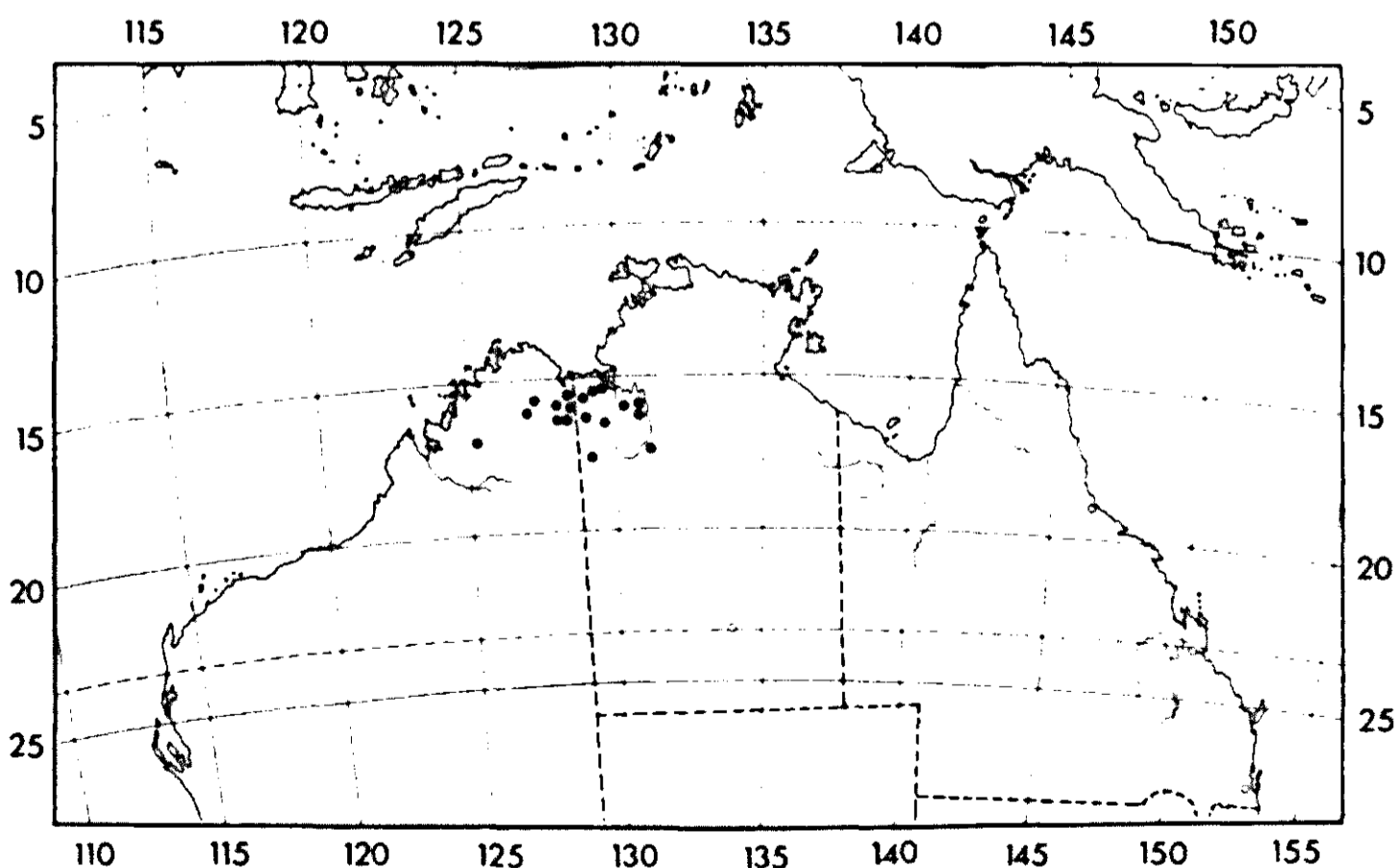
**Altitude:** 60-500? m.

**Flowering:** Mar-Jul(-Oct).

**Fruiting:** Apr-Oct.

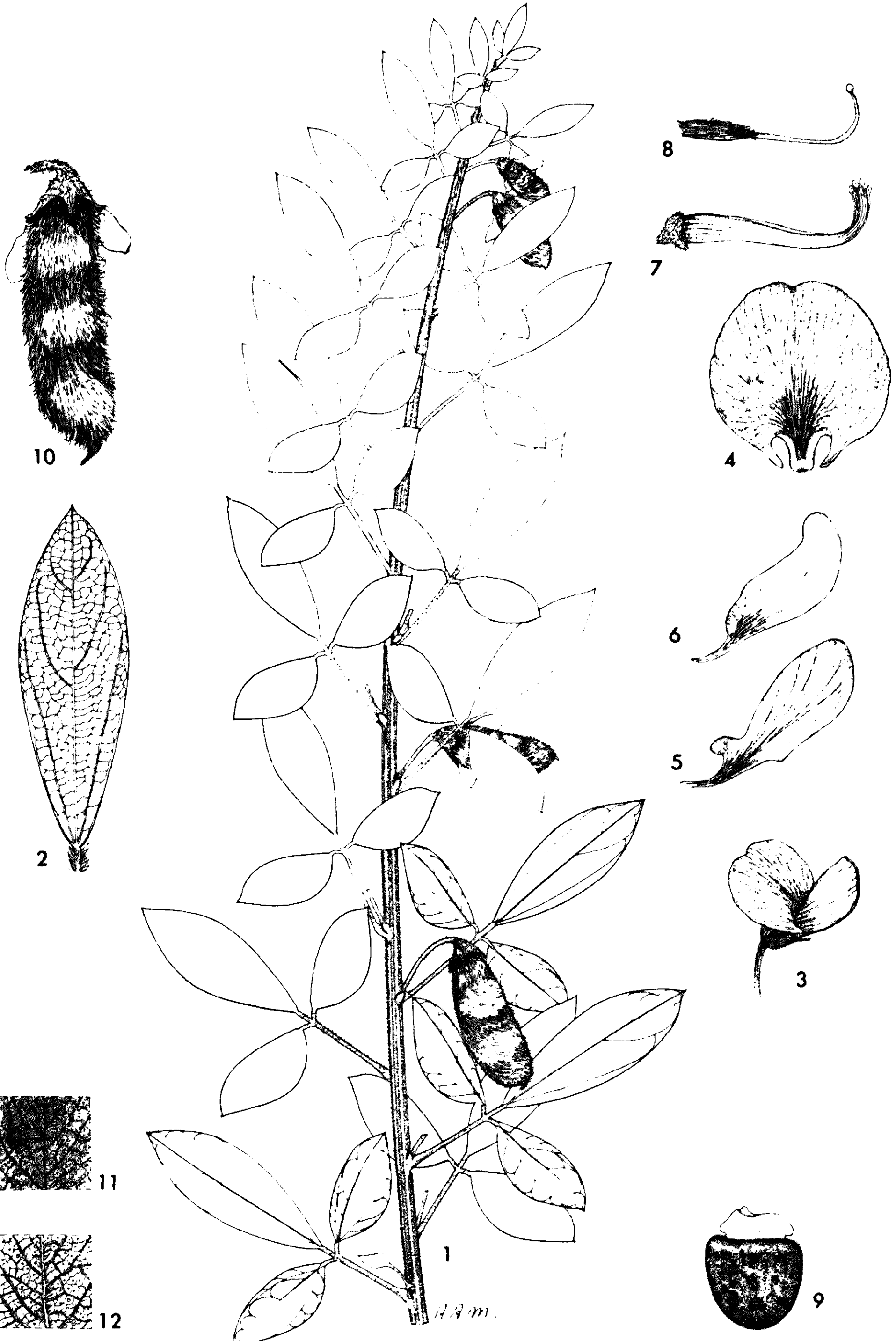
**Specimens examined:**

AUSTRALIA, NORTHERN TERRITORY: Kildurk Station, *Byrnes 1566* (NT); Jasper Gorge, Victoria River distr., *Chippendale 5035* (AD, CANB, K, NT); Mt Napier area, *Dunlop 4077* (BRI, NT);



MAP 22. *Cajanus latisepalus*

FIG. 17. *C. latisepalus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 2½X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface 2X. (1-9: *C. Dunlop 4077*).



Keep River area, *Henshall 1100* (NT); Mouth of Victoria River, *Holtze 1407* (MEL); Upper Victoria River, *Von Mueller s.n.* (k, holo; MEL, iso, photograph seen); Jasper Gorge, *Parker 459* (NT); 162 km SE of Carlton Station, *Perry 3008* (CANB, NT, US).

WEST AUSTRALIA: Middle Springs, Deception Range, Kimberley, *Burbidge 5161* (BRI); Deception Range, *id.* 2214 (NT); nr Ord River, *Donnell s.n.* (MEL); Karungie Station, Kimberley, *Dust 151* (CANB); Lennard River, 16 km above junction of Barker River, *Fitzgerald 580* (PERTH); Spring Creek, E Kimberley, *Gardner 7213* (PERTH); top of Concal Gorge, Carson Escarpment, Drysdale Nat. Park, *George 13867* (PERTH); about 2 km N of mouth of Revolver Creek, base of S Carr Boyd Ranges bordering Lake Argyle, *Hartley 14540* (PERTH); Durack River, *id.* 14653 (PERTH); above headwaters of Helby Ridge, NE Kimberley, *id.* 14825 (PERTH); top of Kelly's Knob nr Lookout, Kununurra, E Kimberley, *Kenneally 1923* (PERTH); Deception Ranges, E Kimberley, *Langfield 309* (CANB); Ivanhoe Station, E Kimberleys, *id.* 382 (CANB); Pentacost Ranges, *Maconochie 160* (K, NT); savanna 8 km SE of Kununurra, *Paijmans 2400* (PERTH); 11 km E of Denham River Station, *Perry 2525* (AD, CANB, NT, US); nr Alligator Springs, 110 km E of Carlton Station, *id.* 2617 (AD, CANB, US); round Kununurra, Ord Dam and Wynham Road, *Scarth-Johnson 543* (BRI); Ord Dam, *id.* 545 (K); Lennard River, *Staer s.n.* (E); Milligan's Lagoon, E Kimberley, *Stokes 21* (K).

Notes: Following REYNOLDS & PEDLEY (1981) I consider *C. latisepalus* as a good species, separate from *C. reticulatus* including var. *grandifolius* (F. v. Muell.) van der Maesen. The epithet *calycina* was used earlier for *Dunbaria calycina* Miquel (a synonym of *C. goensis* Dalz.), which was transferred to *Atylosia* by KURZ (1874). The name *calycina* has no priority outside its own rank. Although the epithet *calycina* in *Atylosia* or *Dunbaria* does not prevent its use in *Cajanus*, I prefer to keep Reynolds & Pedley's new name.

The type sheet at K contains two specimens, the upper one labelled *A. reticulata*, Upper Victoria River, F. VON MUELLER. This must be the specimen BENTHAM referred to when he published the short protologue (1864). The second specimen on the sheet (Robert Brown's collection number 4209) is a branchlet with narrow pods, detached from the empty peduncle. I consider that specimen to be *C. pubescens*.

#### 10.18 *Cajanus lineatus* (W. & A.) van der Maesen

Fig. 18, p. 142, Map 23, p. 145, Plate 10, p. 144

*Cajanus lineatus* (Wight & Arnott) van der Maesen comb. nov.

Basionym: *Atylosia lineata* W. & A., Prodr. Fl. Pen. Ind. Or. 1: 258 (1834); Cooke, Fl. Presid. Bombay 1: 408 (1903, repr. 1958, 1967); Rama Rao, Flow. Pl. Travancore 127 (1914); Gamble, Fl. Presid. Madras 2: 367-368 (1918), 259-260 (repr. 1967); Santapau, Fl. Khandala, Rec. Bot. Surv. India 16-1: 73 (1966); Saldanha & Nicolson, Fl. Hassan Distr. 238 (1976); Matthew, Materials Fl. Tamilnadu Carnatic 181 (1981).

Type: India, 28 Dec. 1816, Graham, *Wallich 5578* (holotype: K), *Cajanus*

FIG. 18. *C. lineatus*: 1. branch with two-seeded pods, 1X; 2. leaflet, 2X; 3. flower, 2X; 4. flag, 2X; 5. wing, 2X; 6. keel, 2X; 7. stamens, 2X; 8. pistil, 2X; 9. seed, 3X; 10. three-seeded pod, 2X; 11. detail upper leaflet surface, 2X; 12. detail lower leaflet surface 2X (1-12: van der Maesen 3055).



PLATE 10. *Cajanus lineatus* on a hill slope between Nadugani and Devala, Nilgiri district, South India, 850 m.

*lineatus* Grah. ex Wall. nom. nud., Wallich Cat. 5578 (1831).

Homotypic synonym: *Cantharospermum lineatum* (W. & A.) Raiz. in Mooney, Suppl. Bot. Bihar & Orissa 53 (1950).

Heterotypic synonyms: *Glycine lineata* Heyne ex Wall. nom. nud., Wallich Cat. 5578 (1831).

Based on: India, Heyne, *Wallich 5578* (second sheet; holotype: K).

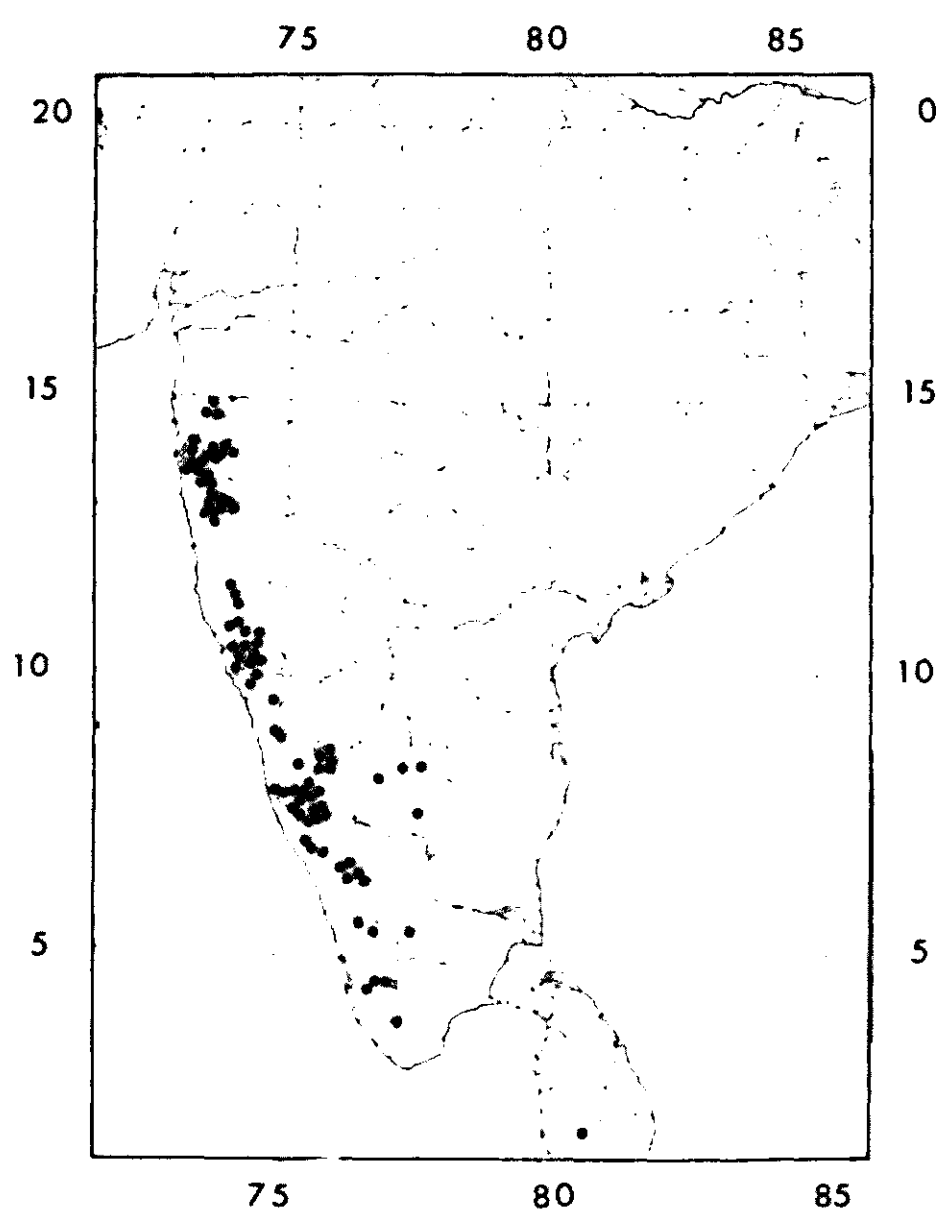
*Atylosia lawii* Wight (as *Lawii*), Icon. 1 t. 93 (1840); Dalzell & Gibson, Bombay Flora 74 (1861, repr. 1973); Dalzell, J. Linn. Soc. 13: 186 (1873).



Type: India, Bombay (Ghats), *Law s.n.* (holotype: K; isotypes: GA, K, OXF).

Erect *shrub*, 0.5-2.5 m tall, open habit, perennial. *Branches* horizontal to quite erect, striate. *Stipules* small, narrowly lanceolate, 2-3 mm, caducous. *Leaves* digitately trifoliolate, petiole 7-25 mm. *Leaflets* soft-coriaceous, glandular punctate both sides, pubescent on the prominent veins below, upper surface thinly pubescent, hairs up to 0.5 mm, top leaflet obovate-oblong, 15-42 mm long, 6-23 mm wide; apex acute to rounded-emarginate, mucronate, base cuneate, side leaflets obliquely so, 12-21 mm long, 5-12 mm wide; petiolules ca 1 mm, stipellae absent. *Racemes* sessile, 1-2 flowered, peduncle absent, pedicels 7-10 mm, corolla yellow, marcescent. *Bracts* triangular pubescent scales, clustered in leaf axil, 1-2 mm long. *Calyx* pubescent, tube 3-4 mm, teeth acute, ca 2 mm, upper ones connate. *Vexillum* obovate-orbicular, ca 13 mm long, ca 13 mm wide, base clawed, auriculate. Keel petals oblique, 11-13 mm long, 4-5 mm wide, ventrally adnate. *Ovary* densely white-pubescent, ca 5 mm, 2-3 ovules; style ca 11 mm, last 5 mm upturned, thickened where curved, base pubescent; stigma capitate. *Stamens* ca 14 mm, free part upcurved, ca 5 mm, anthers dorsifixed. *Pods* small, oblong, acute at both ends, ca 12 mm long, 8 mm wide, pubescent with caducous white hairs sometimes bulbous-based, covered with glands, transverse depressions not deeply marked, and at oblique angle to the sutures; 2-3 seeds. *Seeds* flattened-orbicular, ca 5 mm long, 4 mm wide, 2-3 mm thick, brownish or greyish with black mosaic, strophiole whitish, divided, ca 1 X 3 mm.

Distribution: India, Western Ghats, Nilgiris. Quite common in some places, quite rare elsewhere. Sri Lanka.



MAP 23. *Cajanus lineatus*

Ecology: Tropical dry or moist forest, in shaded and sunny places, often on slopes, forest edges, along roadsides, in undergrowth.

Altitude: 400-1660 m.

Flowering: Oct-Apr (June in Kerala).

Fruiting: (Oct-) Jan-Apr (-May).

Vernacular names: Jungle tur (= jungle pigeonpea); Ran tur (= jungle pigeonpea, Marathi, Konkani); Turati (Marathi, cf. Billore); Kadu-toggeri (Kanarese, cf. Hohenacker); Nattuteri (Malayalam, cf. Lushington 1915)

### Specimens examined:

INDIA: Without location: 28 Dec. 1816, *Graham, Wallich 5578* (K, holotype); *Heyne s.n., Wallich 5578* second sheet (K).

GOA: 3 km S of Codal, *Cherian 106794* (BSI); Choram hilltop, Nadaquem, *Kanodia 96307* (BSI).

KARNATAKA: Belgaum distr.: Belgaum, *Law s.n.* (K); Sudia 13 km E of Ramghat, *Kameswara Rao & Chandra 11* (ICRISAT, WAG); 5 km NE of Ramghat, *id. 17* (ICRISAT, WAG); Belgaum 8 km to Kunkumbi, *id. 46* (ICRISAT, WAG); 2 km E of Chorla, *id. 58* (ICRISAT, WAG). N Canara distr.: Mavingundi - Maleware, *Bole 1563* (BLAT); Castle Rock, E. of Goa, *Fernandez 740* (A, BLAT); Anmod jungles, *J. Fernandez 931* (A, BLAT); Castle Rock, along railway, *Irani 1872* (BLAT); 6 km W of Castle Rock, *Kameswara Rao & Chandra 70* (ICRISAT, WAG); 6 km NE of Kumbarwada, *id. 76* (ICRISAT, WAG); 8 km N of Sirsi, *id. 74* (ICRISAT, WAG); 22 km E of Gersoppa, *id. 101* (ICRISAT, WAG); Mattikari, dry riverbed, *S.D. Mahajan 1276* (BSI); Castle Rock, *Nana 5605* (K); Castle Rock, Goa border, *Saldanha 1003* (JCB); Castle Rock, S. of Station, *Santapau 17703* (BLAT); Nellore?, *Talbot 50* (CAL); Artabail, *Talbot 10-12-1882* (BSI); Khondalghat?, *Young s.n.* (BM). S. Canara distr.: Sampaji, *Barber 2301* (MH); s.l., *Beddome s.n. dated 1873* (MH); near Mangalore, *Hohenacker 516* (BM, C, F, FI, G, K, L, MEL, P, U, US, W); *ibid., Metsius 109* (P); Kervashe, *S.R. Raju s.n.* (MH). Chikmagalur distr.: Kemmangundi, Baba Budan hills, *H.C. Govindu 526* (UAS); 11 km W of Jayapur, *Kameswara Rao & Chandra 126* (ICRISAT, WAG); 14 km S of Dattatreypur, Baba Budan hills, *id. 150* (ICRISAT, WAG); Samse, way to Malleswara forest, *Simhan 0582* (JCB); Kerekate to Gangamulla, *id. 1098* (JCB); Kemmangundi, *id. 1811* (JCB); Santaveri, Baba Budan hills, *Talbot 3665* (BSI). Coorg distr.: Mercara Road, *R.K. Arora 47548* (BSI); Mercara, *id. 31461* (BSI); Nagarhole, *id. 46266* (BSI); Bhagamandala, *id. 61564* (BSI); Fraserpet-Kutompole, *Lowrie 54 (DD)*; Karavangeri, *G.S. Puri 31709* (BSI); Talacauvery, old footpath, 3-6 km from Bhagamandala, *A.S. Rao 85804* (BSI); same loc., 5 km, *A.S. Rao 95172* (BSI); The Glen, *Watt 12885* (CAL). Hassan distr.: Shiradi Ghat, *Hooper & Saldanha 2541* (JCB, US); Ballalarayanadurga, *R.S. Raghavan 85342* (BSI, L), sine loc., *Raghavan 86921* (BSI); stream between Devalkere & Devarunde, *T.P. Ramamoorthy & K.N. Ghandi 54* (JCB, US); Bisle Ghat, *Saldanha 12127* (JCB, US); Shiradi Ghat, upper section, *id. 12269* (JCB, US); Shiradi Ghat, *id. 12605* (JCB); Kandamane Estate, *id. 12815* (JCB, US); stream between Devalkere & Devarunde, *id. 15479* (JCB, US); Maranahalli, *id. 15837* (JCB, K, US). Wynaad: *Beddome 2266* (BM).

KERALA: Cannanore distr.: Chandanathode, *J.L. Ellis 26325* (MH); *ibid., id. 27131* (MH); Theethundamalai to Chandanathode, *id. 29466* (MH). Kottayam distr.: Pamba, *D.B. Deb 30307* (MH); Pirmed (Peermade), *Meebold 13909* (CAL); nr Pirmed, 35 km W of Kumuli, *Remanandan 4842* (ICRISAT, WAG); Kuttikanam, Pirmed, *K. Vivekananthan 22902* (MH); *ibid., id. 29324* (MH). Palghat distr.: Palghat hills, *Beddome 29* (CAL). Trichur distr.: Karimalai, S. Malabar, *C.E.C. Fischer 1628* (CAL); Poringalkoothu, *Sebastine 26648* (MH).

MAHARASHTRA: Colaba distr.: Khandala, Rama's Bed. *Anon. 10295* (BLAT); Matheran, *Cooke s.n.* (BSI); Matheran, *Cooke?* (BLAT); Bombay, on the ghats, *Dalzell s.n.* (CAL, DD, K); Konkan, *Hooker & Thomson s.n.* (GH, MH); Bombay, *Hooker s.n., 1849* (GH); Matheran, Dasturi Point, Panorama Point, *Irani 5674* (BLAT); Bombay Ghats, *Law s.n.* (K, holotype of *Atylosia lawii*; iso:

GA, K, OXF); Mahad Ghat, Konkan, *G.S. Puri 16710* (BSI); Khandala, *Puri 9150* (BSI); Sakanpathar to Khandala, *R.S. Rao 85226* (BSI); Khandala, St. Xavier top, *Santapau 3132 & 3133* (BLAT); *ibid.*, St. Xavier Villa, *Santapau 4037* (BLAT); *ibid.*, Sausages & Saddle Top, *Santapau 4240, 4241, 4242, 4491, 5874, 5875, 5876, 8928* (BLAT); *ibid.*, top of Bhoma, *Santapau 10794* (BLAT); Pen, Konkan, *Stocks & Law s.n., 1846* (BM, C, FI, G, K, L, OXF, US, W). Kolhapur distr.: Radhanajari, *B.S. Ahuja 47420* (BSI); *ibid.*, *G.S. Puri 20081* (BSI); Belgaum hill south, *Ritchie 156* (K); Ramghat, *Ritchie 156.2* (E); Ramghat, *Ritchie 156.3* (E, K). Poona distr.: Dhak forest, 28 km W of Junnar, *K. Hemadri 104454* (BSI); *ibid.*, 27 km, *id. 108212* (BSI); Hira Ki Malay near Bhovargiri, *K.P. Janardhanan 69073* (BSI); Malai near Bhimasankar, *id. 69262* (BSI); Bakadevi Ka Ran, Bhimasankar, *id. 69626* (BSI); Bhari hill near Bhovargiri, *id. 70149* (BSI); Bhimasankar, *D.P. Panthaki 2251* (BLAT); *ibid.*, *G.S. Puri 12610* (BSI); *ibid.*, nr temple, *Remanandan 4030* (ICRISAT); 9.3 km from Lonavla to Ambavne, *id. 4680* (ICRISAT); Bhimasankar, *Ritchie s.n., 1854* (E); Nigdale forest, *Ryan 1745* (BSI); Bhimasankar, *J.A. Varasada 4862* (BSI); Ambavne to Lonavla, *B. Venkata Reddi 93212* (BSI); Jumbulna hill, 11 km from Ambavne, *id. 95877* (BSI); Saltar forest near Dangorwada, Ambavne, *id. 97637* (BSI); Nandgaon Ka Wagjoi, Ambavne, *id. 100990* (BSI). Ratnagiri distr.: Amleoti Ghat, Savantwadi, *Dalgada s.n.* (CAL); *ibid.*, *M.R. Almeida 665* (BLAT). Satara distr.: 28 km S of Mahabaleshwar, *Ackland 350* (BLAT); Lingmala falls, Mahabaleshwar, *M.R. Almeida 213* (BLAT); Panchgani, *R.K. Bhide s.n.* (BSI); Lingmala, Mahabaleshwar, *P.V. Bole 1256* (BLAT); *ibid.*, *id. 2353* (BLAT); Wilson Point slopes, *Bole s.n., 1-1-1973* (BLAT); Mahabaleshwar, *Cooke s.n., 1891* (E); *ibid.*, *Cooke s.n., s.d.* (BLAT); *ibid.*, *Mozes Ezekiel 12501* (BLAT); *ibid.*, *J.A. Lewis s.n.* (BLAT); *ibid.*, *J. Luke? s.n.* (BSI); 16 km W of Mahabaleshwar, *van der Maesen 1957* (K, ICRISAT, WAG); 27 km W of Mahabaleshwar to Bhor, *id. 1959* (K, ICRISAT, WAG); Mahabaleshwar, *G.S. Puri 202* (BSI); *ibid.*, Mahad road, *Puri 4595* (BSI); *ibid.*, hills & table land, *Ralph 615* (G, MEL); *ibid.*, Lingmala road, Bhikauli forest, *R.S. Rao 71706* (BSI); *ibid.*, *Ryan 1499* (BSI); Lingmala, Mahabaleshwar, *Santapau 12472, 22224, 23621* (BLAT); Mahabaleshwar, *id. 23415* (BLAT); Lingmala falls, Mahabaleshwar, *G.L. Shah 10640* (BLAT). Thana distr.: Kedarnath hill slope, Tokavada range, H'garh, *K.V. Billore 1155241* (BSI); Sadrya Ghat top forest, Todavada range, *Billore 113970* (BSI).

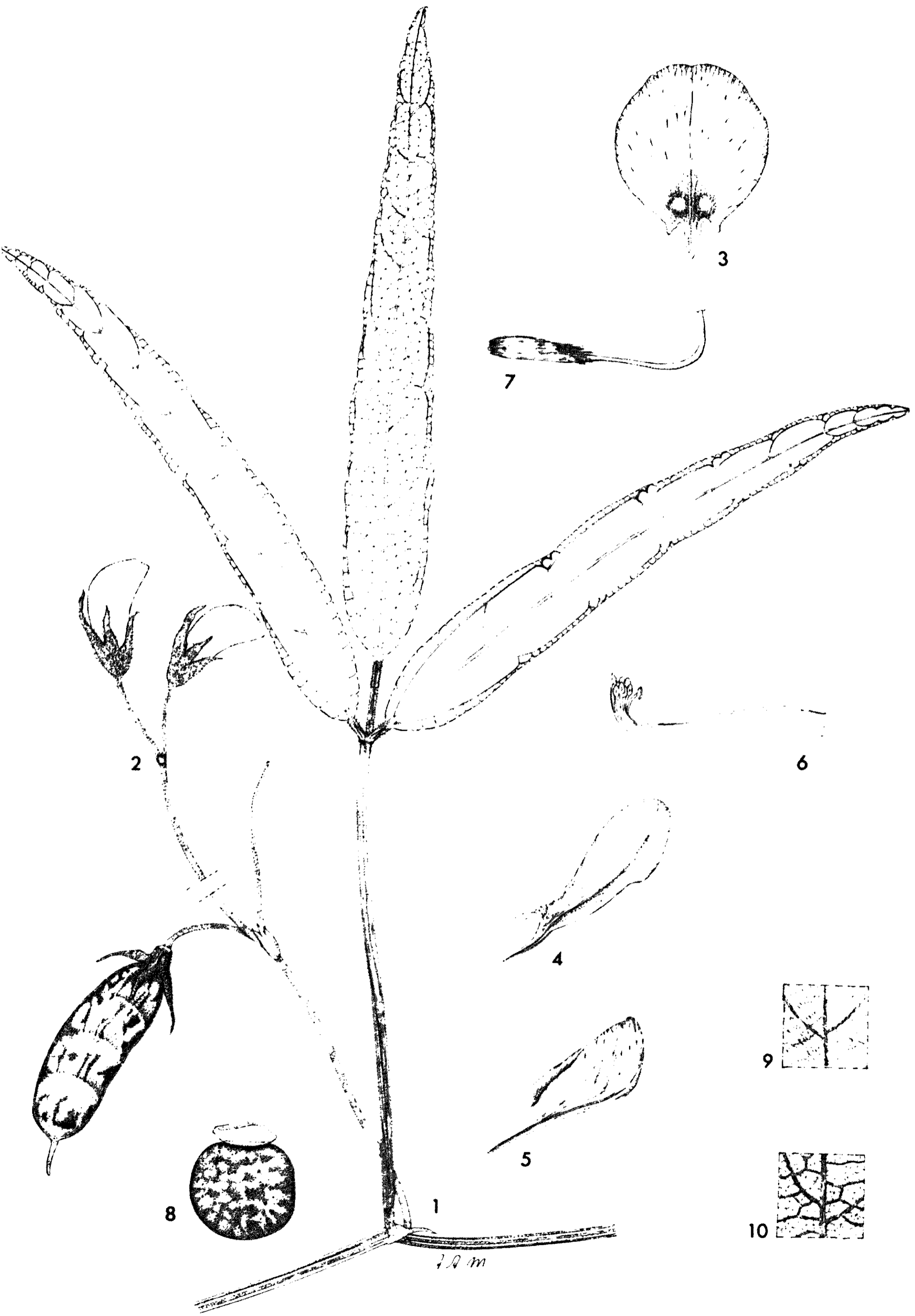
TAMIL NADU: Nelakota, Barwood, Nilgiri distr., *Anstead 88* (MH); Pandalur, Nilgiri distr., *Barber 5575* (MH); Tambracheri ghat, Wynaad, *id. 5699* (MH); Neelgherry Hills, *Wight 775* (C, CAL, GH, K, L, MEL, P, W).

SRI LANKA: above Lindula, flood gravel on the river valley gorge, *Bond s.n., Feb. 1944* (PDA); *ibid.*, *id. s.n., March 1944* (K).

Notes: This is the most common Indian wild bushy species. At both lower and higher elevation in the Western Ghats it may grow quite vigorously up to 2.5 m. I have never seen a dense stand of it, though substantial hedges may occur at places where the forest is less dense. R.S. RAO (1978) lists *C. lineatus* as characteristic of only one of eight representative areas studied in the Western Ghats, i.e. in the deciduous forests on the lower altitude slopes (300-800 m) of the Ponda-Amboli Ghat.

The authority *Dalzell 1873* given for *A. Lawii* cf. Index Kewensis Vol. I is an error, since DALZELL and GIBSON referred to *A. Lawii* Wight in 1861. This reference was omitted in 1873. Conspecificity with *C. lineatus* was announced by WIGHT not DALZELL.

In nature 3-seeded pods are common. *Van der Maesen 1959* and *2639* in culture at ICRISAT have only 2 ovules per ovary, rarely a third.



10.19 *Cajanus mareebensis* (Reynolds & Pedley) van der Maesen comb. nov.

Fig. 19, p. 148, Map 4, p. 63

*Cajanus mareebensis* (S.T. Reynolds & L. Pedley) van der Maesen comb. nov.

Basionym: *Atylosia mareebensis* Reynolds & Pedley, *Austrobaileya* 1-4: 422 (1981).

Type: Australia, Queensland, Granite Creek, 8 miles W of Mareeba, *Pedley* 2249 (holo: BRI; iso: BRI, also in CANB, K, not seen).

*Prostrate* trailing herb, annual or short-living perennial, stems upto several meters long. *Indumentum* short, sparse, but densier on peduncles and petioles. *Branches* inconspicuously striate. *Stipules* cordate, ca 6 mm long, ca 2 mm wide, caducous. *Leaves* pinnately trifoliolate, petiole 4-13 cm, rachis 0.6-1.5 cm, petioles ca 2 mm. *Leaflets* light green above with yellowish, hardly sunken veins, glandular-punctate and olive green below, veins brown and prominent. Leaflets elongate, quite similar, 4-10 cm long, 1-1.5 cm wide, tip acute, mucronate, base cuneate to rounded, stipellae setaceous, 1-3 mm long with hairs. *Racemes* axillary, one per axil, peduncles 10-20 cm long, with few branches, very thin, especially at the ends of branches, few-flowered, pedicels 2-5 mm long, flowers yellow, bracts cordate-acuminate, 3-4 mm long, 1-2 mm wide, not persistent. *Calyx* pubescent, interior also, tube ca 3 mm, teeth lanceolate, 4-7 mm long, upper ones connate except at the tip, lowest one longest. *Vexillum* obovate, base clawed, auriculate, ca 10 mm long, ca 8 mm wide, with two callosities. *Alae* obovate, biauriculate, ca 10 mm long, 3 mm wide. Keel petals oblique, ca 10 mm long, ca 5 mm wide, ventrally joined. *Ovary* densely white-pubescent, ca 3 mm long, ca 4 ovules, style ca 7 mm, last 3 mm upturned, base pubescent, stigma capitate? *Stamens* ca 10 mm long, free part upcurved, 3-5 mm, anthers dorsifix. *Pods* oblong, broad flattened, rounded, acuminate at both ends, surface reticulate, green and red mottled, sparsely covered with long hairs and yellow glands, transverse depressions oblique or at right angles to the suture, base of the style persistent, (2-)3-4 seeds. *Seeds* flattened-globose, brown with black dots, ca 4 mm long, ca 5 mm wide, ca 3 mm thick. *Strophiole* very thick, 1 mm, U-shaped (divided only partly).

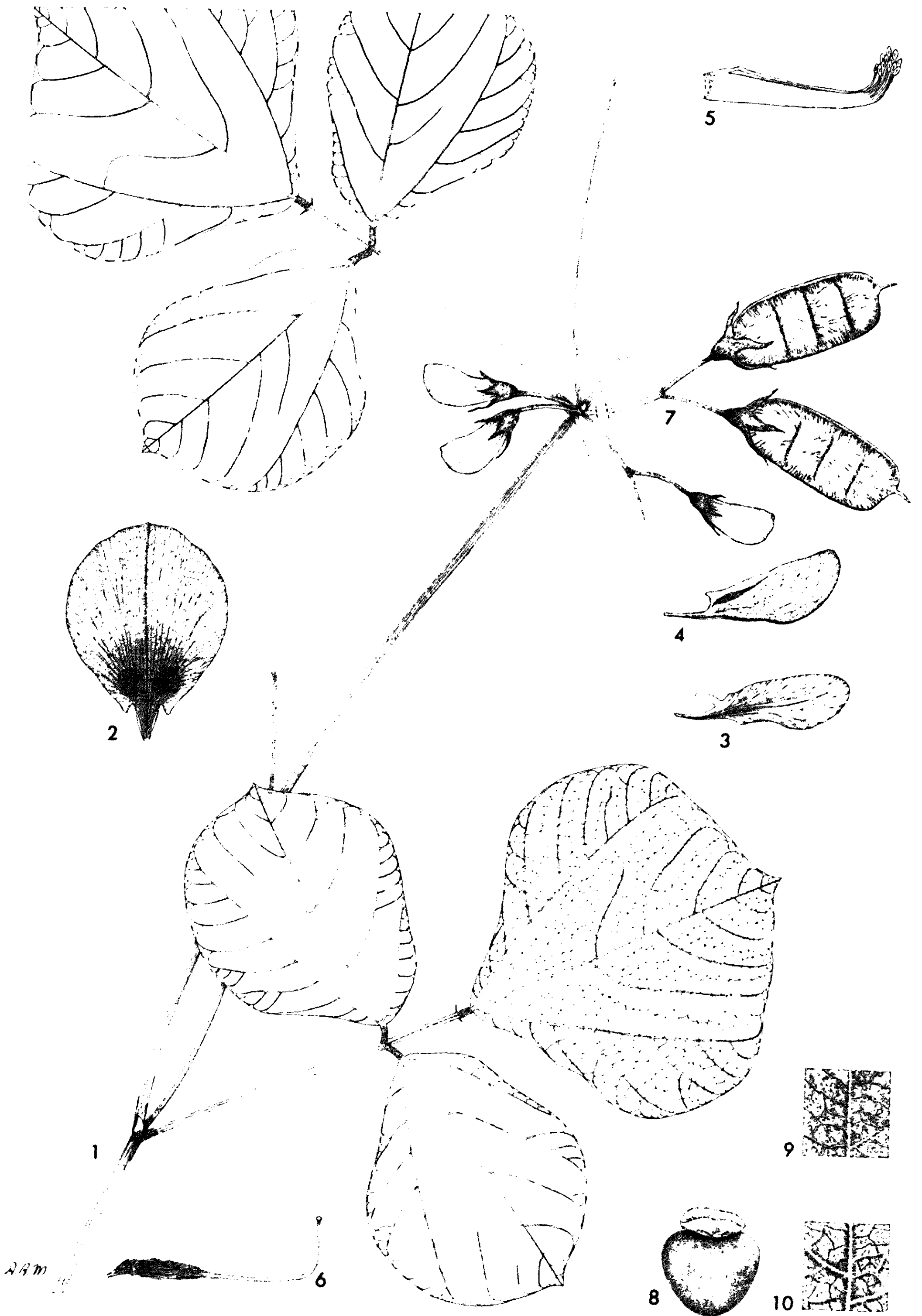
Distribution; Australia, N Queensland, very rare.

Ecology: on sand among granite bounders.

Altitude: 400-600 m.

Flowering and fruiting: around April.

FIG. 19. *C. mareebensis*: 1. branch, 1X; 2. flowers, 1X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens, 2X; 7. pistil, 2X; 8. seed, 3X; 9. detail upper leaflet surface, 2X; 10. detail lower leaflet surface, 2X (1-10: H. S. McKee 9343).



### Specimens examined:

AUSTRALIA, QUEENSLAND: Parada nr Dimbulah, *McKee* 9343 (CANB, K); Granite Creek, 8 m W of Mareeba, *Pedley* 2249 (BRI, holo & iso); Gillies Highway, Walsh River beyond Mungana 65 km NW of Almaden, *Staples* 2455 (BRI, ICRISAT); Gorge Creek valley on Mareeba-Dimbulah rd, *id.* 240667/1 (BRI, ICRISAT).

Notes: As in *Cajanus platycarpus* and *C. marmoratus*, the strophiole (*McKee* 9343) is peculiarly horse-shoe-shaped and not entirely divided as in most species of *Cajanus*. The measurements are approximate, as only one flower could be examined in detail.

### 10.20 *Cajanus marmoratus* (R. Br. ex Benth.) F. v. Muell.

Fig. 20, p. 150, Map 24, p. 152

*Cajanus marmoratus* (Robert Brown ex Bentham) F. von Mueller, Census Austral. Pl. Suppl. 1-4: 41 (1881); *id.*, Second Census Austral. Pl. 1: 71 (1889).

Basionym: *Atylosia marmorata* R. Br. ex Benth., Fl. Austral. 2: 263 (1864); Bailey, Queensland Fl. 2: 438 (1900); Fitzgerald, J. Roy. Soc. W. Austral. 3: 156 (1918).

Lectotype: Australia. Northern Territory: Upper Victoria River, F. v. MUELLER (lecto: K; iso: K, MEL Victoria River), chosen from syntypes of *A. marmorata*.

Paratypes: Australia, N.T., Islands of the Gulf of Carpentaria, *R. Brown s.n.* (E, MEL); *ibid.*, *id.* 4206 (E, K); Sweers Isl, *Henne s.n.* (MEL) Australia, Queensland; Port Denison, *Fitzalan s.n.* (MEL); Nebo Creek & Bowen River, *Bowman s.n.* (MEL).

Homotypic synonyms: *Cantharospermum marmoratum* (R. Br. ex Benth.) Taubert ex Ewart & Davies, Fl. N. Territory 152 (1914).

*Creeper*, perennial, sparsely and uniformly pubescent, hairs short and persistent, also longer, more caducous brown hairs on leaf margins, young stems petioles and pods. *Branches* slender, elongate, ca 1-2(-6) m long, distal internodes very long, upto 15 cm or more, younger parts purplish brown. *Leaves* pinnately trifoliolate, petiole 1.5-6(-10) cm long, rachis 0.5-1.5(-2.5) cm long, petioles 2-5 mm. *Stipules* peltate, 2-4 mm long, 1-3 mm wide, tip acute, base cordate, pubescence of long and short hairs. *Leaflets* very coriaceous, thinly pubescent and glandular punctate on both sides, green above, slightly duller green below, top leaflet rhomboid to obcordate, (1.5-)2.5-5(-10) cm long, (1.5-)2-5.5(-7) cm wide, sometimes wider than long, tip emarginate, obtuse or acuminate, base broadly

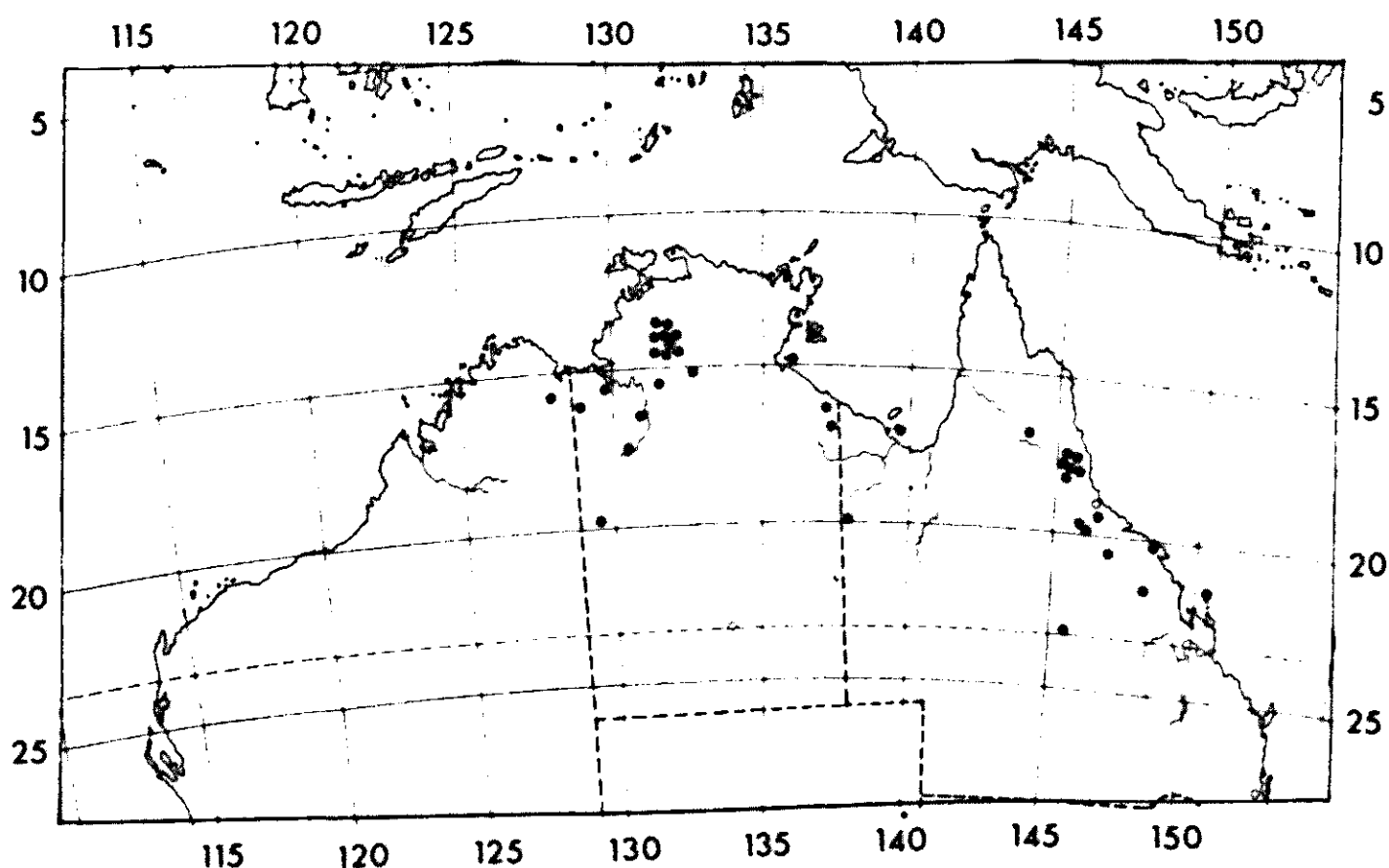
FIG. 20. *C. marmoratus*: 1. branch, 1X; 2. flag, 2½X; 3. wing, 2½X; 4. keel, 2½X; 5. stamens, 2½X; 6. pistil, 2½X; 7. pods, 1X; 8. seed, 2½X; 9. detail upper leaflet surface, 2X; 10. detail lower leaflet surface 2X (1-10: *Remanandan* 4243).

cuneate, mucro small, 1/2 mm, tip acuminate or emarginate. Side leaflets obovate to obliquely obovate, (1.5-)2-4.8(-10) cm long, 1.5-4(-6.5) cm wide. *Stipellae* minute, 1 mm or less. *Racemes* 1-10-flowered, 1-2 per leaf axil, flowers yellow, caducous, peduncles 1-3(-5) cm long, sometimes branched, pedicels 3-5 mm long. *Bracts* small, ovate with 3 teeth at apex, ca 2 mm long and wide. *Calyx* pubescent, interior also, hairs short, tube 2-5 mm long, teeth 3-7 mm long, acuminate, upper teeth almost entirely connate, lower tooth longest. *Vexillum* obovate, ca 13 mm long, ca 10 mm wide, base clawed, auriculate, margins of lobes slightly inflexed, two pointed callosities near the base. *Alae* obliquely obovate, ca 13 mm long, ca 4 mm wide, base biauriculate, keel petals oblique, ca 12 mm long, 4 mm wide ventrally joined. *Ovary* densely white-pubescent, ca 3 mm long, (2-)3-6(-7) ovules. *Style* ca 11 mm, base 7 mm, short-pubescent, last 4 mm upcurved, glabrous. *Stamens* ca 12 mm long, free part 2-11 mm, upcurved. Anthers dorsifix. *Pod* flat-oblong, 2-3.5 cm long, 1.1-1.5 cm wide, rounded-truncate at both ends, distal end acuminate tipped with persistent base of style of ca 3 mm; transverse depressions at right angles to the suture, (1-)3-5(-7) seeds, valves thin, reticulate, mottled with purple, covered with minute hairs and less densely distributed long brown caducous hairs of 2-3 mm, and yellow vesicular glands. *Seeds* rounded-oblong, sides flattened, brown with dark brown on mosaic, ca 5-6 mm long, 5-6 mm wide, 3 mm thick, strophiole thick, U-shaped.

**Distribution:** Australia, Northern Territory, Queensland and W Australia.

**Ecology:** Creeping in grass, in open (Eucalypt) forest among basaltic boulders, on (granite) loose sand with sorghum and *Bauhinia*, on dunes, slopes, along rivers.

**Altitude:** 0-700 m.



MAP 24. *Cajanus marmoratus*



Flowering: Jun-May, Jul-Sep.

Fruiting: Feb-May (-Nov teste REYNOLDS & PEDLEY).

### Specimens examined:

AUSTRALIA, NORTHERN TERRITORY: Settlement Creek, *Brass* 266 (BRI, CANB); Carpentaria, *Brown s.n.* (E); sine loc., *Brown* 4206 (E, K, MEL); 16 km S of Katherine on Stuart Highway, *Burbidge* 5074 (CANB); 200 km S of Darwin on Stuart Highway, *Byrnes* 1405 (NT); 26 km SE of Pine Creek, *Chippendale* 7573 (K, NT); Lloyd Creek, 20 km NW of Pine Creek, *id.* 7624 (BRI, NT); 8 km SW of Grove Hill, *id.* 7667 (CANB, NT); Maria Island, Gulf of Carpentaria, *Dunlop* 2913 (NT); Telegraph line 320 km S of Port Darwin, *Giles* 5 (MEL); 2 km S of Mataranka, *Maconochie* 571 (CANB, K, NT); 24 km S of Inninguna Range, *id.* 943 (K, NT); 29 km N of Tanami, *id.* 1730 (K, NT); 16 km N of Katherine, *McKee* 8511 (K, NT); Keep River, *Mitchell* 357 (NT); Sea range, Victoria River, *von Mueller s.n.* (MEL); Victoria River, *id. s.n.* (MEL, isolectotype: K); Upper Victoria River, *id. s.n.* (lectotype: K); 6 km S of Willeroo Outstation, *Perry* 2031 (CANB); Snake Lagoon 5 km from Foelsche River on beef road to Calvert River, *Simon & Farrell s.n.* (BRI); Little Lagoon, Groote Eylandt, Gulf of Carpentaria, *Specht* 258 (A, AD, BRI, CANB, L, US); 5 km NW of Katherine, *Wilson* 35 (CANB, K, L, NT); 21 km S of Katherine, *id.* 148 (CANB, L, NT).

QUEENSLAND: Nov. Holland, *Bauer s.n.* (W, 3 sheets); 70-80 km S of Mt Garnet, *Blake* 14429 (BRI, CANB); Warlus area C site 300, 48 km ENE of Barcaldine, Mitchell distr., *Boylard* 1002 C (BRI); sine loc., *Bowman s.n.* (MEL); Nebo Creek & Bowen, *Bowman* 205 (MEL, paratype); Mt Molloy, ca 60 km NW of Cairns, *Tom Carr* 7480 (AD); Cape York Peninsula Expedition *Hann s.n.* (K); Sweers Island, *Henne s.n.* (MEL, paratypes); 8 Percy Island, *Ingon (?) s.n.* (BRI?); slopes of Great Dividing Range nr Walsh Bluff, Cook distr., *Keefer* 108 (BRI); Dry Regional Experiment Station, *Kleinschmidt* 147 (CANB); Adel's Grove via Camooweal, Burke distr., *de Lestaing* 460 (BRI); Pioneer, N. Qld., *Rev. Michael s.n.* (BRI); Port Denison, *von Mueller s.n.* (MEL); 21.2 km S of Expedition Pass, *Remanandan* 4209 (ICRISAT, WAG); 59 km from Townsville on Charters Towers road, *id.* 4212 (ICRISAT); 31 km from Mt Garnet towards Herberton, *id.* 4240 (ICRISAT); Mareeba, *id.* 4243 (ICRISAT, WAG); Townside (Townsville?) 18 km from the Station, Cockatoo sands, *van Rijn* 20 (CANB); DPI Southedge Tobacco Res. Sta. via Mareeba, *Staples* 2011 (K); Burdekin River above Dalbeg on track to Gorge Weir, 20.9 km S of Expedition Pass Bridge, *id.* 2110 (BRI). West Australia: Razorback nr Carlton Reach, Ord River, Kimberleys, *Burbidge* 5748 (CANB, PERTH); Breaden Valley, S Tablelands, *George* 15530 (PERTH); NW of Deception Range, *Hartley* 14785 (PERTH); McPhee's Creek, ca 100 km N of Turkey Creek, *Saxon s.n.* (PERTH).

Notes: BENTHAM (1864) based *A. marmorata* on 4 syntypes. From these, the von Mueller specimen labelled Upper Victoria River is now designated as the lectotype, the holotype being at K, since this specimen is the only one of Bentham's syntypes with 'Upper' on the label and almost the only one with pods. The other syntype specimens are now quoted as paratypes. Variation within the species includes leaflet size and shape, from broad-ovate and almost bilobed to rhomboid in the larger-leaved specimens. Small-leaved specimens have denser hairs and more conspicuous vesicular glands. Larger leaves are thinner. The species is very close to *C. platycarpus* and might even be a subspecies. Pods and seeds are identical, but leaf shape and structure differ. The specimen I.W. Wright, 80 km SW of Cooktown, Butchers Hill Station, growing in a sorghum paddock, is a *C. platycarpus* with thin, acute leaflets, perhaps inadvertently introduced with sorghum. The area of *C. platycarpus* is rather disjunct, the Javanese specimens are not *C. marmoratus* and seem to be relics growing in areas remnant of an earlier, more extensive habitat.

The Index Kewensis lists *Atylosia marmorata* Banks ex Benth., perhaps because BANKS imported the species. BENTHAM (1864) listed *Glycine marmorata* R. Br. as manuscript name (in herb., Fl. Austral. 2: 263, 1864).

10.21 **Cajanus mollis** (Benth.) van der Maesen comb. nov.

Fig. 21, p. 155, Map 25, p. 156

*Cajanus mollis* (Bentham) van der Maesen comb. nov.

Basionym: *Atylosia mollis* Benth. in Miquel, Pl. Jungh. 1: 243 (1852); Baker in Hooker, Fl. Brit. India 2: 213 (1876) pro parte, as to syn. *Collaea mollis* only; King, J. As. Soc. Beng. 66-2: 46 (1897); Prain, J. As. Soc. Beng. 66-2: 431 (1897); Duthie, Cat. Pl. Kumaon 50 (1906); Bamber, Pl. Punjab 602 (1916); Parker, Forest Fl. Punjab, Hazara, Delhi 164 (1918), 162 (repr. 1973) (incl. in *A. crassa*); Collett, Fl. Simlensis 142 (1902, repr. 1971); Osmaston, Forest Fl. Kumaon 177 (1927); Gupta, Fl. Nainitalensis 96 (1968); Ali, Fl. W. Pakistan 100, Pap. 220 (1977).

Type: Nepalia, *Wallich 5574* (holotype: K; isotypes in BM, CAL, E, G, K, W). (*Collaea mollis* Grah. ex Wall., nom. nud., Wallich's Cat. 5574 (1831).

Homotypic synonyms: *Cantharospermum molle* (as *mollis*) (Benth.) Taub. in Engl. & Prantl, Nat. Pflz.fam. 3-3: 373 (1894).

*Climber*, perennial. *Branches* terete, length several m, brownish pubescent, hairs short, directed downwards. *Stipules* lanceolate, up to 3 mm, pubescent, caducous. *Leaves* digitately trifoliolate, petiole (2-)3-6 cm, rachis 0-1 mm. *Leaflets* semi-coriaceous, soft, lower surface quite densely greyish pubescent, also on the prominent ribs, but brown in young leaflets, glandular-punctate, upper surface green, thinly puberulous, top leaflet elliptic-obovate, apex acuminate, cuspidate, base rounded-cuneate, 4-7 cm long, 2-4.5 cm wide, side leaflet obliquely ovate, 3-6 cm long, 2-4 cm wide, petiolules 2-3 mm, stipellae setaceous, 1-2 mm long, close together. *Racemes* short, crowded, peduncles 2-6(-10) cm, up to 15 flowers, per node 1-2 flowers, pedicels 7-15 mm, flowers yellow, marcescent. *Bracts* large, elliptic-ovate, apex acuminate, up to 15 mm long, 7 mm wide, shortly pubescent, striate. *Calyx* greyish pubescent, hairs short, not bulbous-based, tube 5-6 mm, teeth ca 3 mm, lower teeth ca 5 mm, upper teeth almost entirely connate. *Vexillum* obovate, base clawed, biauriculate, apex rounded, 22-25 mm long, ca 15 mm wide. *Alae* obovate-elongate, base biauriculate, ca 22 mm long, ca 6 mm wide. Keel petals almost triangular, 20 mm long, ventral side 8 mm long, joined, bases auriculate. *Ovary* ca 6 mm, covered with yellow glandular bulbous hairs and white setae of even length, ovules 8 or more. *Style* ca 17 mm, last 5 mm upcurved, pubescent but less so in the curve. *Stamens* ca 23 mm, free part 4-6 mm, upcurved. *Pods* sturdy, oblong, ends rounded-



FIG. 21. *C. mollis*: 1. branch with nodes, 1X; 2. flowers, 1X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens and stigma, 2X; 7. pistil, 2X; 8. seed, 3X; 9. detail upper leaflet surface, 2X; 10. detail lower leaflet surface 2X (1-10: van der Maesen 2960).

acuminate, 3.5-4.5 cm long, 0.7-1.0 cm wide, densely short-puberulous, (7-)8-10 seeds, transverse depressions at a right or almost right angle to the suture, sutures straight or slightly undulate. *Seeds* ellipsoid to rectangular to 4 mm long, 2-2.5 mm wide and thick, brown, strophiole large, whitish, divided, rough.

**Distribution:** Himalaya foothills from Pakistan to Sikkim and Bhutan.

**Ecology:** Climbing in pine or broadleaf forest, scrub vegetation.

**Altitude:** 700-2100 m.

**Flowering:** (Aug) Sep-Nov.

**Fruiting:** Oct-Nov.

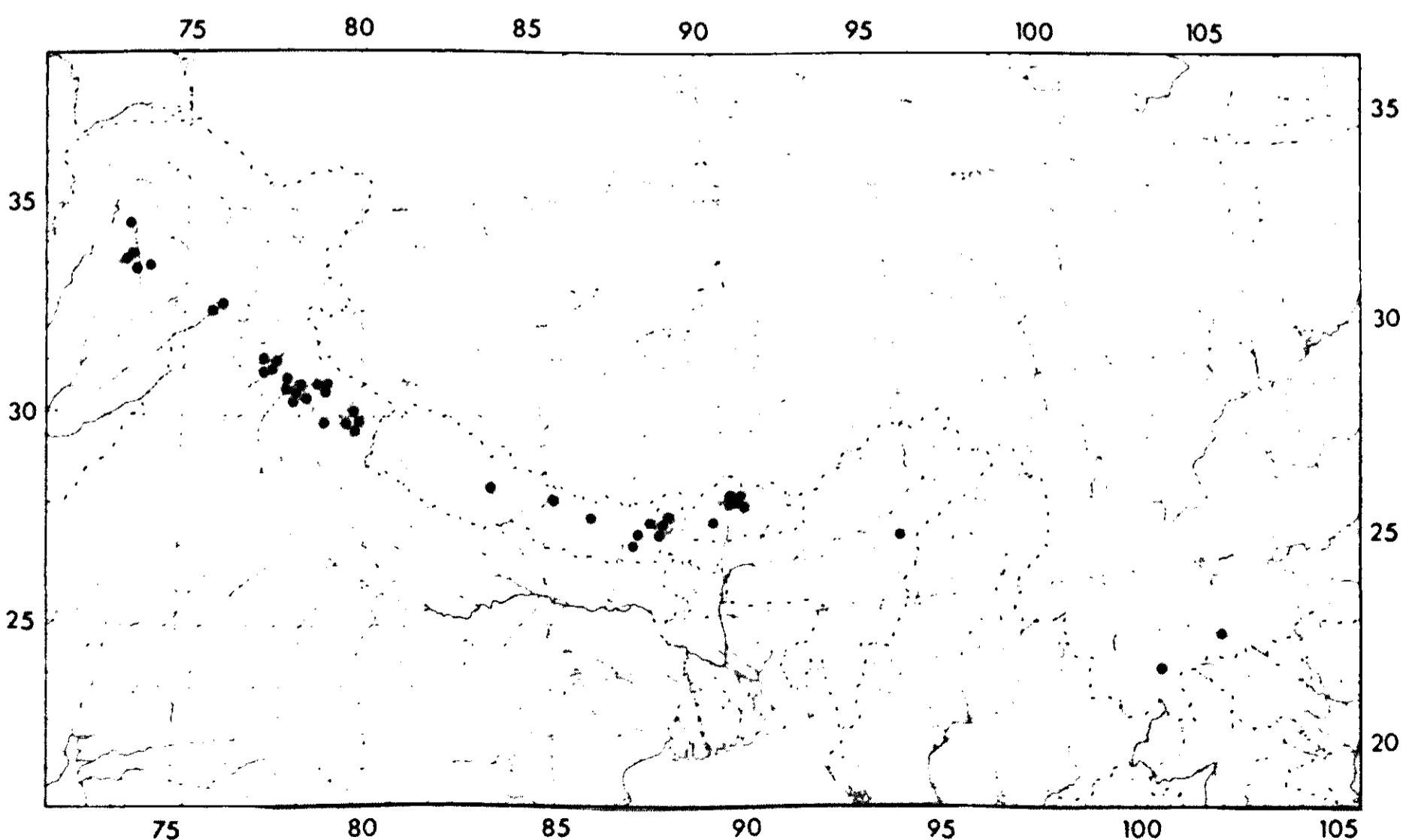
**Vernacular names:** Ban tur, wild pigeonpea (Jaunsar, UP).

#### Specimens examined:

**BHUTAN:** Wangdu Phodrang, *Bowes Lyon 5015* (BM); Gichha Punakha, *Cooper 3167* (E); Bagla La, *id. 4590* (BM, E); Wangdu Phodrang, *id. 2011* (E); *ibid.*, *id. 4849* (BM, E); Hing Lai La, Ludlow, *Sheriff & Hicks 19643* (BM).

**CHINA:** West Yunnan, *Lord Abercrombie's Chinese Collectors 9* (K); Yunnan, Szemao E Mts, *Henry 10132* (E); Yunnan, Manpan, Red River Valley, *Henry 11056* (E, K).

**INDIA:** Arunachal Pradesh: Dirang Dzong, *Kingdon Ward 14052* (BM). Himachal Pradesh: *Chajoorie 9 TD 530* (CAL); Chamba, *Clarke 24283* (BM, CAL, FI); Chajoorie, *Duthie s.n.* (DD); Krol, *Drummond 24520* (K); Solan, Simla distr., *Sushma Khera s.n.* (DUH); 3 km W of Darraghat on Bilaspur-Simla road, *van der Maesen 2943* (ICRISAT, WAG); from Solan 6 km to Kasauli, Simla distr., *id. 2960* (ICRISAT, WAG); Koti, Simla distr., *Sotha Ram s.n.* (DD); Dhami road, Simla.



MAP 25. *Cajanus mollis*

*Watt 7978* (E). Meghalaya: Melomi, Naga Hills, *Bor 2847* (BM, DD). Sikkim: Rirhi to Rinchingpong, *Anderson 442* (CAL, DD); Siriong, *Clarke 13157* (CAL); Kaysing, *Clarke 25066* (FI, K) and *Clarke 25074* (K); Lingcham, *Clarke 25485* (BM, CAL, FI, K); Pashok, *W.W. Smith 458* (CAL); sine loc., *Thompson s.n.* (CAL). Uttar Pradesh: Almora distr.: Hosilla (Kosilla?) below Almora, *Strachey & Winterbottom s.n.* (BR). Dehra Dun distr.: Mussoorie, *Duthie s.n.* (DD, K) and *Hügel 53* (W); *Mackinnon s.n.* (CAL); Karwapani, *Gamble 22399* (BSI); Kalsi, *Kanjilal 338* (ASSAM); near Kalsi, *id. 363* (ASSAM); Ramli, *id. 391* (ASSAM); near Mussoorie, *King s.n.* (CAL); Raikot to Sarjughat, Bantan, *Reid s.n.* (E); Naranibagar, *Reid s.n.* (E); near Kamptee Resthouse, Mussoorie, *Saxena 1399* (DD) and *2242* (DD); N of Landour, Mussoorie, *R.R. Stewart 15696* (GH, RAW, US). Garhwal distr.: Below Kinoli, *Duthie 3951* (BM, CAL, FI, G); sine loc., *Falconer* (K); Pindar valley, *Osmaston U. P. 787* (DD); Chandrapuri, *M.S. Ram 6390* (BSD); Rheel ghat, Saharanpur Siwaliks, *Royle 63/259* (DD). Tehri Garhwal distr.: Kumaon, road to Tehri, *Davidson Re s.n.* (CAL, DD); Tona valley, *Gamble 15050* (CAL, DD) and *25094* (DD, K); Ghunti, Tehri, *Koeltz 21820* (MICH); Hawalbagh, Kumaon, *Strachey & Winterbottom 3* (BM, BR, GH); Parju river, Kumaon, *id. 2* (K).

NEPAL: Tharpu near Chyangthaphu, *Kanai et al. 6301699* (A, BM); Phurigad, *Bis Ram 87* (A); Dhankuta, *Hara et al. 6301697* (E); Porwa, Kathmandu, *Hara et al. 6301696* (BM); Tatopani, S of Dana, Kali Gandaki, *Stainton et al. 7589* (BM, E); Nepalia, *Wallich 5574* (holotype: K; isotypes: BM, CAL, G, K, W); Terhathun, *Williams & Stainton 8447* (BM, K); Dolakha, descending on Dolti Khola, *Zimmermann 1165* (B, G, K).

PAKISTAN: Above Lehtrar, *Jabbar Ali s.n.* (MICH); Lehtrar, Rawalpindi, *Nasir 3173* (RAW); Garlu Habilullah, Kashmir-Abbottabad road, Hazara, *R.R. Stewart 3702* (RAW).

Notes: I agree with PRAIN (1897) that *C. mollis* deserves a status separate from *C. crassus* (= *A. crassa*). He pointed out the most significant morphological differences: *C. mollis* has grey downy non-reticulate leaves beneath, top leaflet longer than broad, and 8-10 seeded pods; *C. crassus* has more sparsely brown-pubescent reticulate leaves beneath, top leaflet almost as long as broad, and 3-5 seeded pods. After observing a larger number of specimens, it was found that flower size did not always differ much and the angle of the transverse depressions may be similar, which is in general agreement with Prain's observations. Seeds of *C. mollis* have the longer diameter across the pod, in *C. crassus* they are parallel to the sutures.

In addition, the time of flowering is strikingly different. *C. mollis* flowers after the monsoon, *C. crassus* in, and after the cold season. The additional differences are not so striking as earlier believed but generally hold true. Prain noted that *C. mollis* occurred above 2000 feet and *C. crassus* below that altitude, but several more recent specimens indicate occurrence of *C. crassus* up to 3000 feet (ca 1000 m). These may be south-facing pockets, warmer than usual at that level. At ICRISAT Center (600m) *C. crassus* grows very well but *C. mollis* grows slowly, and produces smaller leaves than in its home area, but, as is normal, it flowers after the monsoon.

## 10.22 *Cajanus niveus* (Benth.) van der Maesen comb. nov.

Fig. 22, p. 158, Map 26, p. 160

*Cajanus niveus* (Bentham) van der Maesen comb. nov.

Basionym: *Atylosia nivea* Benth. in Miquel, Pl. Jungh. 1: 243 (1852); Baker

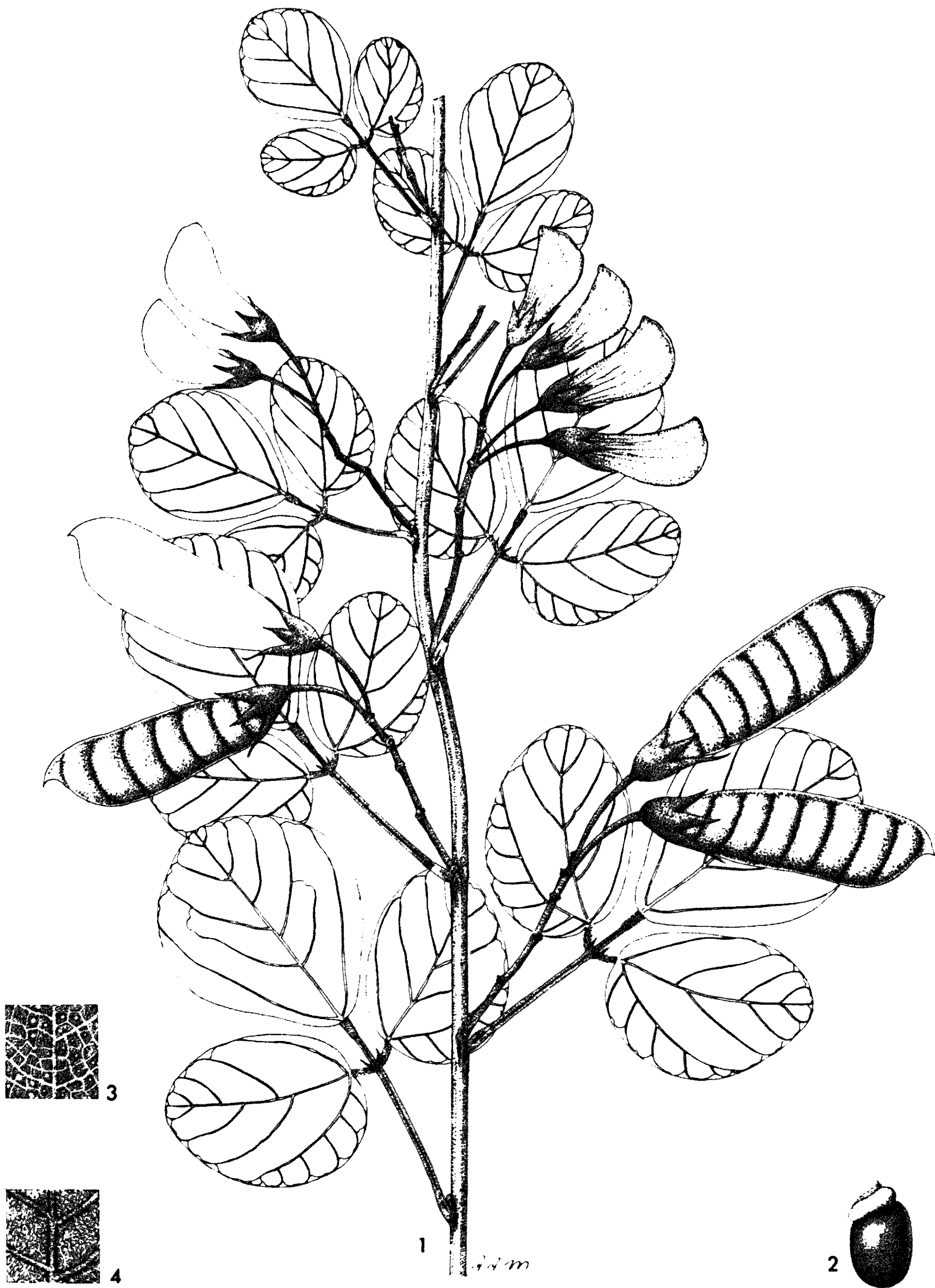


FIG. 22. *C. niveus*: 1. branch, 1X; 2. seed, 3X; 3. detail upper leaflet surface, 2X; 4. detail lower leaflet surface 2X (1-4: *Lace* 2695).

in Hooker, Fl. Brit. India 2: 214 (1876); Collett & Hemsley, J. Linn. Soc. 28: 48 (1890).

Lectotype: Burma, below Yeranghuen, 3 Jan. 1827, *Wallich 5581* (holo, K).

Paratype: Burma, Prome, *Wallich 5581* (other part) (K, BM, CAL, G).

Homotypic synonyms: *Cajanus niveus* Grah. ex Wall. nom. nud., Wall. Cat. 5581 (1831).

*Cantharospermum niveum* (Benth.) Raiz. in Mooney, Suppl. Bot. Bihar & Orissa 53 (1950).

(Sub)erect *shrub*, perennial. *Branches* green, greyish pubescent, terete, ca 50-150 cm. *Stipules* minute, triangular-acute, up to 1 mm, pubescent, very inconspicuous, caducous. Leaves pinnately trifoliolate, petiole 2-3 cm, rachis 2-7 mm. Leaflets coriaceous, glandular-punctate below, covered by dense grey to white pubescence, ribs prominent and pubescent, upper surface green, evenly shortly pubescent; end leaflet obovate, 2-5 cm long, 1.8-3.8 cm wide, top obtuse or rounded mucronate, base cuneate or rounded, side leaflets obliquely so, 1.8-4.5 cm long, 1.7-3.7 cm wide, petiolules ca 3-4 mm, stipellae minute, setaceous, pubescent, up to 1 mm. *Racemes* short, 1-6 flowered, peduncle 5-15 mm, pedicels up to 13 mm, flowers yellow. *Bracts* minute, rounded, up to 2 mm long, 3 mm wide. *Calyx* puberulous, hairs few, short, caducous, rich in glands, the margins ciliate, tube 3-4 mm, teeth obtuse, ca 2 mm long, the upper ones almost entirely connate. *Vexillum* obovate, ca 20 mm long, 18 mm wide, base clawed, biauriculate, apex emarginate. *Alae* elongate-obovate, base auriculate, further 2 bulges not far from the base, ca 20 mm long, 6 mm wide. Keel petals oblique, ca 20 mm long, ventrally joined. *Ovary* densely white-pubescent, ca 7 mm, style ca 20 mm, last 9 mm upcurved, hardly pubescent, base pubescent, stigma capitate. *Stamens* ca 25 mm long, free part upcurved, 5 mm. *Pods* oblong, obtuse at both ends, 2.5-4 cm long, ca 1.2 cm wide, densely covered with short grey adpressed hairs, transverse depressions at right angles to the sutures, 4-6 seeds. *Seeds* cylindrical, 5 mm long, 3 mm wide and thick, strophiole very large, 2 mm thick, divided.

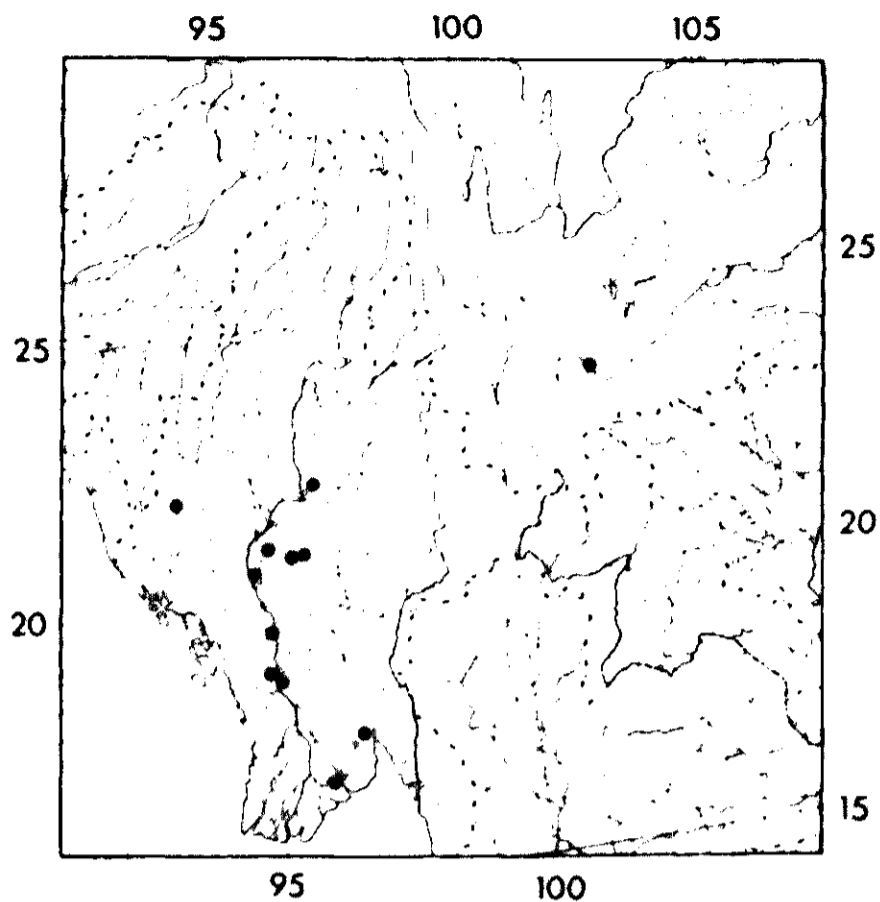
Ecology: Open jungle, hill sides.

Altitude: 50-1350 m (scarce data).

Distribution: Burma, China-Yunnan.

Flowering: Aug-Dec.

Fruiting: Dec-Apr.



MAP 26. *Cajanus niveus*

Vernacular names: Taw me yaing (Burmese).

#### Specimens examined:

BURMA. Rangoon, open jungle, *Barnard Lu E 28* (BM); Sepale, Prome distr., *Barrington 225* (CAL); Meiktila, *Collett 129* (CAL, K); Inbinwa res., Meiktila distr., *Gilbert Rogers 528* (CAL, DD, E); Pegu, Irrawaddy, Sittang valley, *Kurz 2555* (CAL, K); Lehla, Thayetungs distr., *Lace 2695* (DD, E, K); Juhnan distr., *Shaik Mokim 646* (BSI, CAL, G); Chin hill, Muibu distr., *Shaik Mokim 1222* (CAL); Han Dahat, nr Kyauk-O-Minhu distr., *Parkinson 15640* (DD); Popa Taungkalat, Meiktila distr., *Smith 13716* (K); Below Yeranghuan, *Wallich 5581* (part; K, lectotype); Prome, *Wallich 5581* (part; BM, CAL, G, K); Mountain betw. Maymyo and Mandalay, *White 73* (US).

CHINA: Yunnan. Yuenkiang, Ue mountain, 1350 m, *von Wissmann s.n.* (W).

Note: *Cajanus niveus* is very close to *Cajanus albicans*, but is separated by its erect nature, rounded bracts, and more pinnate leaves. WIGHT and ARNOTT joined the two species, which are separated by about 1200 km. More biosystematic data are needed to decide whether both populations are more fittingly placed in two subspecies of *C. albicans*, but at present I prefer to keep the species apart.

#### 10.23 *Cajanus platycarpus* (Benth.) van der Maesen comb. nov.

Fig. 23, p. 162, Map 27, p. 163

*Cajanus platycarpus* (Bentham) van der Maesen comb. nov.

Basionym: *Atylosia platycarpa* Benth. in Miquel, Pl. Jungh. 1: 243 (1852); Baker in Hooker, Fl. Brit. India 2: 216 (1876); Collett, Fl. Simlensis 142 (1902, repr. 1971); Prain, Bengal Pl. 272 (1903, repr. 1963); Bamber, Pl. Punjab 602 (1916); Haines, Bot. Bihar & Orissa 3: 274 (1922), 2: 287 (repr. 1961).



Type: India, in jugo Himalayano, 7000-8000 ft, *M. P. Edgeworth 186* (holotype: K).

Homotypic synonym: *Cantharospermum platycarpum* (Benth.) Raiz. in Mooney, Suppl. Bot. Bihar & Orissa 53 (1950).

Heterotypic synonyms: *Atylosia geminiflora* Dalz., J. Linn. Soc. 13: 185 (1873).

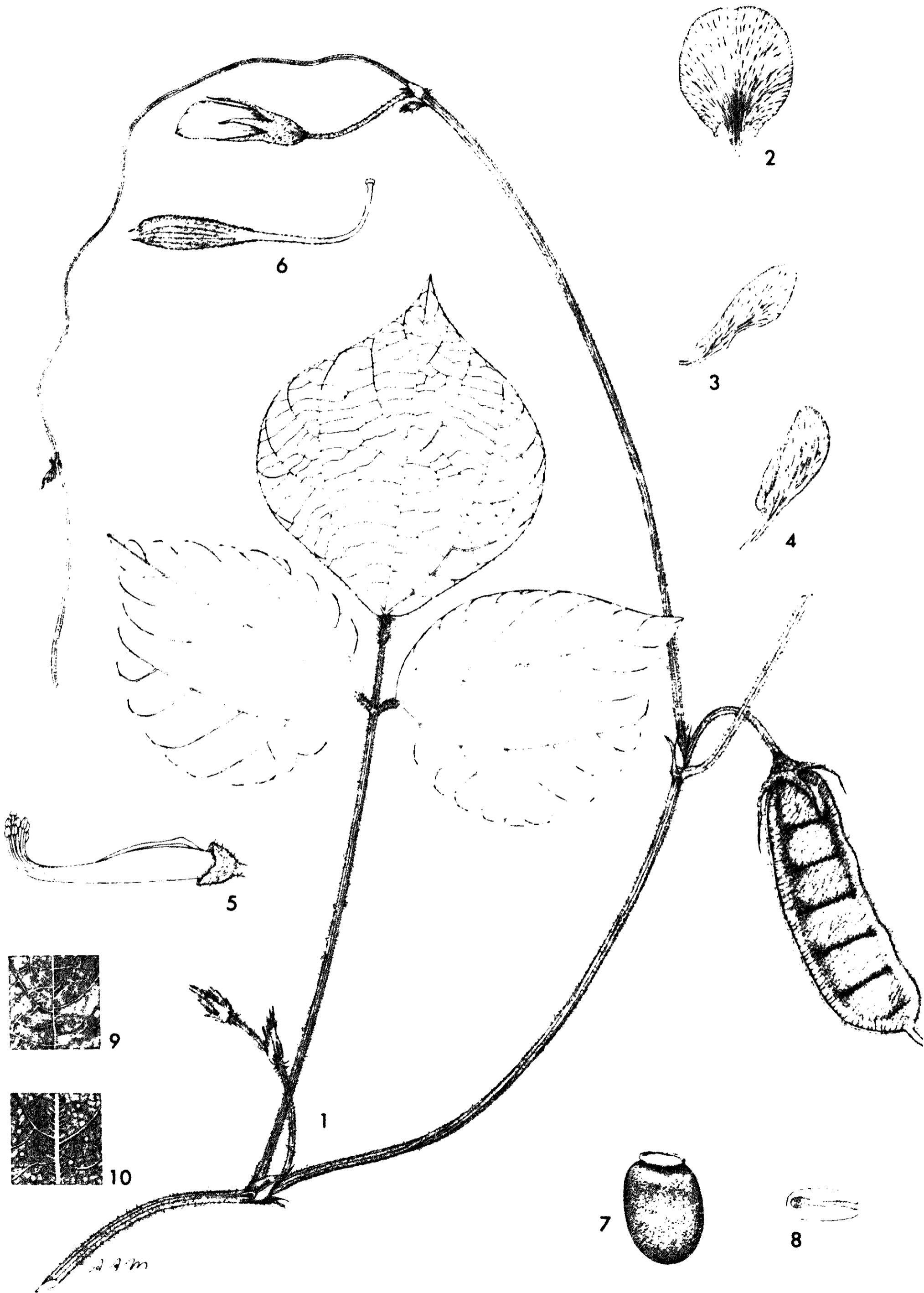
Type: India, Western, *Dalzell s.n.* (holo: K; iso: CAL); Rama Rao, Fl. Pl. Travancore 127 (1914).

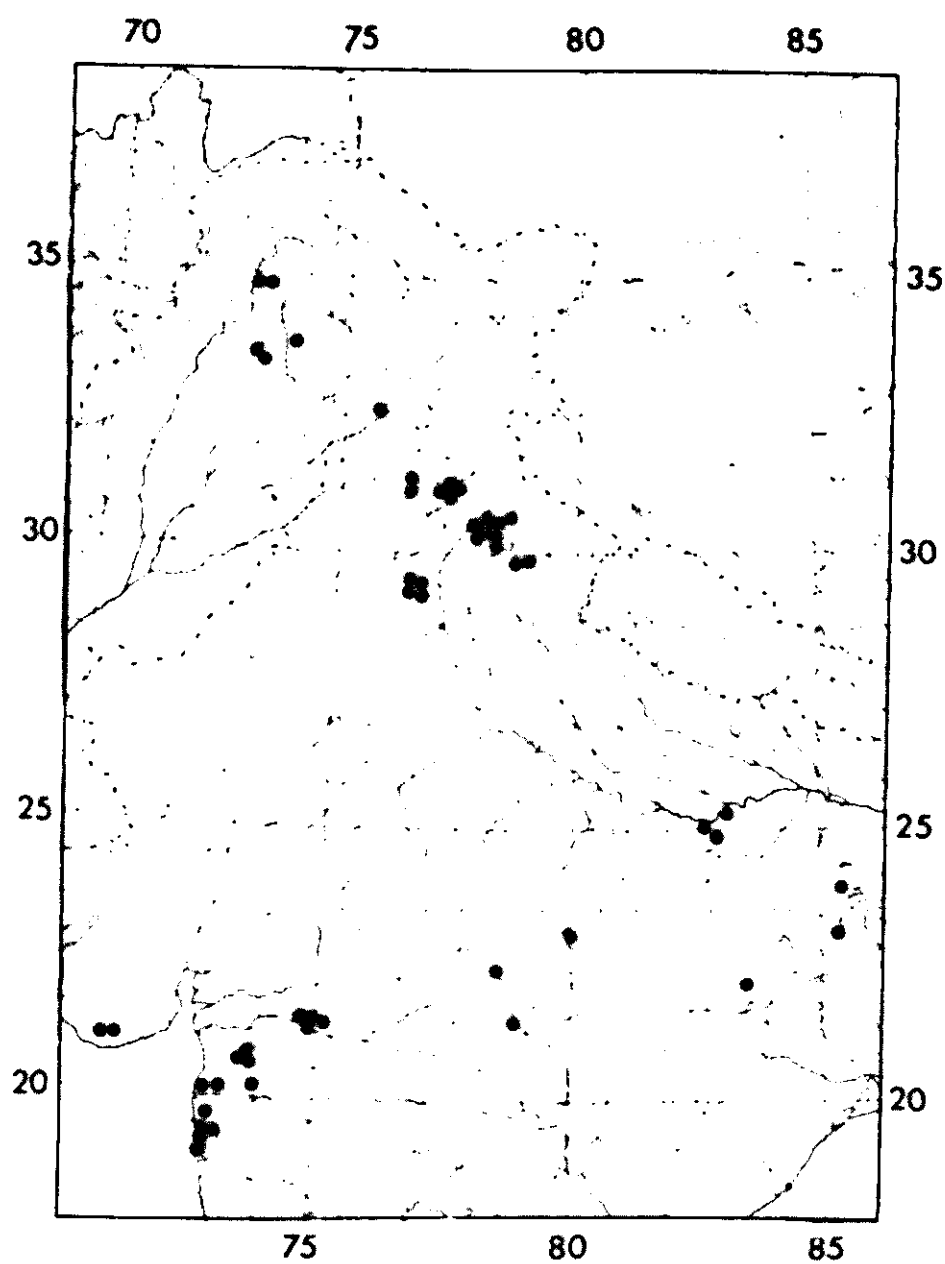
*Cantharospermum ? distans* Royle ex Baker in Hooker, Fl. Brit. India 2: 216 (1876).

Type: NW India, Royle s.n. (holo: CAL; iso: K).

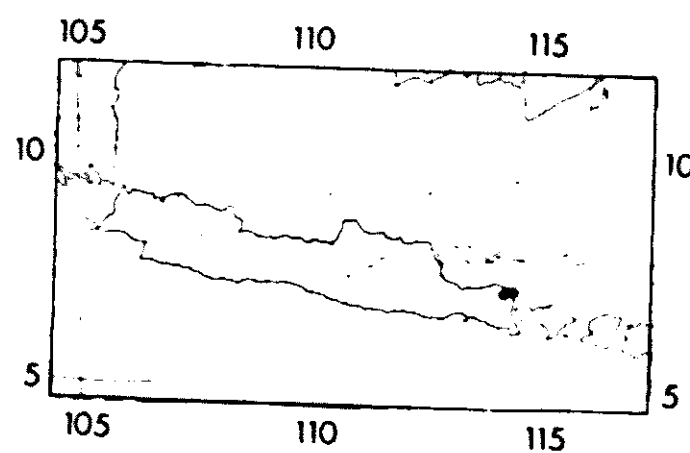
*Cantharospermum geminiflorum* (sphalm. *geminifolium*) (Dalz.) Raiz. in Mooney, Suppl. Bot. Bihar & Orissa 53 (1950). Based on *Atylosia geminiflora* Dalz.

*Creeper-climber*, perennial, but often completing its lifecycle within a year. *Branches* sparsely pubescent, terete, 20-100 cm long, internodes 1-15 cm long. *Stipules* lanceolate, 3-6 mm long, pubescent, not very permanent. Leaves pinnately trifoliolate, at the apex often reduced in size, petiole up to 10 cm, rachis up to 2 cm. *Leaflets* membranous, faintly glandular below, ribs pubescent below, upper surface thinly pubescent, end leaflet ovate-rotundate, 4-7 cm long, 3-7 cm wide, apex acuminate, base straight to slightly cordate; side leaflets obliquely ovate, 3-8 cm long, 4-7.5 cm wide, apex acuminate, base straight, petiolules 2-3 mm, stipellae setaceous, very small (1 mm). *Racemes* lax, up to 5-flowered, peduncle 0.5-8 cm, pedicels 8-12 mm, recurved, flowers pale yellow, creamish or yellow, sometimes with purple veins or dots. *Bracts* triangulate-acuminate, pubescent, 2-4 mm long, caducous. *Calyx* pubescent with long and short yellow and translucent hairs, not all bulbous-based, tube 3-5 mm long, teeth lanceolate, setaceous, 5-11 mm, the upper ones almost entirely connate. *Vexillum* obovate-elongate, base clawed, biauriculate, 12-15 mm long, 8-10 mm wide. *Alae* obovate-elongate, base auriculate, 10-13 mm long, 3 mm wide. Keel petals rounded-oblique, 11-13 mm long, ventrally loosely adnate. *Ovary* 5-7 mm, densely covered with long hairs (up to 5 mm), 5-7 ovules. *Style* ca 5 mm, base pubescent, top glabrous, stigma capitate. *Stamens* 12-13 mm long, last 3-4 mm free, up-curved. *Pod* flat-oblong, 2-4.5 cm long, 1-1.5 cm wide, surface reticulate, reddish speckled in young stage, sparsely covered with caducous short and long yellow and white hairs, the short ones bulbous-based, in Javanese material with dense, white, very short hairs in addition, transverse depressions at right angles to the suture, tip of style remains, (2-)4-7 seeds. *Seeds* 4-6 mm long, 3-4 mm wide, 2.5 mm thick, rectangular-rounded, brown to almost black mosaic, strophiole large, 1 X 3 mm, horse-shoe shaped.





MAP 27. *Cajanus platycarpus* in India



*Cajanus platycarpus* on Java

**Distribution:** Northwest and Central India, Nepal, Pakistan, Java.

**Ecology:** trailing in grass; grasslands, roadsides, pine forests, in crops.

**Altitude:** 50-2600 m.

**Flowering:** (Jul) Aug-Sep (India); Sep, Mar (Pakistan); Mar-Apr (Java).

**Fruiting:** Sep-Oct-Nov (India); Apr (Java).

**Vernacular names:** Sukli Sengha (C India); Mash Parni (= leaves as Mung, Sanskrit).

**Uses:** A concoction of roots and seeds in water is used as a general tonic.

**Specimens examined:**

INDIA, Bihar: Canary hills, 7 km from Hazaribagh, *Kanodia 1050* (CAL); *Kurz s.n.* (CAL); Horhap reserve, Ranchi distr., *Haines 4648* (K). Gujarat: Saily, Daman, *Ansari 93909* (BSI); Subir, Dangs

FIG. 23. *C. platycarpus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. seed, 3X; 8. strophiole of seed shown from above, 5X; 9. detail upper leaflet surface, 2X; 10. detail lower leaflet surface 2X (1-10: *van der Maesen 2873*).

distr., *Asrana* 2818, 2891 (BLAT); Pimpri, Dangs distr., *Panthaki* 2366, 2367, 2368 (BLAT); Hiran river, Gir, Saurashtra, *Raizada* 23123 (DD); Sasan, Hiran river, Saurashtra, *Santapau* 16417 (BLAT); Pimpri, nr river, Dangs distr., *Santapau* 20191-20196 (BLAT). Himachal Pradesh: Raipur, Chamba distr., *Clarke* 23753 (BM, C, CAL, K); Hoya Khud, Simla distr., *Johnson s.n.* (CAL); near Simla, *Drummond* 1526 (K); Himalayas, 2300-2600 m, *Edgeworth* 186 (type, holo: K); Simla 1330 m, *Johnson* 176 (K); 1 km N of Bharwain, Mandi distr., *van der Maesen* 2873 (ICRISAT, K, WAG); Bharwain, Mandi distr., *Misra* 41668 (BSD); Neerat Bashahr, *Nair s.n.* (BSD). Madhya Pradesh: Jabalpur, *Beddome* 64 B (); *ibid.*, *id.* 2282 (BM, CAL); Jata Shankar, Pachmarhi, *Santosh Kumari* 4183 (PUN); Bheru Ghat, C. India, *Puri* 4590 (BSI). Maharashtra: Bombay, *Dalzell s.n.* (type of *Atylosia geminiflora*; CAL, K); 481 km Bombay-Agra rd, 7 km NE of Palasner, Dhulia distr., *R.S. Rao* 92445 (BSI); Borivli Nat. Park, Thana distr., *Herbert* 2187, 2188 (BLAT); Ghatang-Bhullori, NE Amraoti distr., *R.S. Rao* 52485 (BSI); Palasner, Khargaon, *Remanandan* 4557 (ICRISAT, WAG); Shahada to Dhadgaon 25 km, 16 km Dhulia distr., *id.* 4572, 4585 (ICRISAT, WAG); Khosbad hill, Thana distr., *id.* 4656 (ICRISAT, WAG); Mandir forest, Bassein, Thana distr., *Ryan* 1457 (BSI); Bandra, Thana distr., *id.* 1480 (BSI); Andheri Makal Caves, Salsette, Thana dam, *Santapau* 4922 (BLAT); Mumbra, nr Bombay, *Shuroy* 4945, 4953, 4960, 5229 (BLAT). Nagar Haveli: Jamunpada forest, *M. Y. Ansari* 126870 (BSI); Khanvel to Sindhoni, *id.* 127028 (BSI). Haryana: Karnal jungle, *Drummond* 24511, 24610, 24612, 25452, 25454 *etc.* (K); Indri jungle, *Drummond* 24621 (K). Orissa: Kholigaon, Khariar, Sambalpur distr., *Mooney* 3639 (DD, K, L). Rajasthan: Kapil Dhara, *Verma* 788 (CAL). Punjab: Shikkerparoh, Hoshiarpur distr., *Misra* 44540 (BSD). Uttar Pradesh: Dehra Dun and surroundings: *Mrs Donie* 2 (CAL); Bindal, *Babu* 33488 (BSD, L); Saharasradhara road, *Bhathacharya* 37737 (BSD); Mothronwala, *Dakshini* 6221 (BSD); Raipur, *B.L. Gupta s.n.* (DD, MEL); 4.5 km to Saharasradhara, *van der Maesen* 2989 (ICRISAT, K, WAG); Bindal Rao, *Malhotra* 18546 (BSD); New Forest, *Raizada s.n.* (DD, GH); Japleshwar, *Raizada s.n.* (DD); Hathibarkala, *T.A. Rao* 887 (BSD); Barighat banks, *T.A. Rao* 1016 (BSD); Rajpur above Kutal Gate, *Hari Om Saxena s.n.* (DD). Uttar Pradesh, other locations: Near Mussoorie, *King s.n.* (CAL); Garhwal, *King s.n.* (CAL); Mirzapur, *Anon. s.n.* (BHU, Ayurvedic College); Serhi-Bundha rd, Mirzapur distr., *Parsigrahi* 12298 (CAL); Chatam lines, *Prasad* 396 (CAL); Garhwal, *Falconer s.n.* (K); Dobata, Tehri Garhwal distr., *Naithani* 7184 (DD); Varanasi, Banaras Hindu University Campus fields, *van der Maesen* 3310 (ICRISAT).

INDONESIA: W. Baluran, E Java, *Rappard* 12, 232 (WAG).

NEPAL: *Wallich* 5543 (K).

PAKISTAN: Kana Mohri, Punch, *Rashid Khan s.n.* (RAW); Rawalpindi, *R.R.* (RAW); Botal, Saran range, Hazara, *Duthie s.n.* (K); *ibid.*, *Inayat s.n.* (DD).

Notes: *C. platycarpus* is the earliest flowering species. At ICRISAT Center it flowers 43 to 53 days after sowing in June, earlier than most pigeonpeas. This desirable character could not be transferred, as any attempt at hybridization with pigeonpeas has so far failed. It can no longer be considered the only true annual species, since plants have been observed to perennate under moist conditions in the Western Ghats and at ICRISAT Center.

#### 10.24 *Cajanus pubescens* (Ewart & Morrison) van der Maesen comb. nov.

Fig. 24, p. 166, Map 28, p. 167

*Cajanus pubescens* (Ewart & Morrison) van der Maesen comb. nov.

Basionym: *Tephrosia pubescens* Ewart & Morrison, Proc. Roy. Soc. Victoria n.s. 26: 163 (1912); Ewart & Davies, Fl. N. Territ. 147 (1917).

Type: Australia, Northern Territory, Top Spring, Aug 1911, G. Hill 535 (holo: MEL, photograph seen; iso: K, fragments ex MEL).

Homotypic synonym: *Atylosia pubescens* (Ewart & Morrison) Reynolds & Pedley var. *pubescens*, *Austrobaileya* 1-4: 427 (1981).

Small erect perennial *shrub*, up to 1.2, rarely 2 m. *Indumentum* short, dense, silvery on leaves, brown on stem, calyx and pod, vesicular glands inconspicuous except on calyx and ripe pod. *Branches* striate, but inconspicuously so at end of stems. *Stipules* triangular-lanceolate, ca 4 mm long, almost hidden in indumentum, caducous. *Leaves* pinnately trifoliolate, petiole 0.6-2.5(-3) cm, rachis 0.2-0.5 cm. *Leaflets* thick-coriaceous, glandular-punctate on both sides, greyish green and silvery hairy above, veins sunken, greyish and silvery-hairy below, veins raised, end leaflet elliptic, (2-)3-5(-7) cm long, 1.2-2.5(-4) cm wide, side leaflets obliquely-elliptic, 1.5-3(-5) cm long, 1.2-2.5(-3) cm wide, apex obtuse, acute to rounded, mucro small or inconspicuous, base cuneate, petiolules 2-4 mm long, stipellae absent. *Racemes* long, (6-)10-15(-30) flowered, unbranched, or with small side-peduncle at the end, flowers clustered at the end but not in an umbel, nodes slightly tumid, peduncles 2.5-12 cm long, pedicels 0.3-0.8(-1.1) cm long, flowers yellow, flag sometimes dorsally dark reddish veined. *Bracts* small-rounded acuminate or acuminate scales, pubescent, caducous. *Calyx* pubescent (hairs very dense and long in *Lazarides* 6378), interior also, tube 5 mm, teeth lanceolate-acuminate, 6-10 mm, the upper ones connate except at the very tip, the lower one longest. *Vexillum* rounded-obovate, ca 14-20 mm long, ca 12-14 mm wide, base clawed, auriculate with firm upturned edges, tip emarginate-acuminate with two flat callosities near the base. *Alae* irregularly obovate, ca 14-18 mm long, 4-5 mm wide, base biauriculate. Keel petals oblique, ca 13(-18) mm long, 5-6 mm wide, ventrally adnate. *Ovary* densely white-pubescent, ca 3-5 mm long, (3-)4-6 ovules, style ca 11-16 mm, last 5-8 mm upcurved, base pubescent, stigma capitate. *Stamens* ca 16-20 mm long, free part upcurved, 5 mm, anthers dorsifix. *Pods* oblong, rounded-acuminate at both ends, 2-3.5 cm long, covered with orange-yellow glands and short and very short hairs, valves faintly reticulate, transverse depressions oblique or at an almost right angle to the suture, base of style quite persistent, (3-)4-6 seeds. *Seeds* rounded-compressed, dark grey with black mosaic, ca 4-5 mm long, 4 mm wide, 2 mm thick, strophiole short, divided.

**Distribution:** Australia: West Australia, Northern Territory and N Queensland.

**Ecology:** Open forests and scrubs, grass plains, near rivers, slopes, on sandy or stony soils, lateritic podsol.

**Flowering:** Jan, Apr-Sep, especially Jun.

**Fruiting:** Apr-Sep.

**Specimens examined:**

AUSTRALIA, W Australia: Sherlock and Yule Rivers, *Forrest s.n.* (MEL); Fortescue River, *id.*

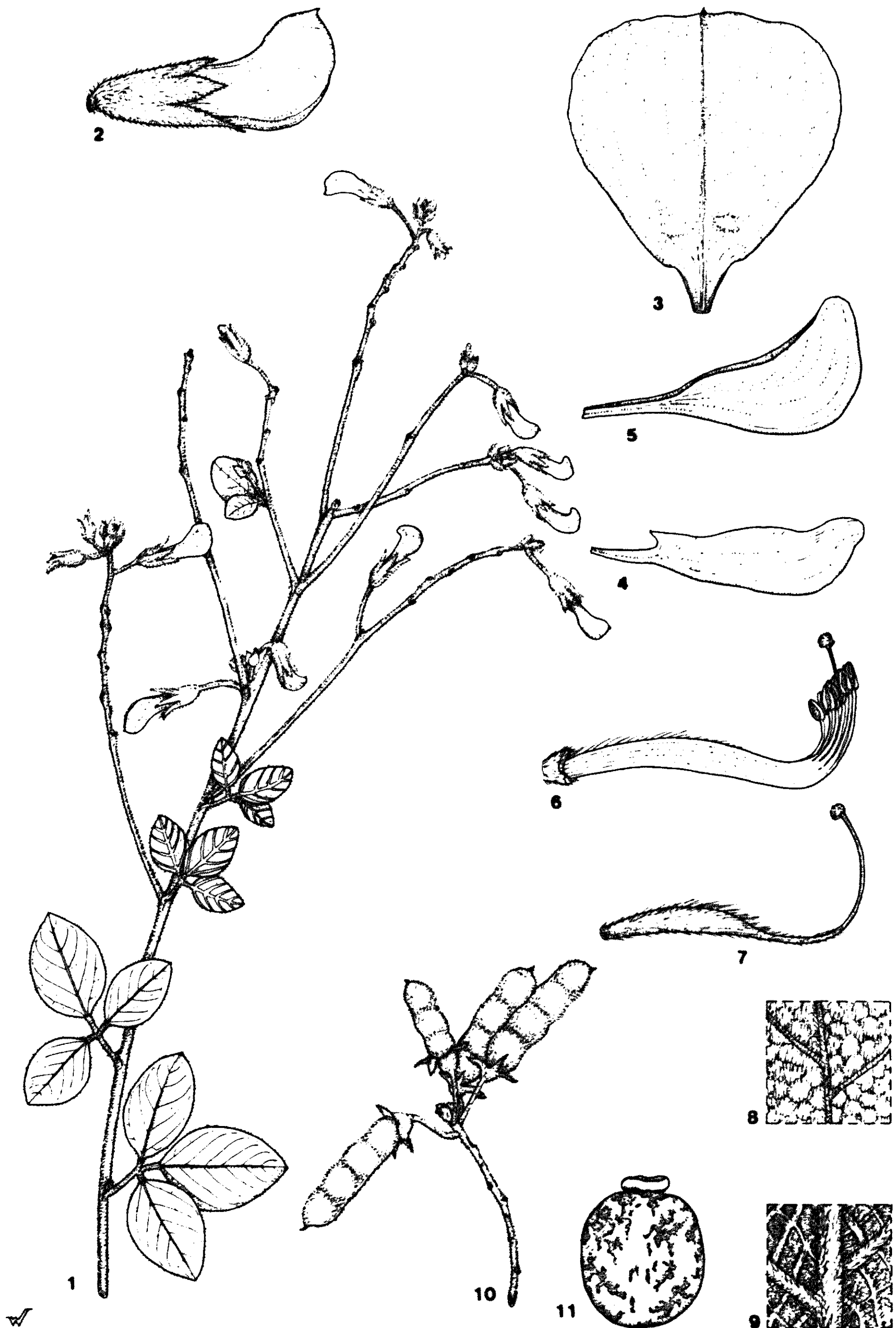
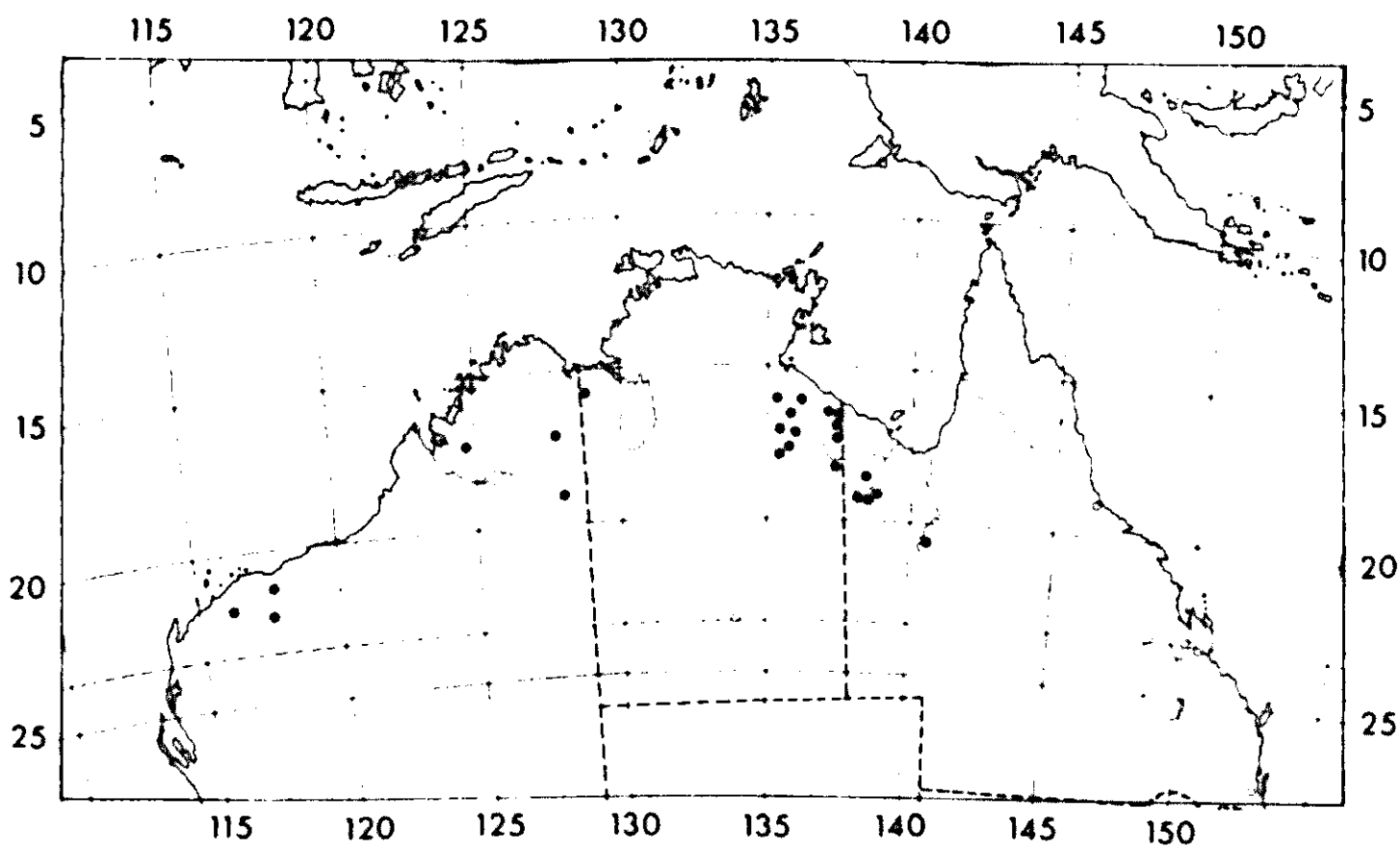


FIG. 24. *C. pubescens*: 1. branch,  $\frac{2}{3}$ X; 2. flower, 2X; 3. flag, 3X; 4. wing, 3X; 5. keel, 3X; 6. stamens and stigma, 3X; 7. pistil, 3X; 7. seed, 4X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface 2X; 10. infructescence,  $\frac{2}{3}$ X; 11. seed, 4X (1-11: *Gittins 802*).



MAP 28. *Cajanus pubescens*

*s.n.* (MEL); Mt Pyrtou, Hamersley Range, *id. s.n.* (MEL); St George's Range nr Noonkabah, Gardner *s.n.* (PERTH); E 6 Prince Regent River Reserve, Kenneally 2120 (PERTH); Port Warrender, Mitchell Plateau, W Kimberley, *id.* 5202 (PERTH); Sturt Creek Station, Denison Range, Latz 4028 (AD, NT); 13.7 km SE of Bedford Downs Station, King Leopold Ranges, Kimberleys, Lazarides 6378 (AD, CANB, K, US); nr the Rocks, King Leopold Range, 38 km SSW of Mt House Stn, *id.* 6455 (US); Lennard River, Staer *s.n.* (E). Northern Territory: McArthur River, Dietrich *s.n.* (MEL); Headwaters of McArthur River, Blake 17772 (A, BRI, CANB, L); Settlement Creek, Brass 69 (A, BRI, CANB, K); 256 km E Highway Borroloola rd, Byrnes 1848 (CANB, K, NT); Carpentaria?, R. Brown 4209 (K); Nicholson River area, Henshall 373 (AD, NT); 35 km NE of Tanumbirini, H/S road to old H/S, Henry 17 (NT); Keep River area, Henshall 1128 (NT); Top Spring, G. Hill 535 (holo: MEL, photograph seen; iso: K, fragment); Gorge, China Wall, Maconochie 1971 (AD); 48 km E Calvert River crossing, *id.* 2039 (NT); Riversleigh, Pedley 2063 (AD, BRI, CANB, K); Settlement Creek 48 km from Coast, Perry 1197 (CANB, K, NT, US); 72 km NNE of Creswell Station, *id.* 1646 (K, NT, US); 88 km NE of Creswell Station, *id.* 1678 (CANB); 48 km S of McArthur River Station, *id.* 1690 (CANB). Queensland: Nova Hollandia, Bauer 1063 (W); Branch Creek, Brass 69 (BRI); Riversleigh Holding, 168 km SS of Burketown, Gittins 802 (K); 18 km SE of Riversleigh, Maconochie 1939 (BRI, NT); 46 km NW of Riversleigh on rd to Lawn Hill, Ollerenshaw & Kratzing 1325 (BRI, NT); Corella Dam nr Cloncurry, Burke distr., Sillar *s.n.* (BRI).

Notes: In the protologue EWART and MORRISON obviously overlooked the glands, which although very much concealed on the leaves, are conspicuous on the calyx and pods.

This species was usually filed under *Atylosia cinerea*, or occasionally under *A. grandifolia*. Lazarides 6378 has conspicuously dense golden-brown indumentum on calyx and pods, strong callosities on the vexillum, seeds wider than long, 3-ovuled ovaries and 3-seeded pods, while the leaf veins are very broad. Blake 17772 has (incompletely expanded?) seeds much longer than wide with a strophiole longer than average for *Cajanus pubescens*. Henshall 1128 probably came from a moist habitat since it has large leaflets with veins less thick than usual, large flowers and a pod with only 2 seeds. Henshall 373 has similar but less accentuated characteristics. Sillar *s.n.* has typical elongate-elliptic leaflets, and

calyx teeth somewhat narrower and more elongate than in the average *C. pubescens*.

REYNOLDS & PEDLEY (1981) described a var. *mollis* in *A. pubescens* with long and spreading indumentum of stems and petioles. I have not seen the type, COLE ET AL. 9098 from near Ballara, Queensland (BRI).

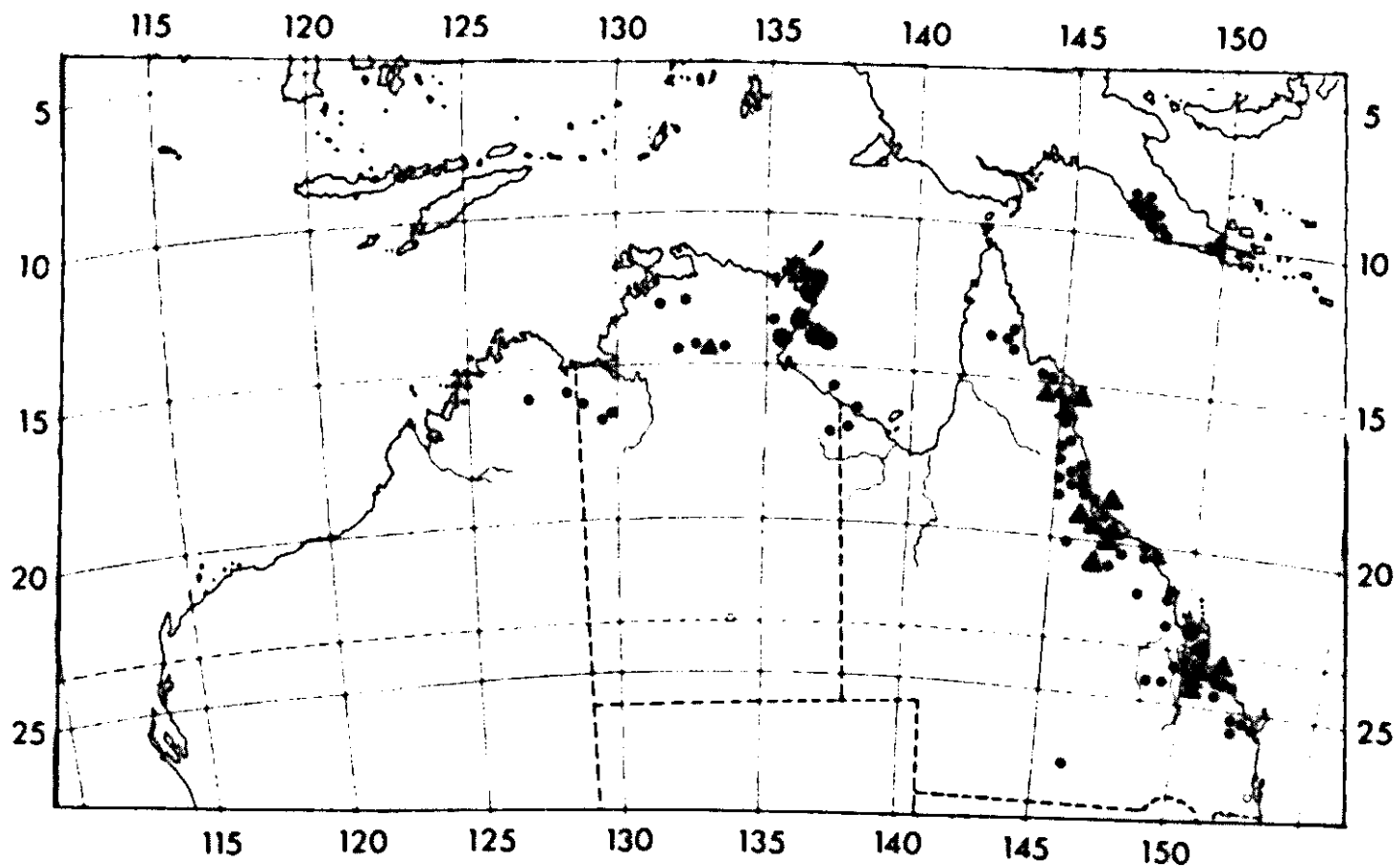
#### 10.25 *Cajanus reticulatus* (Dryander) F. von Mueller

Fig. 25 a, b, c, p. 170, 174, 176, Map 29, p. 169

For typification, literature and synonymy see under varieties.

*Shrub*, strong erect (1-2 m tall) with branches touching the ground or prostrate, weak, with trailing branches. *Indumentum* of dense, soft, short hairs, greyish to golden brown at ends of branches, brown especially when dry. Branches striate. *Stipules* caducous, scales ca 2-4 mm long, 2-3 mm wide, leaving a rim, leaf buds in axils covered with caducous scales. *Leaves* pinnately trifoliolate, petiole 1-4(-6.5) cm, rachis 0.4-1.2(-1.5) cm, petiolules 2-4 mm. *Leaflets* coriaceous, soft-villous, glandular punctate on both sides, dark green reticulate and hairy above, green reticulate and densely hairy with prominent veins below. Top leaflets rhomboid to rounded or elliptic-rhomboid, 2.5-12.5 cm long, 1.5-7 cm wide, tip acute with small mucro, base rounded. Side leaflets rounded or oblique-rhomboid to oblique-ovate, 1.7-9 cm long, 1.3-5.5 cm wide, tip rounded to acute, base rounded. *Stipellae* minute, 1-2 mm long, often covered by indumentum. *Racemes* axillary and terminal, concentrated at ends of branches, short, 1-3 per leaf axil, up to ca 15-flowered, peduncles 2-5(-7) cm long, pedicels 5-8(-10) mm long, flowers yellow, marcescent, flag dorsally plain or red streaked. *Bracts* small, ovate, hairy, obtuse to acute scales, ca 4 mm long, ca 3 mm wide, caducous. *Calyx* pubescent, less so inside, tube 3-5 mm, teeth conspicuously lanceolate, often curved, the upper ones entirely connate, 5-12 mm, the lower one longest. *Vexillum* obovate, bent backwards when fully expanded, ca 12-20 mm long, ca 10-13 mm wide, tip emarginate, base clawed, biauriculate, callosities near the base not prominent. *Alae* narrow-elongate-obovate, ca 12-18 mm long, 4-6 mm wide, tip rounded, base auriculate. Keel petals rounded-oblique, ca 10-16 mm long, ventrally adnate. *Ovary* ca 6 mm, covered with white silky hairs, ca 5-8 ovules. *Style* ca 12-17 mm long, the last 5-7 mm upcurved, pubescent at the basal 7-10 mm, stigma capitate. *Stamens* ca 12-20 mm long, free part ca 3-5 mm, upcurved, anthers dorsifix. *Pods* sturdy, oblong, 1.5-3.5 cm long, 0.8-1.1 cm wide, base tapering, tip obtuse, with base of style, densely pubescent, hairs long and short, vesicular glands present, transverse depressions oblique or straight, sutures straight or undulate, valves twisted when ripe, (2-)4-6(-8) seeds. *Seeds* rectangular-rounded, ca 3-5 mm long, 2.5-4.5 mm wide, ca 2 mm thick, brown or black with grey speckles, strophiole ca 1 X 2 mm, divided, grey when dry.





MAP 29. *Cajanus reticulatus*:

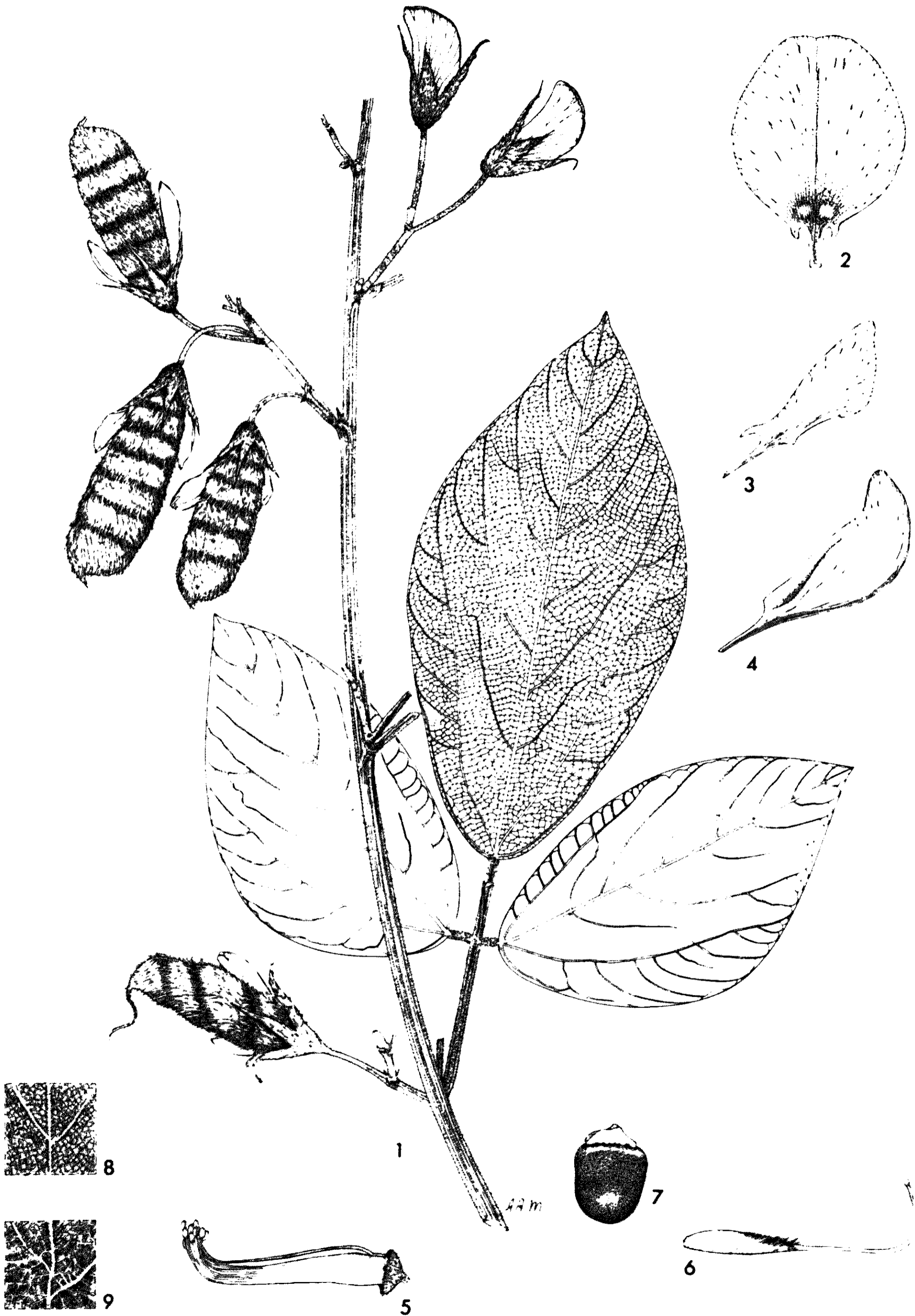
- var. *grandifolius*
- ▲ var. *reticulatus*
- var. *maritimus*

Distribution: Australia: West Australia, Northern Territory and Queensland; Papua New Guinea.

Notes: *C. reticulatus* now includes *Atylosia grandifolia* as a variety. This is one of the more variable species of *Cajanus*, and the differences do not warrant specific status for var. *grandifolius*. Further biosystematical work is needed to establish whether or not var. *grandifolius* should be reinstated as a species. BENTHAM (1864) and VON MUELLER (1881) considered the material with trailing branches as distinct from the more erect *A. grandifolia*. I follow REYNOLDS and PEDLEY (1981) in considering them conspecific, but I maintain the taxa as varieties since this expresses the diversity found. Found over a large area, the habit and leaf size of *C. reticulatus* is obviously influenced by ecological factors. In the herbarium small fragments or some specimens, in particular var. *grandifolius* and var. *reticulatus* are difficult to identify without notes on growth habit. Var. *grandifolius* is the variety most commonly met with. A third variety, var. *maritimus*, is also distinguished.

Key to the varieties:

- 1a. Erect shrub with horizontal or trailing branches, rusty-tomentose, leaves large when fully grown . . . . . var. **grandifolius**
- 1b. Weak shrub, prostrate or trailing . . . . . 2
- 2a. Leaflets rhomboid-ovate with acute to obtuse tip, pubescence golden brown . . . . . var. **reticulatus**
- 2b. Leaflets rounded to rhomboid-rounded, pubescence greyish . . . . . var. **maritimus**



10.25 a **Cajanus reticulatus** (Dryander) F. v. Muell. var. **grandifolius** (F. v. Muell.) van der Maesen comb. et stat. nov.      **Fig. 25a, p. 170, Map 29, p. 169**

*Cajanus reticulatus* (Dryander) F. von Mueller var. *grandifolius* (F. von Mueller) van der Maesen comb. et stat. nov.

Basionym: *Cajanus grandifolius* F. v. Muell., Pl. Fitzalan 9 (1860); F. v. Mueller, Census Austral. Pl. Suppl. 1-4: 41 (1881); id., Second Census Austral. Fl. 1-71 (1889).

Type: Signal Hill, Upstart Bay, *Fitzalan s.n.* (holo: MEL, not seen with these location data).

Paratypes: Mr Aug. Gregory's expedition to the Burnett Ranges, *F. v. Mueller s.n.* (MEL, photograph seen of sheet without collector's name); Victoria River, Jan. 1856 *F. v. Mueller s.n.* (K, MEL, photograph seen).

Homotypic synonyms: *Atylosia grandifolia* (F. v. Muell.) Benth., Fl. Austral. 2: 264 (1864); Bailey, Queensland Fl. 2: 439 (1900); Fitzgerald, J. Proc. Roy. Soc. W. Austral. 3: 157 (1918); Verdcourt, Manual New Guinea Legumes 540-541 (1979).

BENTHAM cited: Australia, (Upper) Victoria river, *F. von Mueller* (K); N Australia: Islands of the Gulf of Carpentaria, *R. Brown s.n.* (E, MEL); Queensland: Burnett Ranges, *F. von Mueller* (see paratypes of basionym); Burdekin Exped., *Fitzalan* (MEL, photographs seen, in MEL also 3 sheets from Port Denison); Fitzroy River, *Bowman* (in MEL a sheet from Neerkool Creek, and a sheet from Fitzroy River, Anon. 29, photograph seen); Port Denison, *Dallachy* (K, in MEL without collector's indication).

*Cantharospermum grandifolium* (F. v. Muell.) Taub. ex Ewart & Davies, Fl. N. Terr. 152 (1917).

Distribution: Australia: West Australia, Northern Territory, Queensland; Papua New Guinea.

Ecology: Open grasslands, rocky places, hillsides, dry riverbeds, *Eucalyptus* forest of e.g. *E. crebra*, *Melaleuca* spp., *Heteropogon* spp., on sandy loam, laterites or granite sand.

Altitude: 0-1000 m.

Flowering: Jan-Oct, mainly (Queensland); Mar-Apr, Jun-Jul (Northern Territory); Jun-Jul (West Australia); Feb-Apr, Jul, Sep (Papua New Guinea).

Fruiting: Similar as for flowering, with year-to-year and locationwise variation.

FIG. 25a. *C. reticulatus* var. *grandiflorus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface. (1-9: EC 124363 ex Papua New Guinea, via Kew).

Uses: AKINOLA et al. (1975) listed *C. reticulatus* var. *grandifolius* (misspelled as *Atylosia grandiflora*) as a hardy, fire-tolerant plant with a low production. A hybrid with the pigeonpea, it is suggested, could become useful for grazing in rangeland subjected to fire. Fuller's gathering (near Kennedy, 16-3-1971, BRI) carries the remark on the label that several acres of land are covered with this plant, and it is still spreading. ROTH (1901) listed *C. reticulatus* roots as edible, SAXON (1981) suggested these as a source of fuel through fermentation of its carbohydrates.

### Specimens examined:

WESTERN AUSTRALIA: Ord River Gorge, *Gardner 7336* (PERTH); nr Ord River, *Johnston s.n.* (MEL); Bindoola Creek 8.5 km WSW of Home Valley Homestead, NE Kimberleys (PERTH); Glenelg River, *Martin s.n.* (MEL); Kimberley distr., *Nyulasy s.n.* (MEL).

NORTHERN TERRITORY: Arnhem Land, *Basedow 156* (AD); Settlement Creek, *Brass 158* (CANB); Islands of the Gulf of Carpentaria, *R. Brown s.n.* (E, MEL, P); 91 km S of Darwin, *Byrnes 1412* (BRI, NT); Sandstone Plateau, 12 40 S, 133 15 E, *Craven 2472* (PERTH); 16 40'S 129 45'E, *Forrest s.n.* (MEL); 16 45'S 129 40'E, *id. s.n.* (MEL); Mountain Valley Station, *Hooper s.n.* (NT); 29 km NE of BHP airstrip, *Maconochie 1502* (BRI); Victoria River, Jan. 1856, *von Mueller* (K, MEL, photograph seen); 162 km SE of Carlton Station, *Perry 3008* (AD, K, MEL); Daly River Levee 1.6 km N Florina Station homestead, *Robinson CSR 65* (L, NT); Rollingsstone, *C.T. White 2971* (P); Katherine Gorge, 24 km E of Katherine, *Lazarides 7030* (CANB, K, L, NT).

QUEENSLAND: Endeavour River, *Banks & Solander* (BM, not the type of var. *reticulatus*); Nov. Holland, *Bauer 1068* (W); Cleveland Bay, *Bertheaud s.n.* (MEL); Gladstone, *Bot. Mus. Hamburg 27* (MEL); Lower Settlement Creek, *Brass s.n.* (CANB); Mossman River, *Brass 2151* (A, K, MEL); Bauple, Wide Bay distr., *Clemens s.n.* (GH, K, MICH); Herbert River, Rockingham Bay, *Dallachy s.n.* (MEL, many sheets); Port Denison, *id. s.n.* (K); Rockhampton, *Dietrich s.n.* (US); Lake Elphinstone, *id. s.n.* (MEL); Port Mackay, *id. 489, 535, 582* (MEL); Gladstone, *id. 1166, 1197, 12387, 1247* (MEL); Gladstone nr Keppel Bay, *id. 2387* (MEL); Port Denison, *Fitzalan s.n.* (MEL); 16 km NW of Kennedy, NE Kennedy distr., *Fuller s.n.* (BRI); Expedition Range, *Gittins 362* (BRI); 40 km from Paluma to Ewan, *id. 2518* (BRI); Broadsound, St. Lawrence, *Gulliver 49* (MEL); Watsonville, Cook distr., *Hyland 2808* (CANB, K); Kennedy nursery, N Kennedy distr., *id. 3904* (BRI, L); Stuart River, *Stephen Johnson s.n.* (MEL); Upper Stuart River, *id. s.n.* (MEL); Sources of Coen River, *id. s.n.* (AD, CANB, P); Burdekin, Valley of Lagoons, *Leichhardt s.n.* (P); Charters Towers, *Longman s.n.* (BRI); Parada nr Dimbulah, *McKee 9348* (CANB, K); Mt Marlowe, *Rev. Michael 781* (E, GH); N of Wairuna Station, ca 64 km S of Mt Garnet, N Kennedy distr., *Morain 196* (BRI); Stuart River, *von Mueller s.n.* (G, P); Burnett Ranges, *id. 29* (MEL, photograph seen); Edgecumbe Bay, *id. s.n.* (MEL); Rockhampton, *id. s.n. or 154* (BM, BR, MEL, many sheets, P); Rockingham Bay, *id. s.n.* (MEL); *ibid.*, Seven Hills, *id. s.n.* (MEL); Cleveland Bay, *id. s.n.* (MEL); Coen River, *id. s.n.* (BM); Summit of Bersaker Range, Rockhampton, *O'Shanesy 26* (MEL); nr Rockhampton, *id. 49* (MEL); Tinaroo Creek road, ca 19 km SE of Mareeba, 2800 feet, *Pedley 2263* (L); Settlement Creek, 48 km from Coast, Burke distr., *Perry 1199* (CANB); Endeavour River, *Persietz 321, 322* (MEL); 21 km S of Expedition Pass, *Remanandan 4210* (ICRISAT, WAG); Mareeba, *id. 4241* (ICRISAT, WAG); Mt Saunders 2 km NW of Yabulu, N Kennedy distr., *L.S. Smith T 109* (A, BRI); Port Curtis, *id. 3585 A* (BRI, CANB, K); Bonnie Doon hills, *id. 4524* (BRI, K); nr Massey Creek, ca 25 km NE of Coen, *id. 11928* (BRI, L); 12 km E of Marlborough, Port Curtis distr., *Speck 1756* (CANB, L); Burdekin River above Dalbeg on track to Gorge Weir, 22.3 km W of Expedition Pass Creek Bridge, N Kennedy distr., *Staples 2119* (BRI); ca 8 km NW of Foxleigh homestead, Leichhardt distr., *Story & Yapp 173* (BRI, CANB); sine loc., *Thozet 571* (P); Mt Morgan, Rockhampton, *Warburg 18519* (E); nr top of Biggenden Bluff, Burnett distr., *C.L.T. White 7295* (A, BRI).

PAPUA NEW GUINEA: Mt Lawes, Central distr., *Bell 30* (MEL); Rona, Laloki River, Central distr., *Brass 3627* (A, BM); Rouna, *Carr 12322* (BM, CANB, L); nr Port Moresby, *Edelfeldt 217* (MEL); Brown River, Iorama Creek, Central distr., *Gillison NGF 221118* (A, CANB, L); tributaries of Gora-

gatabu Creek, 27 km NE of Port Moresby, *Heyligers 1299* (CANB, L); Laloki River, *Jeswiet 108* (WAG); Rigo, *Lister Turner s.n.* (MEL); S Coast nr Kwikila, Aban Subdiv., Central distr., *Paijmans 760, 776* (CANB); S Coast nr Marshall Lagoon, *id. 1000* (CANB); Goldie River N of Port Moresby, *Pullen 3315* (CANB); Laloki River Valley, ca 19 km NNW of Port Moresby, *id. 3333 A* (CANB); Goragatabu Creek area, ca 24 km N of Port Moresby, *id. 6756* (A, CANB, K, L); Brown River, Central distr., *Sheimann & Kairo NGF 27504* (A, CANB, K, L); Rouna Falls, Segeri, Central distr., *Womersley NGF 4739* (BRI, CANB); Mt Lawes Saddle, Central distr., Moresby subdistr., *id. NGF 43684* (BRI, CANB, E, K).

Notes: Bentham's description (1864) is not the protologue, but von Mueller's 1860 description of *Cajanus grandifolius*. The type specimen from Upstart Bay could not be seen, perhaps it is one of the Port Denison specimens, received in MEL in 1874, which was not precisely labelled. Upstart Bay is not too far from Port Denison. var. *grandifolius* is the most widespread variety, and in fact the most widespread wild pigeonpea relative in Australia and Papua New Guinea. *Lazarides 7030* is a peculiar specimen from the Northern Territory, with very thin leaflets and peduncles, smallish flowers and 4-seeded pods.

#### 10.25 b *Cajanus reticulatus* (Dryander) F. v. Muell. var. *reticulatus*

Fig. 25b, p. 174, Map 29, p. 169

*Cajanus reticulatus* (Dryander) F. von Mueller var. *reticulatus*

Basionym: *Dolichos reticulatus* Dryander in Aiton, Hort. Kew. ed. 1, 3: 33 (1789); F. von Mueller, Census Austral. Pl. Suppl. 1-4: 41 (1881); *id.*, Second Census Austral. Pl. 1-71 (1889); Bailey, Queensland Fl. 2: 438 (1900).

Type: Australia, Queensland, Endeavour River, Banks & Solander dd. 1770 (lecto: BM, photograph seen; isolecto: BM, CANB, MEL, W).

Homotypic synonyms: *Atylosia reticulata* (Dryander) Benth., Fl. Austral. 2: 263 (1864); Bailey, Queensland Fl. 2: 438 (1900).

*Cantharospermum reticulatum* (Dryander) Taub. ex Ewart & Davies, Fl. N. Terr. 152 (1917).

Distribution: Australia, Queensland and Northern Territory.

Ecology: Trailing or creeping in grass, open grounds, near creeks, in sandy loam, *Eucalyptus alba* woodland with *Heteropogon contortus*.

Flowering: Mar-Jul, Oct.

Fruiting: Apr, Jul.

Uses: The roots, after being roasted and hammered, are used for food (ROTH, in Bailey, 1900).



Vernacular name: Korlbun (Endeavour River, Roth, in Bailey, 1900).

**Specimens examined:**

AUSTRALIA, Queensland: *Banks & Solander s.n.* (type: BM, holo; iso: BM, MEL, P, W); nr Rockhampton, Bersaker Range, *Bowman s.n.* (MEL); East Coast, *Cunningham s.n.* (K); Cape Cleveland, *id.* 245 (BM, K); Rockhampton, *Dallachy s.n.* (MEL); Queensland sine loc., *id. s.n.* (K, 2 sheets); Rockingham Bay, nr Police Camp, *id. s.n.* (MEL, several sheets); Magnetic Island, Cleveland Bay, *Gulliver 9* (MEL); Cape York peninsula, *Lucas s.n.* (MEL); Rockhampton, *von Mueller s.n.* (MEL); *ibid.*, *id.* 279 (MEL); Cooktown, *Persietz s.n.* (MEL); Endeavour River, *id.* 200 (MEL); Millaroo via Ayr, *Pont 4211* (BRI); 40 km to Townsville on Ayr rd, *Remanandan 4205* (ICRISAT, WAG); Burdekin River area above Dalbeg on track to Gorge Weir, 21 km S of Expedition Pass Creek Bridge, *Staples 2013* (BRI); Cooktown, *Wuth s.n.* (MEL). Northern Territory: Liverpool River, Melville Bay, *B. Gall. s.n.* (MEL); Katherine Gorge, *Robinson 273* (NT).

Notes: It is rather complicated to ascertain the author responsible for naming *Dolichos reticulatus* in Aiton's Hortus Kewensis. SOLANDER and DRYANDER were responsible for the first edition, the AITONS did not prepare botanical descriptions. Since SOLANDER died in 1782, one year after the introduction of the specimens by SIR JOSEPH BANKS from New South Wales (presently part of Queensland), DRYANDER is the most likely real author of *Dolichos reticulatus*. The manuscript in Herb. Banks appears to be that of DRYANDER (Mabberley, via Geesink, pers. commun.).

Specimens of *Cajanus reticulatus* (as *Dolichos*) grown in Hortus Kewensis by AITON have apparently not been preserved. The plants did not flower. The material originally collected from Endeavour River, by BANKS and SOLANDER in 1770 and taken to England, has been designated the type. The sheet in MEL was received from BM. The specimens cited by BENTHAM (1864) include that specimen, others are from the Islands of the Gulf of Carpentaria, *R. Brown s.n.* (now referred to var. *maritimus*); Endeavour River, *Cunningham 245* (BM, K); Shoalwater Bay, *R. BROWN* (a problematic sheet now referred to var. *maritimus* because of its grey indumentum) and Rockhampton, *Dallachy s.n.* (K, Queensland without location, MEL). var. *reticulatus* is not so common as var. *grandifolius*, but can be found in the same areas as the latter. PEDLEY, REMANANDAN and STAPLES recently collected both varieties in the same areas of Queensland.

10.25 c ***Cajanus reticulatus*** (Dryander) F. v. Muell. var. ***maritimus*** (Reynolds & Pedley) van der Maesen comb. et stat. nov. **Fig. 25c, p. 176, Map 29, p. 169**

*Cajanus reticulatus* (Dryander) F. von Mueller var. *maritimus* (Reynolds & Pedley) van der Maesen comb. et stat. nov.

Basionym: *Atylosia reticulata* subsp. *maritima* Reynolds & Pedley, *Austrobaileya* 1-4: 426 (1981).

FIG. 25b. *C. reticulatus* var. *reticulatus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface 2X (1-9: *Remanandan 4210*).





Type: Australia, Northern Territory: Port Bradshaw, Arnhem Land Aboriginal Reserve, *Specht 714* (BRI, holo, not seen; iso: AD, CANB, K).

Distribution: Australia: Northern Territory, Queensland.

Ecology: white sand of coastal dunes.

Altitude: 0-100 m.

Flowering: Jan-Jul.

Fruiting: Apr-Jul.

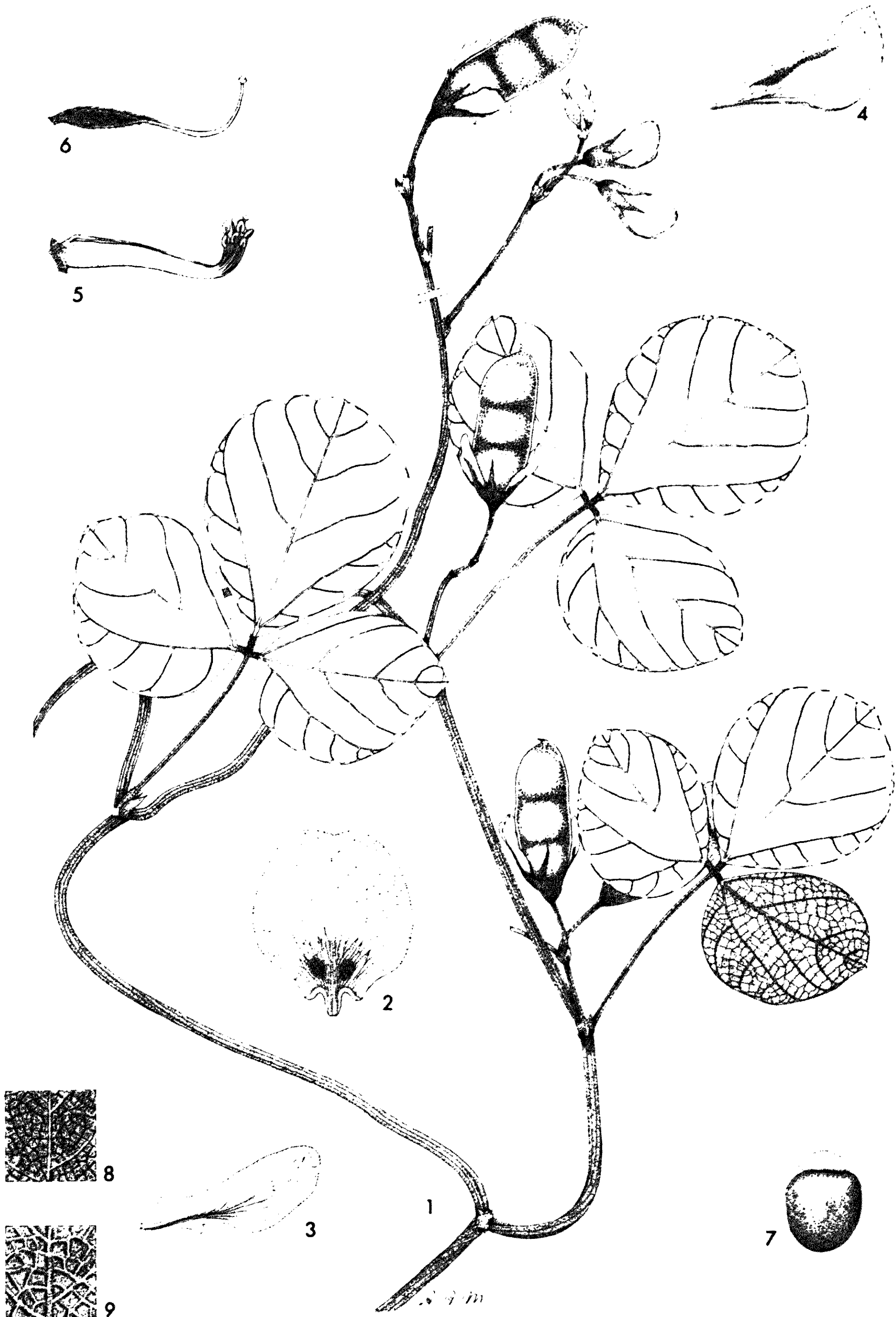
#### Specimens examined:

AUSTRALIA: Northern Territory: sine loc., *R. Brown s.n.* (MEL); Carpentaria, mainland opposite Groote Eylandt, *id. 4210* (BM, E); 16 km S of Cape Arnhem, *Maconochie 1547* (NT); Hempe Bay, Groote Eylandt, Gulf of Carpentaria, *Specht 277* (NT, US); South Bay, Bickerton island, in the Gulf of Carpentaria (13 45' S, 136 6' e), common on coastal dune, *R.L. Specht 503* (A, AD, CANB, K, L, US, not seen in NT); Port Bradshaw, Arnhem Land Aboriginal Reserve, *id. 714* (isotypes: AD, CANB, K); Groote Eylandt, *Wilkins 195* (BM). Queensland: Shoalwater Bay, *R. Brown s.n.* (E).

Notes: This variety is apparently restricted in distribution, only *R. Brown's* Shoalwater Bay specimen, the identity of which is slightly less certain, occurs away from the Gulf of Carpentaria. Old age (1802-1805) may have obscured the brown colour, otherwise it could have been classified as var. *reticulatus*. The grey indumentum and round leaflets of var. *maritimus* separate it from var. *reticulatus*, its nearest ally.

The following specimens of *C. reticulatus* lack elements to identify the variety: Australia, Queensland: Muldiva, N Qld., *Broome 52* (MEL); Shoalwater Bay S of Townsend Island, *R. Brown 4211* (BM, E); Thompson River, *Buckland s.n.* (MEL); Rockingham Bay, *Dallachy s.n.* (MEL); Trinity Bay, *Fitzalan s.n.* (MEL); betw. Channel and Granite-Spring Creek junction, *Goodall s.n.* (BRI); Mt Perry, *Heys? s.n.* (BRI); Herberton, Irvinebank, N Kennedy distr., *Martin & Gould 3889* (BRI); Rockingham Bay, *von Mueller 79* (FI, MEL 91623); Endeavour River, *Persietz 635* (MEL); Hodgkinson River, *Persietz? or Reiswerk?* (MEL 91615); Herb. *Robertson 1017* (MEL); Lyndbrook, Etheridge Line, Cook distr., *Towers s.n.* (BRI); Barooa or Darooa, *Wuth s.n.* (MEL).

FIG. 25c. *C. reticulatus* var. *maritimus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. pods, 2X; 8. seed, 3X; 9. detail upper leaflet surface, 2X; 10. detail lower leaflet surface 2X (1-10: *Specht 277*).



10.26 *Cajanus rugosus* (W. & A.) van der Maesen comb. nov.

Fig. 26, p. 178, Map 30, p. 180

*Cajanus rugosus* (Wight & Arnott) van der Maesen comb. nov.

Basionym: *Atylosia rugosa* W. & A., Prodr. 1: 257 (1834); Willis, Ann. Roy. Bot. Gard. Peradenya 4-7: 494 (1910); Fyson, Fl. Nilgiri Pulney Hill Tops 1: 120 (1915, repr. 1974); Gamble, Fl. Presid. Madras 2: 369 (1918), 260 (1967); Fischer, Surv. Fl. Anaimalai Hills, Rec. Bot. Surv. India 9-1: 1-218 (1921); Fyson, Fl. S. Indian Hill Stations 1: 170, 2: 132 (1932); Fernando, Wild Fl. Ceylon 2nd ed. 39 (1980); Matthew, Materials Fl. Tamilnadu Carnatic: 181 (1981); id., Illustr. Fl. Tamilnadu Carnatic: 183 (1982).

Type: India, Neelgherries?, *Wight 761* (holotype: E; isotypes in BR, CAL, E, G, K).

Homotypic synonym: *Cantharospermum rugosum* (W. & A.) Alston, Ann. Roy. Bot. Gard. Peradenya 9: 209 (1929).

Heterotypic synonym: *Rhynchosia? velutina* Grah. ex Wall, nom. nud., Wallich Cat. 5501 (1831), based on Graham, *Wallich 5501* (K).

*Climber-creeper*, perennial. *Branches* terete, greyish-pubescent, at the end often filiform when flowering, up to ca 1 m long. *Stipules* ovate-acuminate, ca 1-3 mm long, 1-2 mm wide, very pubescent, not caducous until a second season. *Leaves* digitately trifoliolate, petiole 1-5 cm. *Leaflets* thick, glands hardly visible on the densely grey-pubescent lower surface with woolly intertwined hairs and very prominent ribs, hairs on ribs yellowish, hairs 0.5-1 mm, upper surface green, covered with velvety pubescence, end leaflet obovate, top obtuse, mucronate, base cuneate-rounded, 1-5 cm long, 0.8-3.8 cm wide, side leaflets obliquely obovate, 1-4 cm long, 0.8-3.5 cm wide, petiolules 1-3 mm, no stipellae. *Racemes* long, 2-4 flowers, peduncles 1-4.5 cm, pedicels 3-8 mm, flowers yellow, or flag with vague red stripes, marcescent. *Bracts* minute, rounded, ca 1 mm, pubescent, caducous. *Calyx* pubescent, hairs grey, adpressed, tube 3 mm, lower teeth linear, 3-4 mm, other teeth lanceolate, 5-6 mm, the upper ones rather separate than connate. *Vexillum* obovate, base clawed, biauriculate, top rounded, faintly emarginate, two callosities near the base, middle vein thickened, 7-13 mm long, 5-10 mm wide. *Alae* obovate, base biauriculate, 7-13 mm long, 3-4 mm wide. Keel petals rounded-oblique, ca 7-13 mm long. *Ovary* densely white pubescent, 3-5 mm, ca 4 ovules, style ca 9 mm, upcurved in the middle, base pubescent, top glabrous, thickened, stigma capitate. *Stamens* ca 14 mm long, last 3-4 mm free, upcurved, anthers dorsifix. *Pods* oblong, not quite straight, (8-)14-23 mm long, 5-7 mm wide, surface brown to grey pubescent, hairs short, transverse

FIG. 26. *C. rugosus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X (1-9: van der Maesen 3567).

depressions at oblique or right angles to the suture, 1-4 seeds, when fertilization is incomplete pods are moniliform. *Seeds* compressed-globose, ca 3.5 mm long and wide, ca 2 mm thick, dark brown or light brown with dark blotches, strophiole large, greenish, divided.

**Distribution:** S. India and Sri Lanka.

**Ecology:** twiner-creeper in forest, low scrub, open spaces (downs).

**Altitude:** 1300-2400 m.

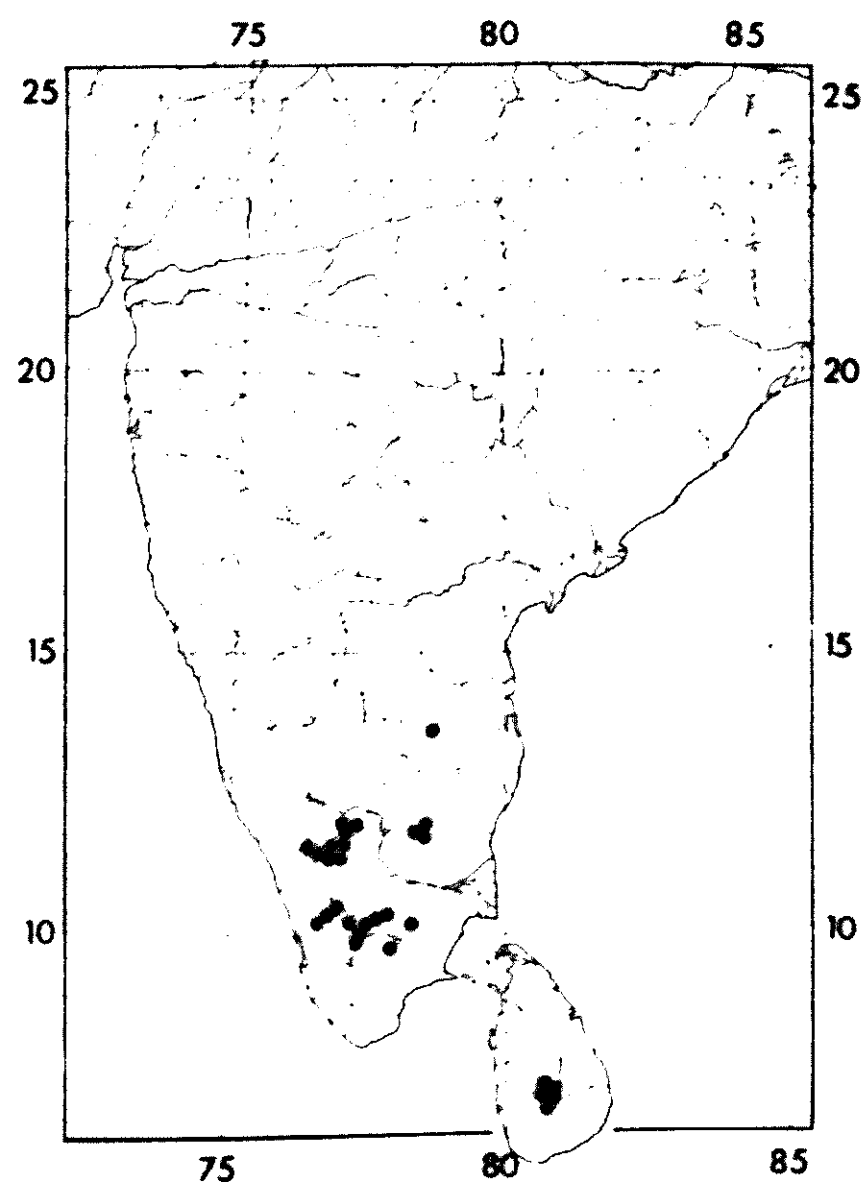
**Flowering:** Sep-Apr, Jun-Jul.

**Fruiting:** Oct-Apr, Jun-Jul.

**Vernacular names:** Wal-kollu (Sinhalese, Sri Lanka cf. Willis).

#### Specimens examined:

INDIA: Andhra Pradesh: Cuddapah hills, *Beddome 2275* (BM). Karnataka: Biligirirangan hills, highest part, Mysore distr., *Barnes 630* (GH); Biligirirangan hills, Dupabarry E. Ridge, Mysore distr., *id. 714* (GH); Biligirirangan hills, Attikan, *Raghavendra Rao 1027* (MGM). Kerala: Hannavan Shola, High Range Travancore, *Barnes s.n.* (DD); Karnakullam, *id. s.n.* (DD); Santanpara, Travancore, *Meebold 13231* (CAL). Tamil Nadu: Coimbatore distr.: Anaimalai hills, *Beddome 2274* (BM); Anaibetta, *Fischer 311* (CAL); Coimbatore (distr.), *id. 1299* (CAL); Ibec hill, Anaimalai hills, *id. 3285* (CAL); Madurai distr.: Pulney (Palni) hills, *Beddome 2276* (BM); Kodaikanal, *id. 209* (MICH); High Waivy Mts (W of Palni hills), *Blatter & Hallberg 615* (CAL); Upper Lake road, Kodaikanal, *id. 2040* (K) hybrid?; Vilpatty valley (nr Kodaikanal), *id. 2571* (K); Upper Palni hills, *Fischer 2898* (CAL); Kodaikanal, *van Malderen 1296* (CAL); Palni hills (Peninsula Indiae Orienta-



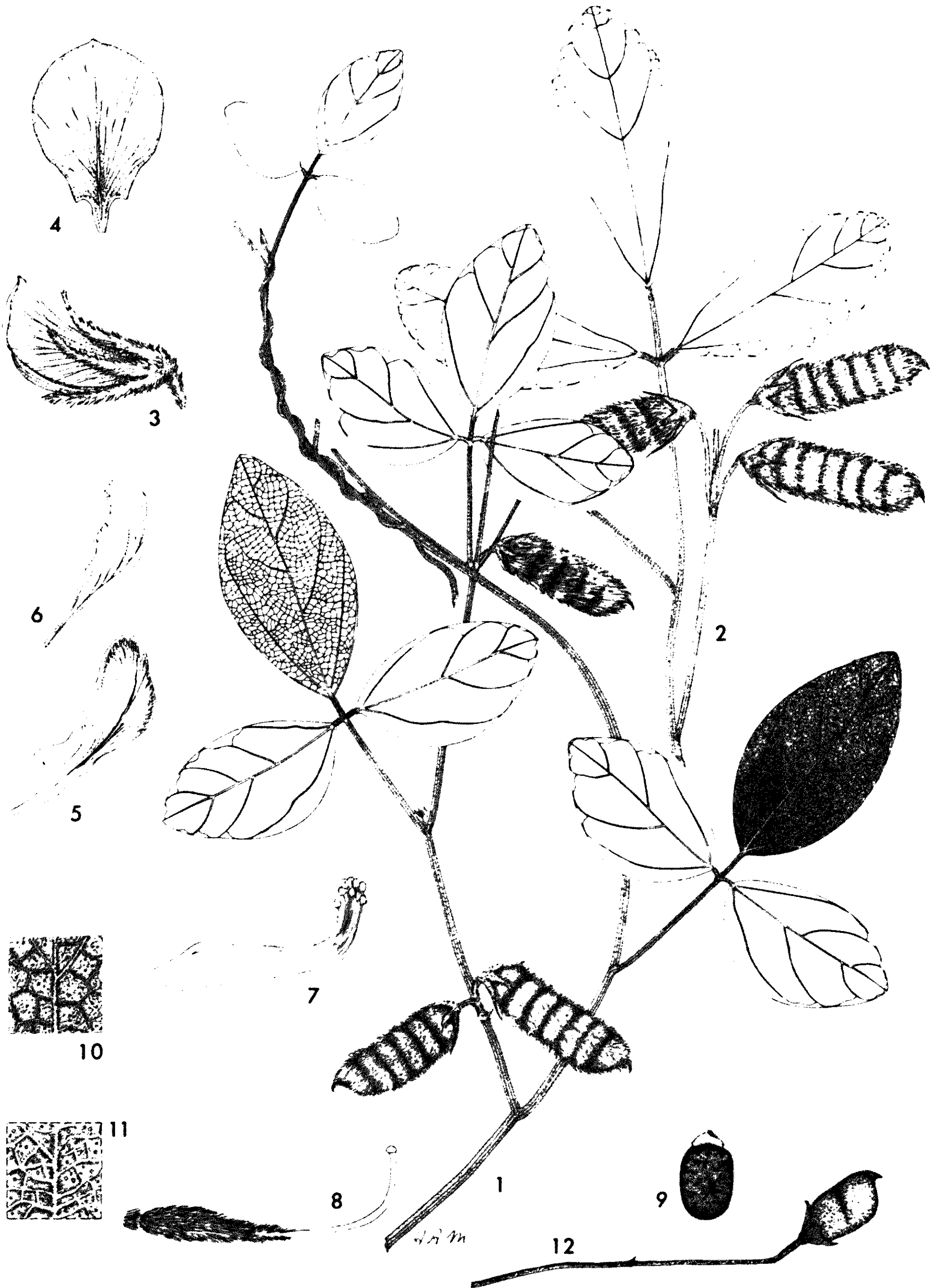
MAP 30. *Cajanus rugosus*

lis), *Wight s.n.* (MH); Neelgherries? *id.* 761 (E. holo; iso: BR, CAL, E, G, K); *id.* 773, (C, CAL, DD, GH, K, L, P); Nilgiri distr.: Malkondah, *Beddome* 2278 (BM); Coonoor, *Bourne* 3528 (K); Coonoor, *Clarke* 1815 (BM); *id.* 10501 (CAL); Naduvattam, *Gamble s.n.* (K); Coonoor, *id.* 12264 (DD); *id.* 12575 (CAL, DD); *id.* 12637, 13106, 13249 (K); Kolakamki, *id.* 16773 (BSI); Nilgiri hills, *Hohenacker* 1185 (BM, C, E, FL, G, K, MEL, P, W); Nilgiri hills, *Hooker & Thomson* (K, L, W); Coonoor, *King* 1038 (CAL); Neddunvadam (Naduvattam), *Meebold* 11671 (CAL); Coonoor, *Prain s.n.* (PRE); Hulical Droog, *Sebastine* 4166 (MH); nr E. Varhapalam Dam, *B.V. Shetty* 37547 (MH); Kinnakurai, *id.* 37675 (MH); Kodanad, Shola nr viewpoint, *Vajravelu* 36871 (MH); Nilgiri hills, *Wallich* 5501 A & B (K); Nilgiri hills, *Wight s.n.* (OXF); Salem distr.: Shevaroy Mines, *Arochiasamy* 10164 (RHT); Shevaroy hills, *Bourne* 2571 (K); Yercaud, Temple Peak from Kadukamaram, *Matthew, Butto & Rani* 28452 (RHT); Yercaud, Shevaroy Bauxite hills, *A.V.N. Rao* 26923 (MH); nr Yercaud, *van der Maesen* 3567 (ICRISAT).

SRI LANKA: Path to Ambawela, *Anon. s.n.* (PDA); Nuwara Eliya, *Anon.* 16480 (MH); to Maturotu, *Anon. s.n.* (CAL); Hantani, *Champion s.n.* (K); Patana, Welimada, *Douglas Simpson* 8652 (BM); Hantani, *Gardner s.n.* (PDA); Elephant plains, *id.* 239 (FI, K, PDA); 3 km NE of Madugoda, Kandy distr., *Jayasuriya et al.* 483 (PDA, US); Madugoda to Tamitiyanbi, 22 km to Mahiyangana, *van der Maesen* 4033 (ICRISAT, WAG); 1 km W of Hakgala, Nuwara Eliya distr., *id.* 4167 (ICRISAT, WAG); Haputale to Bandarawela, culvert 9 4, Nuwara Eliya distr., *van der Maesen* 4179 (ICRISAT, WAG); *ibid.*, *Maxwell & Jayasuriya* 769 (PDA, US); *ibid.*, culvert 9 8, *id.* 773 (PDA, US); N of Welimada, Badulla distr., *id.* 889 (PDA, US); Hakgala to Ambawela, road marker 5 3, *Mueller-Dombois & Comanor* 67091408 (PDA, US); Mc Donald's Valley below Hakgala, N. Eliya distr., *Rudd & Balakrishnan* 3174 (K, PDA, US); Welimada to Badulla, *id.* 3194 (PDA, US); Hewaheta, road marker 23 2, N. Eliya distr., *Rudd & Jayasinghe* 3250 (K, PDA, US); Bolgandawela, Uma Oya, *Silva* 223 (PDA); Central Province, *Thwaites* 1441 (BM, BR, CAL, DD, G, K, MEL, W); sine loc., *Walker* 117 (E, K, PDA).

Notes: The likeness between *C. rugosus* and *Rhynchosia filipes* Benth. ex Bak. is remarkable, especially when the pods are young and the ovules imperfectly fertilized. The linear depressions, present in the former and absent in the latter, are not visible at that stage. The number of ovules (2-4) put it in *Cajanus*. A persistent silky lanceolate bracteole close to the base of the calyx, linked with short pedicels, often solitary peduncled flowers, and 2-seeded reticulate-puberulous pods separate *R. filipes* from *C. rugosus*, which has more cupshaped, caducous bracteoles, often two or more flowers with quite long pedicels on the same side of the peduncle and has hairier pods. The thread-like ends of the branches in *R. filipes*, although they occur in *C. rugosus*, are much shorter and not so thin.

Fyson's illustrations (1915, 1932) show *Rhynchosia filipes* rather than *C. rugosus* and it is the former species which is, or used to be, common on the Kodaikanal downs. In Kodaikanal I could not find *C. rugosus*, only several populations of *R. filipes*, one form with small rounded leaflets, the other with ovate-acute larger leaflets, the latter in a more moist environment or less disturbed than the former. Fyson did not include *R. filipes* in his flora of 1915, but did in 1932. All specimens with acutely-tipped leaflets should be carefully examined, as the typical *C. rugosus* has rounded leaflets. It seems possible that intermediate, natural hybridization may happen since both species occur in the Nilgiri Hills. BOURNE 1675 = 2040 has 2- and 3-seeded pods, hardly depressed between the seeds. BOURNE 1091, also from Kodaikanal, with rather filiform branches, small flowers but more than one per peduncle, was determined as *Atylosia rugosa* by GAMBLE (teste Gamble's handwriting) despite the excentric strophiole. The



present author presumes these specimens may be hybrids with *R. filipes* or peculiar *R. filipes* specimens. Experimentation is warranted.

Further differences between the species are the smaller size of the flowers and pods in *R. filipes*, and the upper row calyx teeth which are almost entirely connate. The eccentric strophiole (FYSON, 1915) does not occur in the type specimen or other specimen of *C. rugosus*, and is not reported by BAKER or BENTHAM but is a characteristic of *R. filipes*.

#### 10.27 *Cajanus scarabaeoides* (L.) Thouars

Fig. 27, p. 182, Maps 31-34, 185, 186, 187

For literature, synonyms and typification see under varieties.

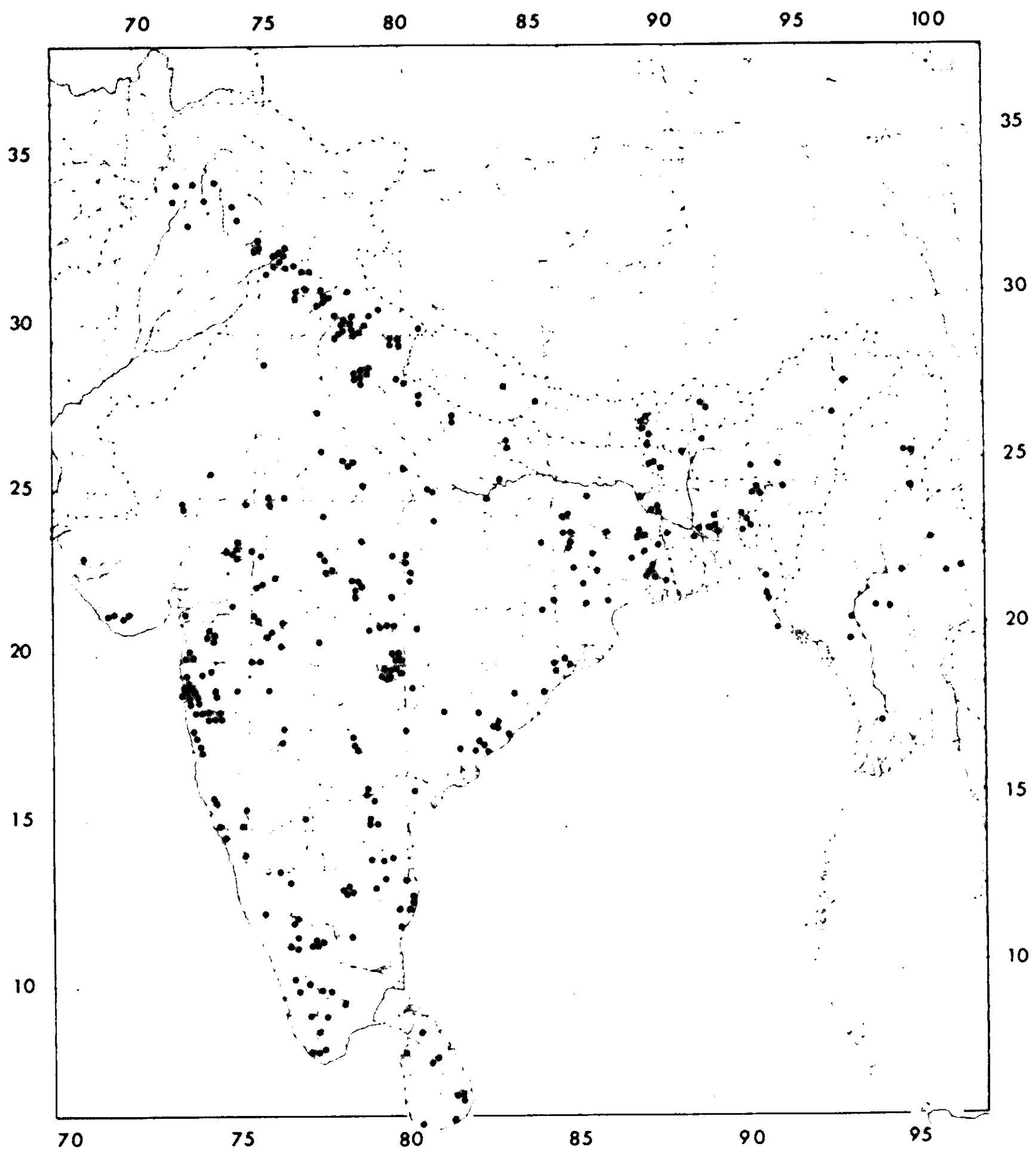
*Creeper-climber*, supported by grasses and shrubs. *Branches* straight or winding, quite woody at the base, striate, pubescent with purple pigmentation or not, length up to 1.5 m. *Stipules* small triangular scales, ca 1 mm long, pubescent, caducous. *Leaves* pinnately trifoliolate, petiole 4-20 (25) mm, rachis 2-5 mm. *Leaflets* coriaceous, glandular punctate below, lower surface densely white-pubescent especially on the prominent veins, thin-woolly, hairs 0.25-0.5 mm, upper surface white-pubescent, hairs ca 0.25 mm, end leaflet obovate, 15-45(-60) mm long, 7-27(-36) mm wide, top acute or obtuse, mucronate, base cuneate, side leaflets obliquely obovate, 10-35(-45) mm long, 7-24(-35) mm wide, apex and base as in end leaflet, petiolules 1-2 mm, pubescent, stipellae minute scales, only near side leaflets. *Racemes* short, 1-6 flowered, peduncles (0-)2-10(-15) mm, in var. *pedunculatus* to 60 mm, pedicels 2-5 mm, flowers yellow, creamish yellow, flag sometimes dorsally with red veins. *Bracts* tiny, broad and toothed scales, ca 1-2 mm wide. *Calyx* densely pubescent, tube 2-3 mm, teeth lanceolate, 4-6 mm, lower one longest, upper ones connate except the tips. *Vexillum* obovate, 6-8 mm long, 4-5 mm wide, base clawed, barely auriculate, no callosities, apex rounded, mucronate. *Alae* elongate-obovate, ca 9 mm long, 1.5 mm wide, base auriculate. Keel petals oblique, ca 7 mm long, ventrally adnate. *Ovary* densely white-pubescent with long hairs, ca 4 mm long, 1 mm wide, ca 6 ovules. *Style* ca 5 mm long, glabrous, the top 3 mm upcurved. *Stamens* ca 9 mm long, last 2-3 mm free, upcurved, anthers dorsifix. *Pods* oblong, 15-20 mm long, 6-10 mm wide, broadly oblong in var. *pedunculatus*, densely covered with dull or golden brown long and short hairs, glandular-punctate, transverse depressions at right angles to the sutures, base cuneate, apex obtuse, tipped with the base of the style, (2)3-5(6) seeds. *Seeds* rectangular-rounded, ca 4-5 mm long, 3-4 mm wide, 2 mm thick, greyish with black and cream mosaic, strophiole divided, 1 X 2 mm or less, greenish.

FIG. 27. *C. scarabaeoides*: 1. branch, 1X; 2. branch of long-peduncled variant, 1X; 3. flowers, 2X; 4. flag, 2X; 5. wing, 2X; 6. keel, 2X; 7. stamens, 2X; 8. pistil, 2X; 9. seed, 3X; 10. detail upper leaflet surface, 2X; 11. detail lower leaflet surface 2X; 12. fruit of var. *pedunculatus* (1, 3-11: van der Maesen 2881; 2: A. Floyd 5528; 12: McKee 9363).

Distribution of var. *scarabaeoides*: South and South-East Asia, Queensland, Pacific Islands, Zanzibar, Madagascar, Mauritius, Coastal West Africa, Jamaica.

Country	Altitude (m)	Flowering and fruiting
Australia (Qld)	low	May-Aug
Asia		
Bangladesh	0-350	Sep-Apr
Bhutan	1500	Sep, Apr
Burma	0-1350	Jun, Aug-Mar
China	0-1000	Sep-Jan, Mar, May
Fiji Islands	low	throughout the year
India	0-1000(2000)	(Aug-Sep) Oct-Mar (Apr-Jun)
Indonesia	0-800	Feb-Aug, Oct-Nov
Japan (Ryukyu)	low	Apr-Sep
Malay Peninsula	sea level	Dec
Mariana Islands	0-270	throughout the year
Nepal	0-1000	Aug-Oct, Jan-Mar
Pakistan	0-1300	Sep-Oct, Mar-May
Papua New Guinea	0-150	Feb-Aug, Oct
Philippines	low	Jul, Sep-Apr
Sri Lanka	low	Dec-Apr, Jul
Taiwan	low	Aug-Dec Jan, Mar
Thailand	0-300	Oct-Mar, Jul
Vietnam	?	Mar-May, Aug-Dec
Africa		
Ghana	low	Feb-Mar, May-Jul, Oct
Guinea-Bissau	low	Nov-Dec
Madagascar	0-900	Dec-Aug
Mauritius	low	Feb, May, Jun
Senegal	low	?
Sierra Leone	low	Jan
Zambia	?	May
Zanzibar	sea level	Jun
America		
Jamaica	sea level	Sep

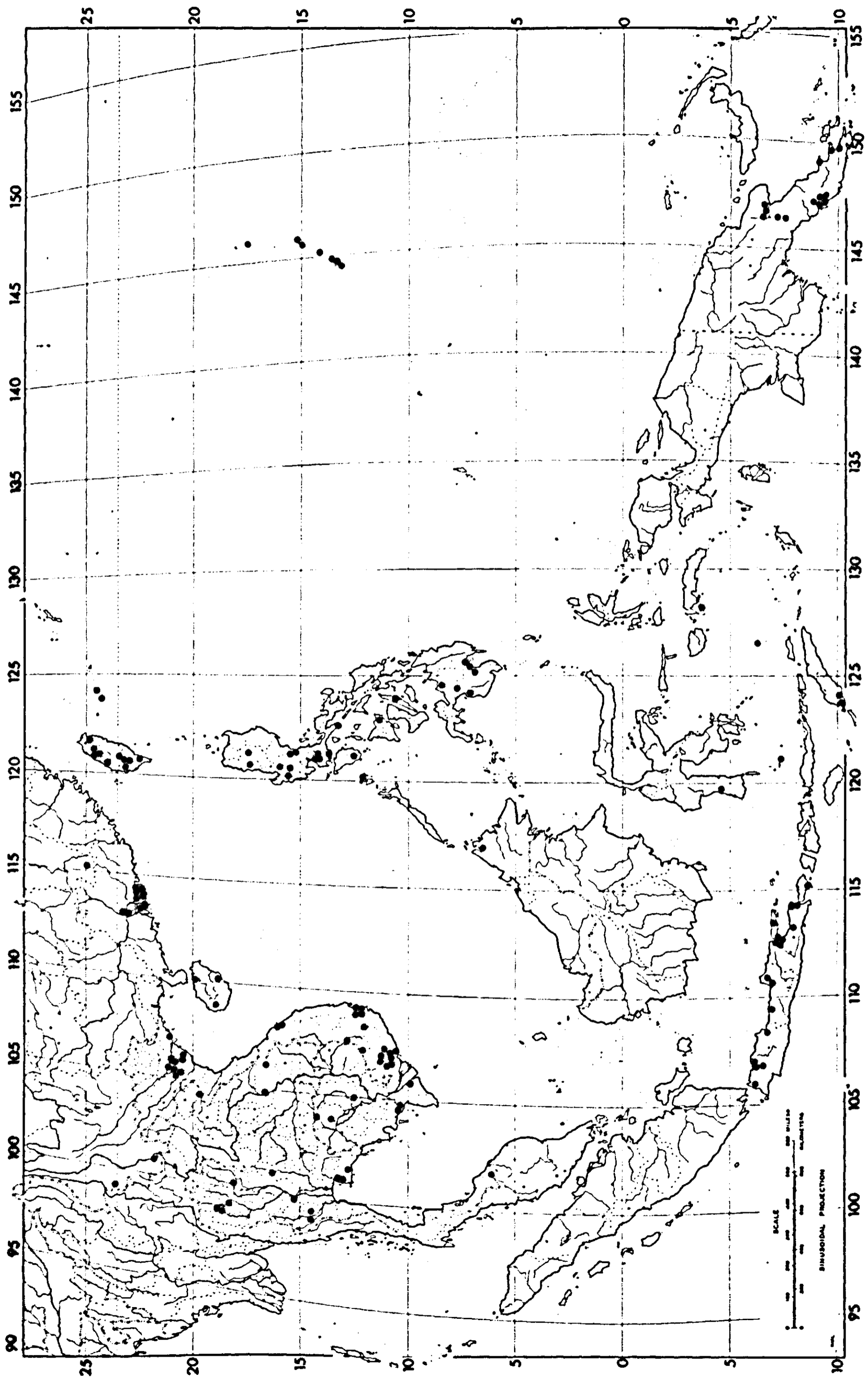




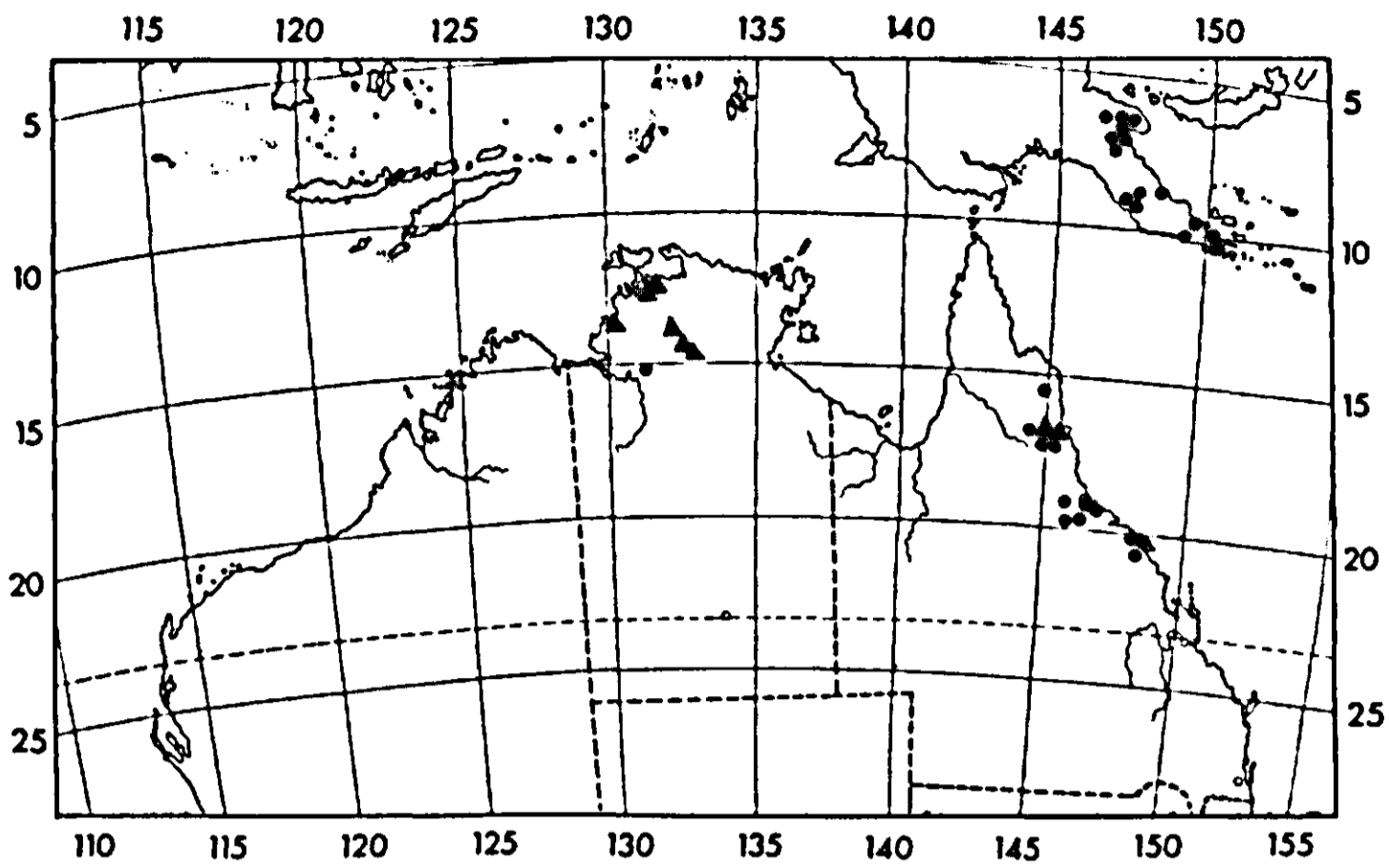
MAP 31. *Cajanus scarabaeoides* in South Asia

Distribution of var. *pedunculatus*: Australia

Country	Altitude (m)	Flowering and fruiting
Australia (NT)	0-500?	Jan-May, Sep
Australia (Qld)	0-500?	Apr, Oct

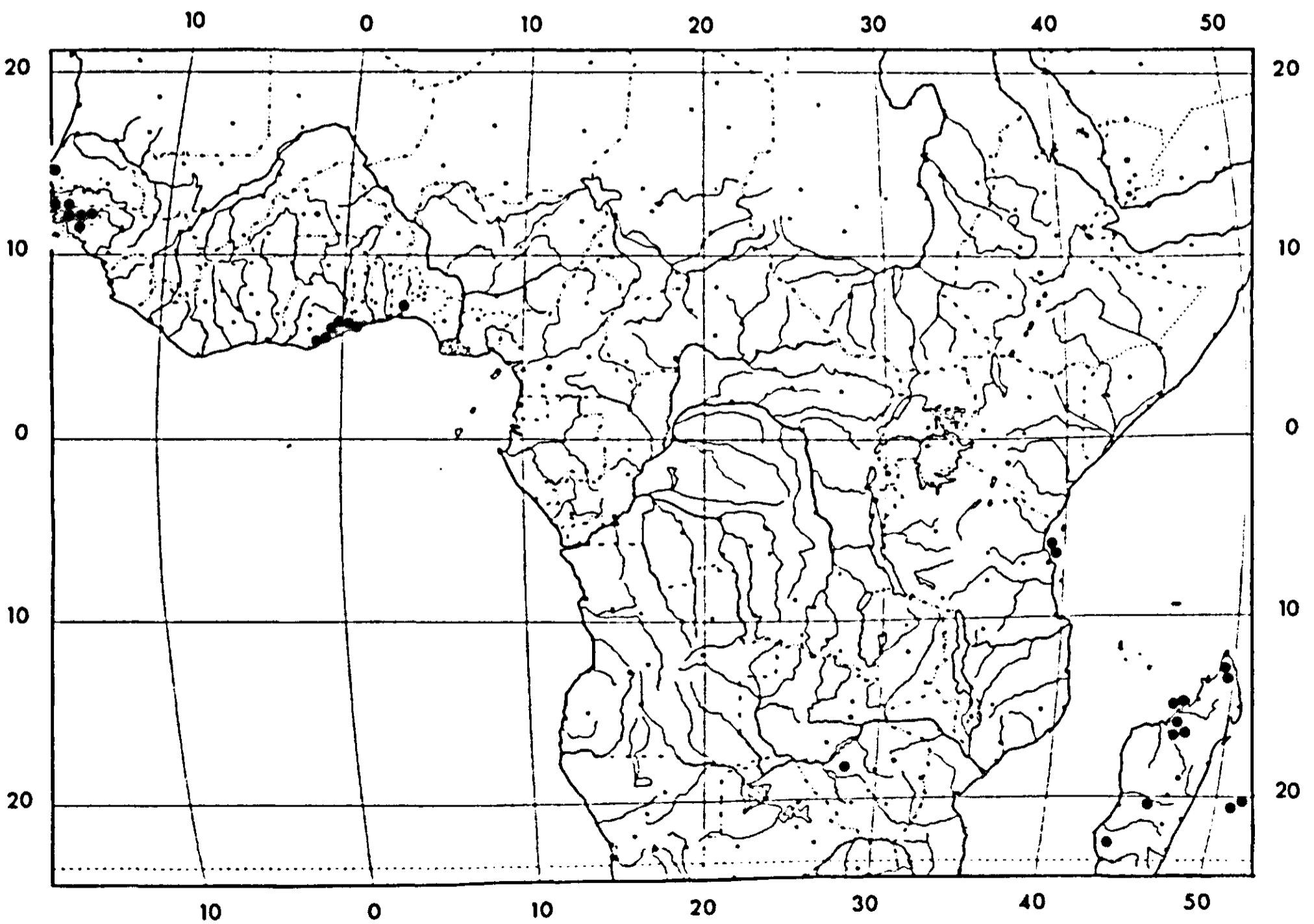


MAP 32. *Cajanus scarabacoides* in Southeast Asia



MAP 33. *Cajanus scarabaeoides* in Australia

- var. *pedunculatus*
- ▲ var. *scarabaeoides*



MAP 34. *Cajanus scarabaeoides* in Africa

Distr. Hughli-Howrah, 24 Pergunnahs, Rec. Bot. Surv. India 3-2: 195 (1905); Haines, Forest Fl. Chota Nagpur 320 (1910); Willis, Rev. Cat. Flow. Pl. Ferns Ceylon 4-7: 494 (1910); Backer, Schoolfl. Java 380 (1911); Dunn & Tutchet, Fl. Kwangtung, Hongkong 85 (1912); Rama Rao, Fl. Plants Travancore 127 (1914); Harms, in Engler, Pflz.welt Afrikas 3-1: 665 (1915); Duthie, Cat. Pl. Kumaon 50 (1906); Bamber, Plants Punjab 602 (1916); Boldingh, Zakflora Landb. Str. Java 115 (1916); Gagnepain, Fl. gen. Indo-Chine 2-3: 281 (1916); Gamble, Fl. Presid. Madras 2:369 (1918), 261 (1967); Parker, Forest Fl. Punjab, Hazara, Delhi 165 (1918), 162 (1973); Fischer, Survey Fl. Anaimalai Hills, Rec. Bot. Surv. India 9-1: 70 (1921); Collett, Fl. Siml. 142 (1921); Ridley, Fl. Malay Peninsula 1: 564 (1922); Haines, Bot. Bihar Orissa 274 (1922), 287 (1961); Uhl, Guntur Fl. 5 (1930); Baker, Leguminosae Trop. Afr. 460 (1926); Burkill, Botany Abor Exp., Rec. Bot. Surv. India 10-1/2: 271 (1925); Sharma & Sharma, Obs. Fl. Chandigarh, Res. Bull. N.S. Punjab Univ. 17-3/4: 390 (1966); Gupta, Fl. Nainitalensis 95 (1968); Gunawardena, Gen. Sp. Pl. Zeyl. 69 (1968); Patel, Forest Fl. Melghat 117 (1968); Verdcourt, Fl. Trop. E. Afr. Ed.2, 1: 707 (1971); Dabadgao & Shankaranarayan, The Grass Cover of India 109 etc. (1973); Ramaswamy & Razi, Fl. Bangalore 297 (1973); Fosberg et al., Vasc. Pl. N. Marianas Islands, Smithsonian Contrib. Bot. 22: 26 (1975); Berhaut, Fl. Illustr. Senegal 5: 64-65 (1976); Pl. Corbett Nat. Park, U. P., J. Bombay Nat. Hist. Soc. 73-2: 28 (1976); Saldanha & Nicolson, Fl. Hassan 238 (1976); Srivastava, Fl. Gorakpurensis 91 (1976); Walker, Fl. Okinawa 592 (1976); Huang & Ohashi, Fl. Taiwan 3: 179-180 (1977); Oommachan, Fl. Bhopal 114 (1977); Ali Fl. West Pakistan 100: 219 (1977); Shah, Fl. Gujarat 1: 184 (1978); Verdcourt, Manual New Guinea Legumes 540, 542-543 (1979); Nguyen Van Thuan, Fl. Cambodge, Laos, Vietnam 17: 112-115 (1979); Matthew, Materials Fl. Tamilnadu Carnatic 181(1981).

*Cantharospermum scarabaeoides* ('scarabaeoideum') (L.) Baill., Bull. Soc. Linn. Paris 1: 384 (1883), based on *C. pauciflorum* W. & A. and *A. scarabaeoides* (L.) Benth.; Merrill, Fl. Manila 255 (1912) Merrill, J. Straits Branch Roy. As. Soc. Special nr, Sept 1921: 311 (1921), Keuchenius, Proefstat. Thee 90: 15 (1924) (as *scarabaeoides* (Bth.) Kds.); Mooney, Suppl. Bot. Bihar Orissa 52 (1950) (as *scarabaeoides*).

*Cajanus scarabaeoides* (L.) F. von Muell., Census Austral. Plants, Suppl. 1-4: 41 (1881); F. von Mueller, Census Genera Pl. Indigenous Austral., J. Proc. Roy. Soc. N.S. Wales 15: 204 (1882); F. von Mueller, Second Census Austral. Plants 71 (1889).

*Cantharospermum scarabaeoides* (Benth.) Kds, in Koorders-Schum., Syst. Verz. 1. Fam. 128: 68 (1911).

Heterotypic synonyms: *Glycine mollis* Willd., Sp. Pl. 3-2: 1062 (1800); Hepper, Kew Bull. 28-2: 319 (1973).

Type: Guinea, probably Ghana, *Insert s.n.* (B, holotype, Herb. Willd. 13446 IDC microfiche).

*Dolichos scarabaeoides* Roxb. ex Grah. in Wall. Cat. No. 5580 a (1831); nomen nudum, based on India, *Wallich 5580 A* (K).

*Glycine scarabaeoides* Hb. Ham. et HBC ex Wall., nomen nudum in Wall. Cat. No. 5580 B (1831); based on India, Kattipur 30 Aug 1810, Mungger Hills (Monghyr Hills) and 16 Sept 1811, Bot. Garden Calcutta 2 Jan 1815 (K).

*Hedysarum biflorum* Willd. ex Wall., nomen nudum in Wall. Cat. No. 5580 C (1831), based on India, in itinere Travancoras Octbr 1814 (K).

*Cajanus scarabaeoides* Thouars ex R. Grah., Wall. Cat. No. 5580 (1831), apud Ind. Kew. 1: 312 (1895).

*Cantharospermum pauciflorum* W. & A., Prodr. 1: 255 (1834); Royle, Illustr. Bot. Himal. 192 (1833-39)(sphalm. *paucifolium.*); Dalz. & Gibson, Bombay Fl. 73 (1861, repr. 1973).

Type: India orientalis, *Wight 758* (E, holotype, isotypes BM, C, CAL, E, G, K, WU).

*Dolichos minutus* Roxb. ex W. & A., Prodr. 1: 256 (1834).

Type: Roxburgh drawing E. I. C. Mus. Tab. 252 f. 1 (CAL or K, not seen).

*Atylosia pauciflora* (W. & A.) Druce, Rep. Bot. Exch. Cl. Brit. Isles 1916: 607 (1917).

*Atylosia scarabaeoides* (L.) Benth. var. *queenslandica* Domin, Bibliothek. Bot. 89: 227 (1926)

Type: opp. Pentland, Domin '4870' (PR, holo, not seen, teste REYNOLDS & PEDLEY 1981).

#### Specimens examined:

*C. scarabaeoides* var. *scarabaeoides* is the most widely distributed wild *Cajanus*, and is quite common in India. Only a few representative specimens are cited. Locations of all specimens seen have been plotted on the maps, insofar as they could be ascertained. It may also occur in Sumatra, on the Andamans (Helfer 1716, DD, G, has indication Tenasserim + Andamans) and other areas from where no specimens appear to have been collected.

ASIA: BANGLADESH: Dacca, *Clarke 16728* (CAL); St. Martin's Island, *Hasan, Huq & Khan 4119* (BNH); Univ. Campus, Rajshahi, *Huq 482* (BNH).

BHUTAN: Wangdu Phodrang, *Cooper 4864* (BM).

BURMA: Camp Landis area, Myitkyina region, *Belcher 864* (G, K, US); Mt. Popa, *Dickason 6625* (A); Nr Mausam falls, N Shan States, *Lace 5485* (CAL, E, K).

CHINA: Wanning, Hainan, *F.C. How* 73882 (BM, G); (Hinghwa) Putien, Fukien prov., *Metcalf* 6466 (BM); Canton, *Sampson s.n.* (K); Yang Tse Ferry nr La Ka Triang, betw. Yunnansu and Huili, Yunnan, *Schneider* 440 (GH, K, WU).

FIJI ISLANDS: Viti Levu nr Nandi, *Edwards* 117 (K); Nas Savu Savu; nr Landopa, *Greenwood* 731 (A, K).

HONG KONG: Deep Bay, *Shiu Ying Hu* 5793 (K, US); Chung Chi College, Shatri, N.T., *id.* 6354 (U, US).

INDIA: Andhra Pradesh: W. Pakhal, Warangal, *Henry* 15968 (MH); Srisailam dam site, *van der Maesen* 2369 (ICRISAT, WAG); Waltair, Univ. Campus, *Wagh* 4672 (BLAT). Arunachal Pradesh: Saleri Camp, Kameng Frontier Div., *Rolla Rao* 1437(AU, Waltair).

ASSAM: Silchar, *Clarke* 18572 (FI); Bihar: Ranchi, *Dahlstrand s.n.* (W); Singbhum Sal Forests, *Haines* 60 (K). Goa: Ordofond, *Raghavan s.n.* (L). Gujarat: Waghai, Dangs forest, *Asrana* 3025 (BLAT); Gir Forest, Junwania nr Sasan, *Hodd* 79 (K). Himachal Pradesh: Kudi plantation, Bilaspur, *Agrawal* 1183 (CAL, DD); Palampur to Bajnath, *Heybroek s.n.* (L). Karnataka: Bandipur, way to Kakanara, *Marthani* 21281 (MH); Tiptur, Arsikere rd, Hassan distr., *Saldanha* 11953 (JCB). Jammu & Kashmir: Tanvi Bank, Sedera Jammu, *Hallberg* 11863 (BLAT); Seda, Jammu-Kashmir road, *Stewart* 13286 (RAW). Madhya Pradesh: Bunglapur, Towa river bank, Hoshangabad distr., *Joseph* 11130 (MH); Komeli forest, Bastar, *Mooney* 1397 (K). Kerala: Dhon Reserve Forest, Palghat distr., *Joseph* 17864 (MH). Maharashtra: Borivli Nat. Park, *Herbert div. nrs* (BLAT); above Paud, Poona distr. *van der Maesen* 1965 (WAG, ICRISAT). Meghalaya: Shillong Govt. Fruit Garden, *Deka s.n.* (ASSAM); Garampani, *Panigrahi* 4244 (ASSAM). Orissa: Gangapur, Ganjam distr., *Gamble* 13636 (CAL, K); Baripita Forest, Puri distr., *Lace* 2524 (E); 56 km S of Rourkela, *van der Maesen* 1988 (ICRISAT, K, WAG). Punjab: Hoshiarpur, *Mardan Ali* 336 (DD); Pathankot, Chakki river, *Stewart* 1716 (K, RAW). Rajasthan: Kotah, *Gupta s.n.* (BSD); Syampura Reserve Forest Area, Banswara, *Kanodia* 75389 (BSI). Sikkim: Regio trop., *Hooker s.n.* (K). Tamil Nadu: Madurai Aerodrome, *Nanda* 654 (CAL, DD); Shevaroy Hills, *Perrottet* 175, 202 (CAL, DD, MH, W). Tripura: Agartala, *D.B. Arb.* (DD); Kunjaban hills, *Debbarman* 260 (CAL). Uttar Pradesh: Gola, Kheri distr., *Inayat* (DD, CAL); Dehra Dun, *King* 50 (MH); Ratapanisot Bijrani, Corbett Nat. Park, *Pant* 43374 (BSD, G). West Bengal: Amlashal and Mour Jhana forests, Midnapur distr., *Sen Gupta* 516 (CAL); Tondou forest, Jalpaiguri Duars, *Haines* 551 (E).

INDONESIA: Gunung Api, Gayu Luas Islands, *Atmodjo* 283 (L); S of Kapan, bridge across Puchuk river, *Eyma* 384 (L); W. Flores, *Kostermans* 22010 (L); Gilimanuk, *de Voogd* 1727 (L); Cirebon, *Backer* 4757 (K); Surakarta, *Horsfield* 126 (BM, CAL, GH, K).

JAPAN: Ryukyu Islands: Tozato Ishigaki-shima, *Amano* 7370 (US); Yaeyama Gunto, Ishigaki; Isl., *Walker & Tawada* 7202 (L, US).

MADAGASCAR: Nossibe, *Boivin* 2235 (G, W); Tulear Prov. nr Ambohibe, Morondafa, *Mabberley* 739 (EAH, K); 20 km SW of Andranovory, *Staples* 223 (CANB).

MALAY PENINSULA: Pulau Besar nr sea, *Maingay* 531 (K).

Mariana Islands: Guam, nr Piti, S of Asan Point, *Anderson* 30 (L); Saipan, sea cliffs on Tsukimi Bay, *Fosberg* 25207 (K, L, US).

MAURITIUS: Mayolle, *Boivin s.n.* (W); Pouce Mountain, *Bouton s.n.* (K).

NEPAL: Sangu, Luitel, *Kanai* 670 605 (BM); Kuchani, nr Jajakot, *Polunin, Sykes & Williams* 5771 (BM); Pokhara, *Wraber* 152 (BM).

PAKISTAN: Rustam to Ambela Kandao, road to Swat, Mardan distr., *Burt* 1495 (E); Dabbeji, Sind, *Koelz* 7606 (US); Peshawar, *Nasir & Siddiqui* 914 (RAW).

PAPUA NEW GUINEA: Erap Grasslands, Lae, Morobe distr., *Hartley* (10207) (A, CANB, G, U, L).

PHILIPPINES: La Paz, Tarlac Prov., Luzon, *Farinas* 37088 (L, PNH); nr Tanculan, Bukidnon Subprov., Mindanao, *Fenix* 26072 (A, BRI, US); San Jose, Occ. Mindore, *Hernaez & Orlido* 1057 (CAHP).

SRI LANKA: 48 km N of Dambulla, Matale distr., *Hepper & Jayasuriya* 4602 (K); Harabane to Kantalai, Polonnaruwa distr., *Rudd & Balakrishna* 3120 (K, US).

TAIWAN: Chi-shan 40 km NE Kaohsiung, *Chien-Chang Hsu* 6487 (TAI); Yulou, Hsinchu, *Kao* 8735 (TAI).

THAILAND: Doi Sutep, nr Chiangmai, *Kerr* 1497 (BM, CAL, K, L); Bennang Sata, Pattani Riv.,

Kerr 7293 (BM, K); Bo Tai, Petchaburi, *Marcan* 2731 (K).

VIETNAM: Cao Phong, Hoa Binh prov., *Anon. s.n.* (C, US); Dong Hain (Kien Khe) Ninh-Binh prov., *Bon s.n.* (K); Tourane & vicinity, *Clemens* 4020 (BM, G, K, U, US, W).

AUSTRALIA:

QUEENSLAND, Lakeland Downs, Cook distr., *Byrnes* 3463 (BRI); Burdekin River nr Home Hill, *McDonald s.n.* (BRI).

AFRICA:

GHANA: nr Dawa, Accra to Ada, *Adams* 4352 (K); Makongo, *Hall* 40499 (K).

GUINEA-BISSAU: Piche to Buruntuma, *Alves Pereira* 2205 (BR); Arredores de Bafata, *Espirito Santo* 2836 (COIM, LISC).

SENEGAL: Yoff S of Dakar, *Berhaut s.n.* (BR); Zingulchor, Casamanche, *Chevalier* 3405 (Hepper FTWA) (Not seen).

SIERRA LEONE: Moria to Dumbaia, Kurn Hills, N Prov., *Morton & Gladhill* 544 (K, WAG, also in FHI, GC, IFAN, SL); nr Franziga, Tambakha County, *Scott Elliot* 5408 (K).

ZAMBIA: Lusaka, orig. W Africa ex Verboom, *Staples* 447 (CANB).

ZANZIBAR: Mile 171 Chwaka, *Faulkner* 3202 (B, BR, K); Mangapuwami Bushland, *Oxtoby* 9 (K).

AMERICA:

JAMAICA: St. Thomas Parish, Yallahs Fording nr sea, *Robertson* 5616 (BM); *ibid.*, *Wynter & Robinson* 3606 (BM).

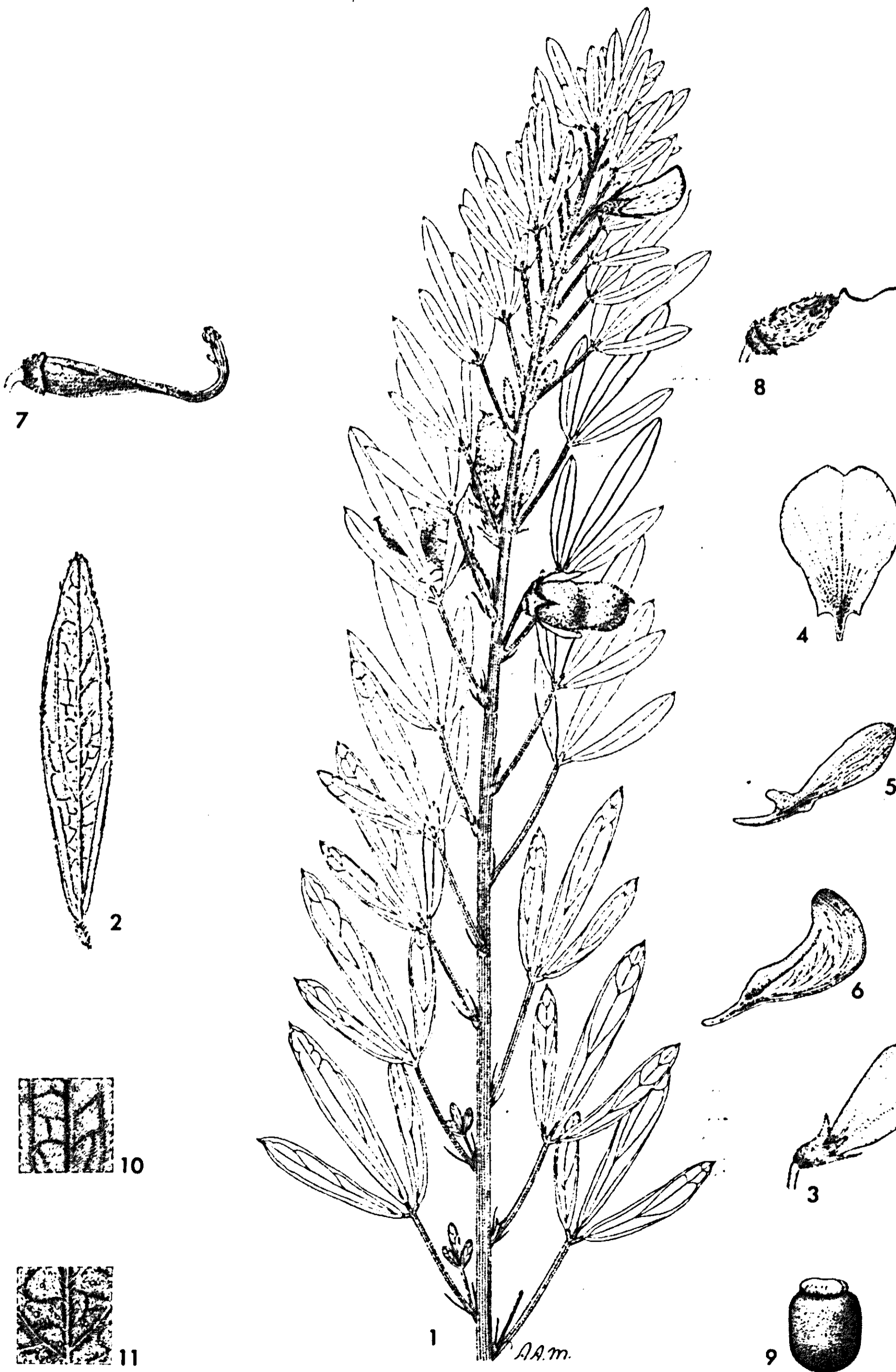
Notes: The combination in *Cajanus* was first made by du Petit-Thouars. Articles 73 and 75 of the 1983 Code allow for correction of the spelling *Cajanus scarabaeoides*.

Specimens from Papua New Guinea usually have longer peduncles than is usual in var. *scarabaeoides*. Floyd 5528 (BRI, CANB) from Erap grasslands, Morobe district, as an extreme looks like var. *pedunculatus* with its long peduncles (2-7 cm) but has the typical hirsute *scarabaeoides* pods. VERDCOURT (1979) decided not to formally name these variants. They are best classified as var. *scarabaeoides*, but obviously differ genetically from the ordinary specimens.

The African accessions from Ibadan (*R.J. Williams coll. s.n.*) have a less dense indumentum on the pod with shorter hairs. Further variability within the species includes leaf size, thickness, colour and shape, observed when growing various accessions together in the Botanical Garden at ICRISAT during different seasons (1978-79). These factors appear to be both genetically and environmentally influenced. Narrow leaflets are found in specimens from the Philippines, Australia, Burma and India.

*C. scarabaeoides* exhibited antibiosis to podborer (*Heliothis armigera* Hub.) as larval periods were extended and weights of larvae and pupae fed on green pods proved. *C. scarabaeoides* also showed mechanical resistance to the podborer, as larvae could not penetrate the pod wall, although this barrier was not effective in younger pods. These characters are difficult to transfer to pigeonpea, most later hybrid generations appear susceptible (W. REED, S.S. LATEEF, pers. commun.).

The variety *pedunculatus* (Reynolds & Pedley) van der Maesen has most often been previously determined as *Atylosia reticulata*.





10.28 *Cajanus sericeus* (Benth. ex Bak.) van der Maesen comb. nov.

Fig. 28, p. 194, Map 35, p. 196, Plate 11, p. 198

*Cajanus sericeus* (Bentham ex Baker) van der Maesen

Basionym: *Atylosia sericea* Benth. ex Baker in Hooker, Fl. Brit. India 2: 213 (1876); Cooke, Fl. Pres. Bombay 1: 408 (1903, repr. 1958, 1967); Gamble, Fl. Presid. Madras 2: 369 (1918), 260 (repr. 1967); Santapau, Fl. Khandala, Rec. Bot. Surv. India 16-1: 72 (1966); Shah, Fl. Gujarat 1: 185 (1978).

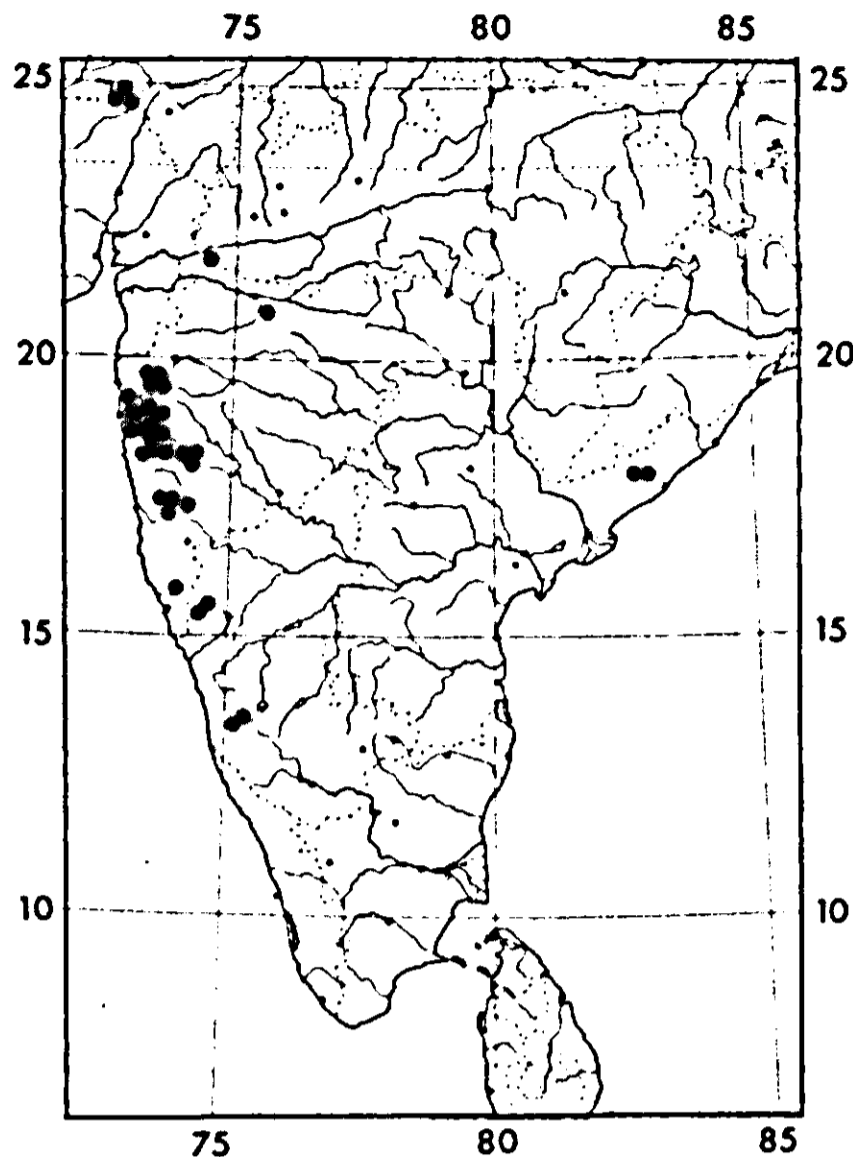
Type: India, Concan, *Stocks s.n.* (lectotype: K; iso: GH). Paratypes: India, Concan, Law (K), India, Concan, Belgaum, *Ritchie s.n.* (E); 4 m S of Belgaum, ?*Ritchie 156* (E); Concan, Ram Ghaut, *Ritchie 156/2* (K).

Homotypic synonym: *Cantharospermum sericeum* (Benth. ex Bak.) Raizada in Mooney, Suppl. Bot. Bihar Orissa 53 (1950).

Erect *shrub*, (0.5)1-1.5 m tall, more or less densely branched. *Branches* quite erect, striate, cauliflorous. *Stipules* conspicuous, narrowly lanceolate, 5-7 (15) mm long, tips purplish, rather persistent. *Leaves* digitately trifoliolate, petiole 1.5-2.5 cm. *Leaflets* soft coriaceous, glandular both sides, lower surface green with adpressed white pubescence, especially on the prominent ribs, upper surface green, thinly evenly pubescent. Hairs 0.2-0.5 mm. Top leaflet oblanceolate, 20-35 mm long, ca 6-7 mm wide, apex obtuse, mucronate, base cuneate; side leaflets obliquely elliptic, 15-22 mm long, 5-6 mm wide; petiolules 1-2 mm. *Stipellae* absent. *Racemes* sessile, axillary, 1-3 flowered, peduncles 1 mm, pedicels ca 5 mm, flowers yellow. *Calyx* pubescent, inside too, glandular, hairs green, later greyish, tube 3-4 mm, teeth triangular, 2-3 mm long, the upper ones almost entirely connate, tips sometimes brownish purple. *Vexillum* obovate, base clawed, auriculate, apex emarginate, 9-11 mm long, 8-9 mm wide. Callosities near the base not pronounced, but two stripes visible, darker than other parts of the flag, especially ventrally. *Alae* obovate-elongate, base curved, auriculate, ca 9 mm long, 1.5 mm wide. Keel petals pale yellow, oblique, clawed, ca 10 mm long, ventrally joined. *Ovary* densely white-pubescent, with long hairs, ca 2 mm long, 2-3 ovules. *Style* glabrous, ca 8 mm, top 4 mm, upcurved. *Stamens* ca 11 mm long, last 3 mm free, upcurved, anthers dorsifix. *Pods* small, oblong, 11-13 mm long, 5-7 mm wide, densely covered with long adpressed silvery hairs, transverse depression at right angle to the sutures, mostly 2 seeds. *Seeds* orbicular or rectangular-rounded, ca 4 mm long, 3-4 mm wide, 2-3 mm thick, grey and black and cream mosaic, strophiole divided, greenish white, 1 X 2 mm.

**Distribution:** India, Western Ghats, Eastern Ghats, Mount Abu, Satpura Mountains.

FIG. 28. *C. sericeus*: 1. branch, 1X; 2. leaflet, 2X; 3. flower, 2X; 4. flag, 2X; 5. wing, 2X; 6. keel, 2X; 7. stamens, 2X; 8. pistil, 2X; 9. seed, 3X; 10. detail upper leaflet surface, 2X 11. detail lower leaflet surface, 2X (1-11: van der Maesen 1961).



MAP 35. *Cajanus sericeus*

**Ecology:** Undershrub in dry deciduous monsoon forest, grassy fields, open hill slopes.

**Altitude:** 500-1300 (2000) m.

**Flowering:** Sep-Jan (-Feb).

**Fruiting:** Oct-Feb (-May).

**Vernacular names:** Rantur (Hindi, Marathi), Jujunia (Oriya), Kondakan-di (Telugu, cf. Lushington, 1915).

#### Specimens examined:

INDIA; Andhra Pradesh: Vishakhapatnam distr.: Aralagudem, Madgol (Madugula) hills, *Lushington s.n.* (K); Endrika block, Madgol hills, *id. s.n.* (K). Karnataka, Belgaum distr.: Belgaum, *Ritchie s.n.* (E); 4 m S of Belgaum, ?*Ritchie 156* (E). N. Kanara distr., hills over Sohaleh, *Young s.n.* (BM). Shimoga distr.: Agumbe Ghat, *Sundara Raghavan 68180* (BSI). S. Kanara distr.: Sameshwar Ghat, *id. 6937 A* (BSI). Maharashtra: Konkan (no further locations): *Cooke s.n.* (BSI); *Dalzell s.n.* (CAL, DD, K); *Hooker* (K); *King* (CAL); *Law* (GH, K, paratype); *Stocks* (K, lectotype); *Stocks and Law* (BM, BR, C, CAL, E, FI, G, GH, L, MEL, OXF, P, U, US, W); Colaba distr.: Matheran, Panorama point, *Anon. s.n.* (BLAT); Pen, *Blatter 11371* (BLAT); on way to Garbut, *Irani 4747* (BLAT); Dasturi and Panorama Point, *id. 5655* (BLAT); *ibid.*, *Woodrow s.n.* (BSI). Dhulia distr.: Turanmal, *Blatter 12452, 12556* (BLAT). Nasik distr.: Deolali, *Ackland 349* (BLAT); Igatpuri, *Blatter 10052, 10352, 11625* (BLAT); Igatpuri to Kasara, *id. 11622* (BLAT); Indor, Kalsubai hills, *Patwardhan 1197* (BSI); Devaldhar hills, Kalsubai area, *Wadhwa 128434* (BSI). Poona distr.: Khandala: *Ackland 348* (BLAT); *Blatter 10588, 10622, 10648, 11102, 11128, 11927* (BLAT); Khandala, Rama's Bed, *id. 10298* (BLAT); Purandhar, *id. 10032, 12579* (BLAT); Lohagad, *id. 10237* (BLAT); Lonavla, *Garade s.n.* (BSI); Ralegaon plateau 10 km W of Junnar, *Hemadri 70172* (BSI); Khandala, *Kapadia 809* (BLAT); *ibid.*, *Kimaralinjam 30745* (BSI); Paud, *S.K. Jain 8281, 8817* (BSI), Karla,



PLATE 11. *Cajanus sericeus*, in botanic garden, ICRISAT.

*id.* 18812 (BSI); S slope of Mulshi lake, 30 km W of Poona, *van der Maesen* 1961 (WAG, ICRISAT); Khandala, Maroli, *Mahajan* 17179 (BSI); Khandala, Bohr Ghat, *Panthaki* 1987, 1988 (BLAT); Khandala, Tank, *Seshagiri Rolla Rao* 78923 (BSI); *ibid.*, Top of Bhoma Hill, *id.* 83454 (BSI); Khandala, *Saldanha* 787 (JCB, US); Sinhgad (Sinhgarh), 12 m SW of Poona, *Patil* 9260 (BSI, CAL); *ibid.*, 2 km from Kandala to Lonavla, *Remanandan* 4679 (ICRISAT); *ibid.*, *Santapau* 102.16 (BLAT); *ibid.*, Rama's Bed, *id.* 102.98 (BLAT); *ibid.*, St. Xavier's Cemetery, *id.* 1221 (BLAT); *ibid.*, St. Mary's Ravine, nr Engineer's Bungalow, *id.* 1342 (BLAT); *ibid.*, Meroli Plateau, *id.* 1243 (BLAT); *ibid.*, Battery Hill Plateau and Monkey Hill, *id.* 2980 (BLAT); *ibid.*, St. Xavier's Villa Top, *id.* 3134 (BLAT); *ibid.* Sausages Top, *id.* 5195 (BLAT); *ibid.*, to Echo Point, *id.* 10212 (BLAT); Bhimashankar, *Talbot* 5045 (BSI); Ambavne, Kotri forest, *Venkata Reddy* 93377 (L). Ratnagiri distr.: Amleoti Ghat, Savantvadi, *Palgado s.n.* (CAL); Ram Ghat, *Ritchie* 156/2 (paratype, K). Satara distr.: Mahabaleshwar, *Almeida* 243 (BLAT); Panchgani, *Blatter* 10353 (BLAT); *ibid.*, *Bhide* 1096 (BSI); Mahabaleshwar, Bhilar Estate, *Bole* 1252 (BLAT); *ibid.*, Bhilar, *Santapau* 11764 (BLAT); Mahabaleshwar to Panchgani, *Sedgwick & Bell* 4744 (CAL, K); Wai, *Talbot* 4462 (BSI). Thana distr.: Parsik hill, nr Thana, *Blatter* 10474 (BLAT). Rajasthan: Siroki distr.: Mount Abu, Gamurte, *Anon s.n.* (CAL 128670); *ibid.*, Gurishankar, *Blatter* 11980 (BLAT); *ibid.*, to Shergaon, *id.* 12027 (BLAT); *ibid.*, *Duthie* 6631 (CAL, DD, K); *ibid.*, *King s.n.* (CAL).

Notes: In the Poona, Satara, Colaba and Nasik districts specimens were found in recent times. The plants collected in Mount Abu, Satpura mountains and Vishakhapatnam district are at least sixty years old. In Mount Abu the species could not be found recently, indicating at least a low frequency in those periferal areas of occurrence. On Endrika Hill, one of Lushington's (1915) locations, *C. sericeus* could not be found in 1981. The vegetation around the hill is severely denuded due to shifting cultivation, the hill itself (ca 1000 m) is now almost completely barren. *Cajanus sericeus* is much less widespread than *C. lineatus*. *C. sericeus* is listed by R.S. RAO (1978) as characteristic of bare grassy hill tops of the Karnataka ghats, however, the species is most commonly found in Maharashtra.

The flowers are sessile and the fruits may remain indehiscent for a few months. The fruits have rarely more than two seeds per pod, at ICRISAT the specimens never had more than two ovules per ovary or two seeds per pod, a *Rhynchosia*-like character. BAKER, GAMBLE and others must apparently have seen 3-ovuled ovaries, otherwise they would have classified the species in *Rhynchosia*. The habit is quite similar to that of *C. lineatus*.

BAKER (1876) describes the corolla colour as red. Probably the reddish-brown faded petals remaining on the developing pod led to this description. The flower colour, if at all reported, is (pale) yellow, but the Lushington specimens from Vishakhapatnam district (Andhra Pradesh) were red according to GAMBLE (1918). I found the species only once, with yellow flowers at Mulshi lake near Poona. More observations in situ are warranted on ovaries during collection.

Conspecificity with *C. lineatus*, as suggested by KOPPULA HEMADRI (The Flora of Junnar and surroundings, Poona district, Maharashtra State, unpubl. thesis) is questionable. Leaflet size and shape, stipule size, and flowering habit are sufficiently different to keep the species apart. The possibility of natural hybridization (Hemadri, *ibid.*) is quite good. In the progeny of *C. sericeus* at ICRISAT Center hybrids regularly occur, supposedly from *C. cajan* pollen but this cannot be ascertained, since *C. lineatus* flowers have also been present concurrently.

Bees are the most likely pollen vectors. However, after many attempts, crosses between *C. lineatus* and *C. sericeus* yielded only a single hybrid in 1979-80 (Table 6).

*C. sericeus* is less suitable as food for *Heliothis armigera* Hub. This antibiosis is being investigated further (W. REED, pers. commun.).

10.29 *Cajanus trinervius* (DC.) van der Maesen comb. nov.

Fig. 29, p. 200, Map 36, p. 202, Plates 12, 13, p. 201, 204

*Cajanus trinervius* (de Candolle) van der Maesen comb. nov.

Basionym: *Collaea trinervia* DC., Mem. Leg. 6: 247 (1825) t. 41.

Type: India, Nilgiri Mountains, Leschenault (Montagnes de Nelligery dans l'Inde orientale) (holo: P; iso: P). Illustration in Mem. Leg.

Homotypic synonyms: *Odonia trinervia* (DC.) Spreng., Syst. ed. 16 Suppl. 4-2: 279 (1827).

*Cantharospermum trinervium* (DC.) Taub. [as (Spreng.) Taub.] in Engl. & Prantl, Nat. Pflz.fam. 3-3: 373 (1894).

*Atylosia trinervia* (DC.) Gamble, Fl. Presid. Madras 2: 368 (1918), 260 (repr. 1967), Fyson, Fl. S. Indian Hill Stations 1: 170; 2: 131 (1932); Sharma et al., Bull. Bot. Surv. India 15-182: 56 (1973); Fernando, Wild Fl. Ceylon 2nd ed. 39 (1980).

Heterotypic synonyms: *Rhynchosia?* *Wightiana* Grah. ex Wall. nom. nud., Wallich's Cat. 550 (1831).

Based on: India, Wight Herbar. (K).

*Atylosia Candollii* W. & A., Prodr. 1: 257 (1834).

Type: India, Wight 763 (holotype: E).

*Atylosia Candollei* W. & A., orthographic rectification, Baker in Hooker, Fl. Brit. India 2: 212 (1876); Thwaites, Enum. Pl. Zeyl. 91 (1864); Willis, Rev. Cat. Fl. Plants Ceylon, Ann. Roy. Bot. G. Peradeniya 4-7: 494 (1910); Rama Rao, Fl. Pl. Travancore 127 (1914); Fyson, Fl. Nilgiri Pulney Hill-Tops 1: 120 (1915, repr. 1974); Trimen, Hand-Book Fl. Ceylon 2: 78 (1894, repr. 1974).

*Atylosia major* W. & A., Prodr. 1: 257 (1834).

Type: India, Wight 762 (holotype: E; isotypes: CAL, G, K, MH, P).

*Atylosia trinervia* (DC.) Gamble var. *major* (W. & A.) Prain ex Gamble, Fl. Presid. Madras 2: 368 (1918), 260 (repr. 1967), based on *A. major* W. & A.

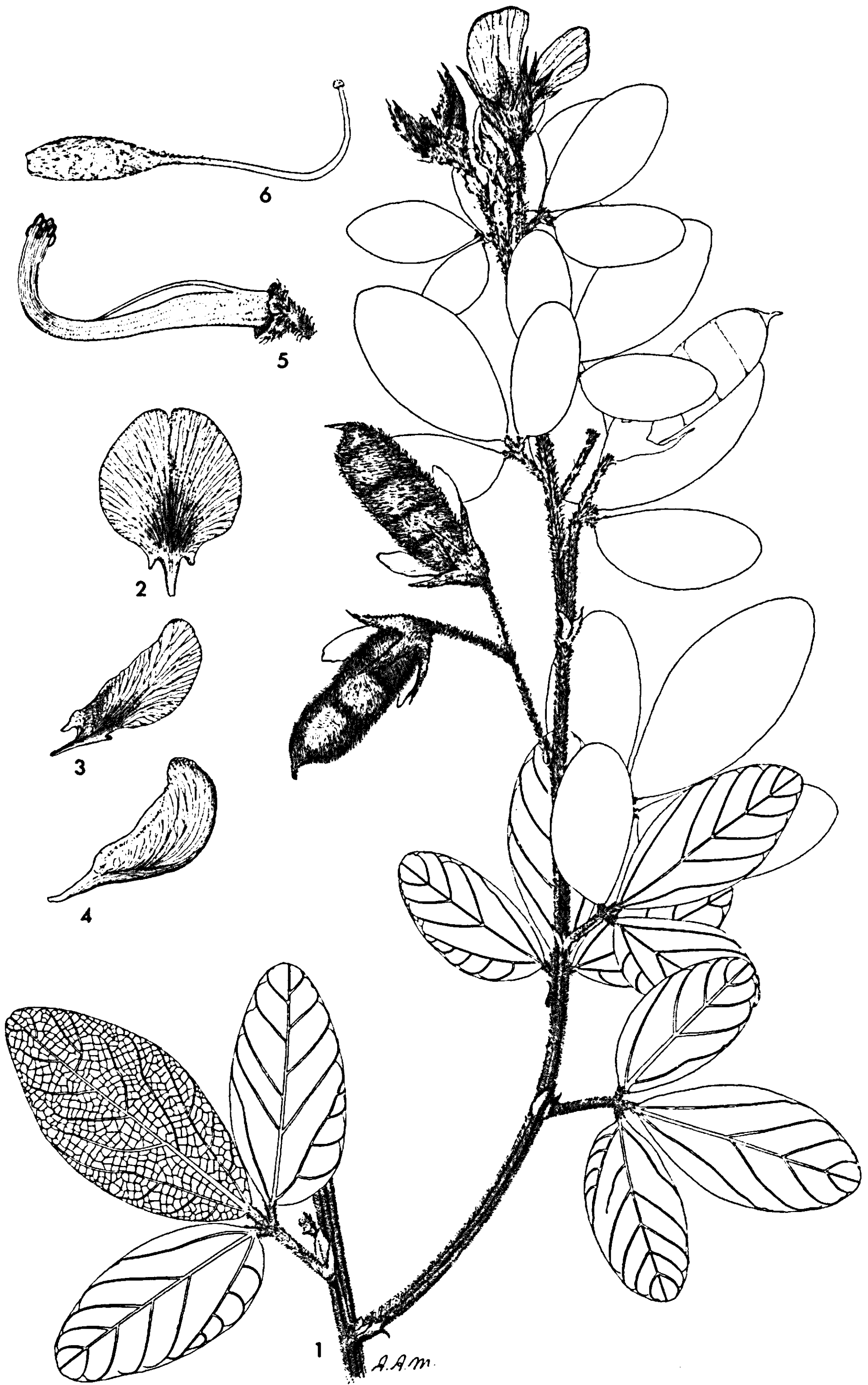




PLATE 12. *Cajanus trinervius* on Doddabetta Peak, Ootacamund, Nilgiri district, S India, 2630 m.

Erect *shrub*, perennial, height 0.5-2 m. *Stems* and branches straight, terete, densely pubescent, golden brown at the top, becoming less dense and greyish with age. *Stipules* triangular-lanceolate, acuminate, up to 5 mm, pubescent, caducous. *Leaves* digitately trifoliolate, petiole 5-18 mm. *Leaflets* thick, soft, lower surface reticulate, shortly haired, longer on the veins, upper surface evenly covered with short hairs, ovate to elongate-ovate, apex acute to obtuse, mucronate, end leaflet 2-6 cm long, 1-2.7 cm wide, side leaflets 1.5-4 cm long, 0.8-2.3 cm wide; petiolules 2-3 mm, stipellae none. *Racemes* short, pubescent, peduncles

FIG. 29. *C. trinervius*: 1. branch, 1X; 2. flag, 1X; 3. wing, 1X; 4. keel, 1X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface 2X (1-9: van der Maesen 3010).

5-15 mm, (1-)2-flowered, pedicels 5-15 mm, flowers yellow, flag red-purple veined, marcescent. *Bracts* ovate-acuminate, dorsally pubescent, ventrally glabrous, ca 4 mm long, 3 mm wide. *Calyx* pubescent (interior also), hairs golden brown up to 2 mm, bulbous-based or not, especially the interior ones bulbous-based, tube ca 5-6 mm, teeth lanceolate, 7-15 mm long, the lower one longest, the upper ones connate. *Vexillum* obovate, base clawed, auriculate, apex emarginate, 20-28 mm long, 9-20 mm wide. *Alae* obovate, base clawed, auriculate, 17-25 mm long. Keel petals rounded-oblique, clawed, 17-22 mm long. *Ovary* densely whitish-pubescent with long hairs of ca 2 mm, ca 7 mm long, 2 mm wide, style ca 16 mm long, base pubescent, upcurved glabrous top 7 mm, stigma capitate, ca 5-7 ovules. *Stamens* ca 20 mm long, free part ca 6 mm, upturned, anthers dorsifix. *Pods* oblong, 2-4 cm long, ca 1 cm wide, ends rounded, base of the style pointing down, (3-)5-7 seeds, very pubescent, sticky, transverse depressions at a right angle to the sutures. *Seeds* rectangular-rounded, ca 4 mm long and wide, ca 2.5 mm thick, dark brown, strophiole large, whitish, divided.

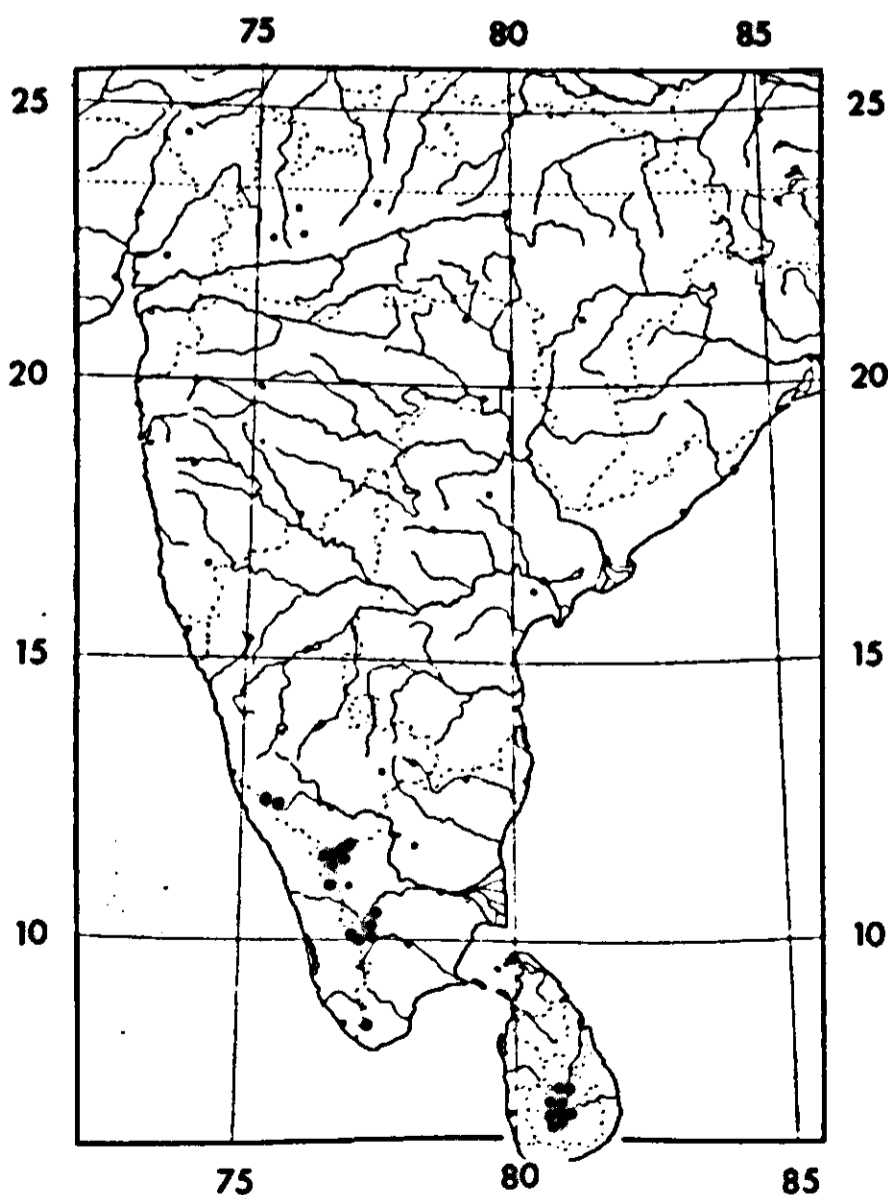
**Distribution:** Hills and hilltops of South India and Sri Lanka.

**Ecology:** In scrub vegetation, open forest, grasslands, between boulders.

**Altitude:** (850-) 1400-2650 m.

**Flowering:** almost throughout the year, less in the monsoon (July).

**Fruiting:** mainly Jan-Mar, also May-Aug, less during Oct-Dec.



MAP 36. *Cajanus trinervius*



Vernacular names: Kadukadale, Kadutogari, Katutogari (Kannada, cf. Lushington, 1915). Kattuthuverai (= wild pigeonpea), (Malayalam, Kerala, cf. Rama Rao, 1914), Et-tora (Sinhalese, cf. Willis, 1910), Eth-thora (Sinhalese).

#### Specimens examined:

Not listed are the numerous accessions from the Nilgiri hills (India) without more precise location or simply Ootacamund or Coonoor. These include specimens collected by *Beddome, Fyson, Gamble, Hooker, King, Leschenault* (the type), *Perrottet, Wallich* and *Wight*.

INDIA: Tamil Nadu, Coimbatore distr.: Periakotimale, Attapadi hills, S. Malabar, *Fischer 2394* (CAL). Nilgiri distr.: Doddabetta peak, Ootacamund, *Ansari 1047* (CAL); Coonoor, *Bourne s.n.* (K); Snowdon, Ootacamund, *Bourne 4627* (K); Coonoor, *Clarke 10514* (CAL); Ootacamund, *Clytron s.n.* (MH); Kotagiri, *Edie 4392* (K); Kinnacoorie, *Fischer 1712* (CAL); Bikkapattimund, *Fischer 4580* (CAL); Kartery, *Foulkes s.n.* (K); Coonoor to Ootacamund, *Gamble s.n.* (MH); Doddabetta, *Gardner s.n.* (OXF); Kartery, *Gardner s.n.* (OXF); Kartery, in montibus Nilageri, *Hohenacker 1188* (BM, C, CAL, E, FI, G, K, L, MEL, MPU, P, STU, U, US, W, WU); 4 km S of Kodanad viewpoint, *van der Maesen 2674* (ICRISAT, K, WAG); Kotagiri, *Morjoribanks 7471* (K); Lamb's Rock, Coonoor, *Radhakrishnan 39102* (MH); Staircase Shola, *Kirat Ram s.n.* (DD); Kottabettu-Kotagiri, *Sebastine 915* (MH); Upper Tiger Shola, Coonoor, *id. 2084* (MH); Pakaswa Malai Fort, *id. 4177, 8087, 8088* (MH); Pakaswara hills, *Sebastine 4805* (L); Naduvattam to Gudalur, *B.D. Sharma 35918* (MH); Snowdown reserve forest, *id. 36001* (MH); Thia Sholai to Dodaikombai, *B.V. Shetty 34337* (MH); Mullimund, Avalanche, *id. 37599* (MH); Black Bridge reserve forest, *Sinclair 3402* (E); Bimaka Shola, *G. V. Subha Rao 36368* (MH); nr Ebanad, *id. 37361* (MH); Upper Bhavani, *Townsend & Ramamoorthy 80* (JCB); Longwood reserve forest to Kotagiri, *Vajravelu 35138* (MH); Shola nr Kodanad viewpoint, *id. 36870* (MH); Kunnakombai Shola, *id. 43638* (MH); Kartery falls, Coonoor, *Watt s.n.* (E). Madurai(i) distr.: High Wavy mountains, *Blatter 603, 11223-1154* (BLAT); High Wavy mountains, *K.C. Jacob 17589* (CAL, K); Kodaikanal, *Janaki 89* (MICH). Tirunelveli distr.: Thukek-kamparai, Thirukurungudi (850 m!), *Kartikayan 40161* (MH). Karnataka, Coorg distr.: Brahmagir-is, *Anon. 7-12-1907* (BLAT). Kerala, Idiki distr.: Munnar to Devicolam, *Ananthkrishnan s.n.* (RHT); 14 km W of Top Station, *van der Maesen 4820* (ICRISAT, WAG); Devicolam, *Meebold 13479* (CAL).

SRI LANKA (CEYLON): nr Paradryme, *d'Alleizette s.n.* (L); Hunnasgiriya, culvert 25/10, Kandy distr., *Cramer 3617* (PDA); Culvert 55/5, Hakgala-Boragas rd, Nuwara Eliya distr., *id. 3871* (US); Ambawela-Boragas rd, *ibid.*, *id. 4977* (US); St. Coombes estate, Jalawakelle, *Douglas Simpson 8886, 8887* (BM, PDA); Pusselawa, *Gardner 240* (BM, FI, K); Galagama, C. prov., *id. s.n.* (PDA); E. of Hunnasgiriya, marker 24/14, *Jayasuriya et al. 1416* (K, US); Boralanda to Welimada, Badulla distr., *Jayasuriya & Austin 2257* (PDA); 2 km E of Hunnasgiriya, *van der Maesen 4027* (ICRISAT, WAG); Loolecondera Group, 45 km from Kandy, Nuwara Eliya distr., *id. 4047* (ICRISAT, WAG); Helbodde km 41.7, Nuwara Eliya distr., *id. 4159* (ICRISAT, WAG); 1 km S of Hakgala, *id. 4168* (ICRISAT, WAG); Haputala to Bandarawela nr Diyatelawa, Badulla dt, *id. 4179* (ICRISAT, WAG); Welimada to Ettampitya, Badulla distr., *id. 4183* (ICRISAT, WAG); Nuwara Eliya to Hakgala, *Maxwell 885* (PDA, US); Kandy to Maturata, culvert 20/5, Nuwara Eliya distr., *id. 997* (PDA, US); NE to Badulla on A 5, culvert 53/11, *id. 1013* (PDA, US); *ibid.*, culvert 54/1, *id. 1014* (PDA); N OF Haputale, Thangamalai Forest Reserve, Nuwara Eliya distr., *Maxwell & Jayasuriya 765* (US); 800 m S of Subpostoffice, Hakgala, Badulla distr., *Maxwell & Jayasuriya 903* (PDA, US); below Ohiya railroad station, *Mueller-Dombois 67091502* (PDA, US); Horton Plains at World's End, *id. 67070848* (PDA, US); Hakgala to Ambawela, marker 5/3, *Mueller-Dombois & Comanor 67091407* (PDA, US); McDonald's valley below Hakgala, Nuwara Eliya distr., *Rudd & Balakrishnan 3166* (K, PDA, US); Gurutalawa, St Thomas College area, Badulla distr., *id. 3187* (PDA, US); Madugoda to Hunnasgiriya, marker 24/19, Kandy distr., *id. 3245* (E, K, L, PDA); Hewaheta, marker 23/2, Nuwara Eliya distr., *Rudd & Jayasinghe 3251* (K, PDA, US); Hakgala, *de Silva s.n.* (PDA); Ohiya to Boralanda, marker 9/5, Nuwara Eliya distr., *Sohmer & Sumithraarachchi 10056, 10058* (PDA); nr Boralanda, Badulla distr., *Stone 11223* (PDA); Bandarawela to Haputale, marker 10/12,



PLATE 13. *Cajanus trinervius* between grasses on Doddabetta Peak, South India.

Badulla distr., *D.B. & D. Sumithraarachchi* 928 (PDA); Ohiya to Horton Plains road, *id.* 946 (PDA, US); Galagamer, *Thwaites CP 2P9, CV 224* (K); 7 km from Palugama on Boralanda road, Badulla distr., *Townsend 73/125* (K, US); sine loc., *Walker-Arnett s.n.* (E, FI, G, GH, K, P, PDA); *id.* 315 (K); sine loc., *Wight 258* (E).

Notes: SHARMA et al. (1973) while describing the flora of Mahendragiri Hill (Kanyakumari and Tirunelveli districts, Tamil Nadu, India) mention (p. 50) *Atylosia trinervia* as a climber. This must be a misidentification. The species under consideration is probably *C. albicans*. On p. 56 they list *A. trinervia*, and this identification is correct (specimen seen, MH).

*Atylosia major*, described by WIGHT and ARNOTT as a separate species, and intended as a variety by PRAIN (1897) and GAMBLE (1918), is only distinguished by larger flowers, leaflets and a denser indumentum. This is no doubt the effect

of a more salubrious ecology and a continuous variation can be observed now that more material is available.

The Sri Lanka material is distinguished from the South Indian specimens by narrower leaflets. Even when the difference is of a genetical nature, the two populations (S India and Sri Lanka) belong naturally to the same species. WIGHT and ARNOTT (1834) remarked that the Ceylon plants were more robust with the habit and leaves of *A. major*, but were of the opinion that the specimens were nevertheless distinct. A separate 'robusta' variety has never been validly published, but some written herbarium labels carry that name. The scanty information on plant height points to similar ranges, 60-150 cm (Sri Lanka), 50-200 cm (India).

### 10.30 *Cajanus villosus* (Benth. ex Baker) van der Maesen comb. nov.

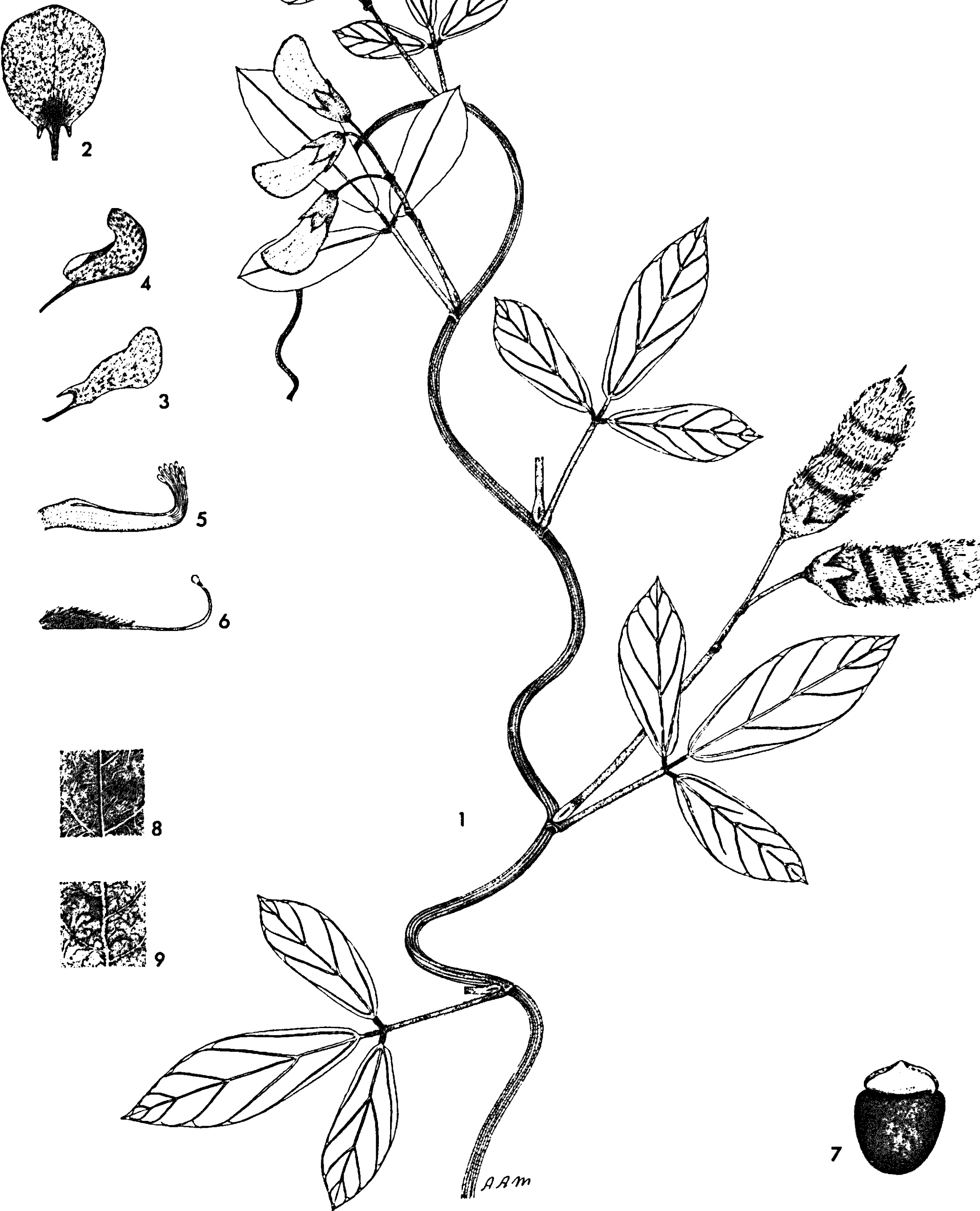
Fig. 30, p. 206, Map 15, p. 116

*Cajanus villosus* (Benth. ex Baker) van der Maesen comb. nov.

Basionym: *Atylosia villosa* Benth. ex Baker in Hooker, Fl. Brit. India 2: 214 (1876); Nguyen Van Thuan, Fl. Cambodge, Laos, Viet-nam 17: 112 (1979).

Type: India, Sikkim, lower hills, 4000 ft, *Hooker fil.* 376 (holotype: K; isotypes: GH, K, P).

*Creep*er-climber, probably perennial. *Branches* shortly pubescent, faintly terete, 0.5-1 m. *Stipules* very minute, triangular, less than 1 mm, pubescent, caducous. *Leaves* subdigitately trifoliolate, petiole up to 3 cm, rachis up to 3 mm. *Leaflets* subcoriaceous, glandular below, ribs prominent and pubescent below, surface thinly grey pubescent, upper surface thinly pubescent, top leaflet obovate-elliptical, tip cuspidate, base cuneate, 2.5-4 cm long, 1.2-1.9 cm wide; side leaflets obliquely ovate to obovate, tip cuspidate, base cuneate, 2.5-4 cm long, 1.2-1.9 cm wide, petiolules ca 1 mm, stipellae setaceous, ca 1 mm. *Racemes* dense, up to 5-flowered, peduncle 0.5-6 cm, pedicels 5-8 mm, straight, later sometimes recurved, corolla possibly yellow, marcescent. *Bracts* elliptical, glabrous, surface rugose, up to 14 mm long, caducous. *Calyx* almost glabrous, margins pubescent, tube 3-5 mm, long; teeth lanceolate, 3-5 mm long, the upper ones connate except the tips. *Vexillum* obovate, ca 17 mm long, 14 mm wide, base clawed, auriculate, top emarginate. *Alae* obovate, clawed, base with a long auricle, ca 15 mm long, 5 mm wide. Keel petals obovate, ventrally joined, base clawed, ca 10 mm long, 5 mm wide. *Ovary* 8 mm, densely covered with long hairs (up to 3 mm), style ca 11 mm, about the middle upcurved, pubescent except in the curve, ovules 5-6. *Stamens* ca 18 mm long, free part ca 5 mm, upcurved. *Pods* oblong, 2-3.5 cm long, 0.8-1.1 cm wide, densely covered with spreading brown long silky hairs, tipped with the base of the style, transverse depressions at about right angles to the sutures, quite covered by hairs, 5-6 seeds. *Seeds* ca 4 mm long, 3.5 mm wide, 2 mm thick, rectangular-rounded, blackish, strophiole large, divided, light coloured.



Distribution: India, Sikkim and West Bengal Himalayan foothills, Terai.

Ecology: probably creeping, in grass and low shrubs.

Altitude: 150-1300 m.

Flowering: Sep.

Fruiting: Oct.

Vernacular names: not known.

**Specimens examined:**

INDIA, Sikkim: Dulkajhar, Terai, 500 feet, *Clarke 36759* (BM, CAL, FI, K); Regio trop. 4000 feet, lower hills, *Hooker f. 376* (K, holotype; isotype: GH, K, P). West Bengal: sine loc., *Anon. s.n. 512*, lower India, Dec. 1894 (K); Pankaban 1500 feet, *Gamble 169* (CAL, K); Darjeeling Terai, *Gamble 28077* (K); East Duars, *Haines s.n., 1895* (CAL); Tondu Forest, Jalpaiguri Duars, *Haines 551* (E, K).

Notes: In the protologue the flowers were not described as BAKER only had a single fruiting specimen at his disposal. *Cajanus villosus* is a rarely collected species, only about eight gatherings are deposited. It appears to be very localised in the Sikkim and Darjeeling Terai. Attempts made in approachable places to collect this species recently were in vain (REMANANDAN, VAN DER MAESEN, unpublished).

THUAN (1979) considered *Atylosia villosa* a (new) synonym of *A. scarabaeoides* on the basis of its very densely haired pods. However, since *C. villosus* pods are much larger, and the foliage consists often of larger acuminate-cuspidate leaflets, its alliance is more with *C. mollis* in Section *Volubilis*.

**10.31 *Cajanus viscidus* van der Maesen sp. nov.      Fig. 31, p. 208, Map 4, p. 63**

*Cajanus viscidus* van der Maesen sp. nov.

Type: West Australia, Camp Creek, Mitchell Plateau, West Kimberley (14 52 S, 125 46 E), *K. Kenneally 4807* (holo: K; iso: K, ex PERTH).

*Frutex viscidus, semi-erectus vel procumbens, folia trifoliolata, pinnata, petiolis tenuis, foliola ovata, membranacea, glandulae conspicuae. Calyx pubescens, dentibus lanceolatis, corolla aurea, in gemma castanea, caduca, ovarium pubescens. Legumina parva, oblonga, viscida, 3-4-seminalis, indumentum sparsum, strophiola seminum divisa. Species rarior ad sectionem Fruticosa pertinens, differt ab ceteris, habitu semi-erecta, viscida, aliquantum C. elongato in sectione Cantharospermum affinis. Planta in Australia occidentalis (Kimberleys) endemica.*

FIG. 30. *C. villosus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface 2X (1-9: *Haines 551*).

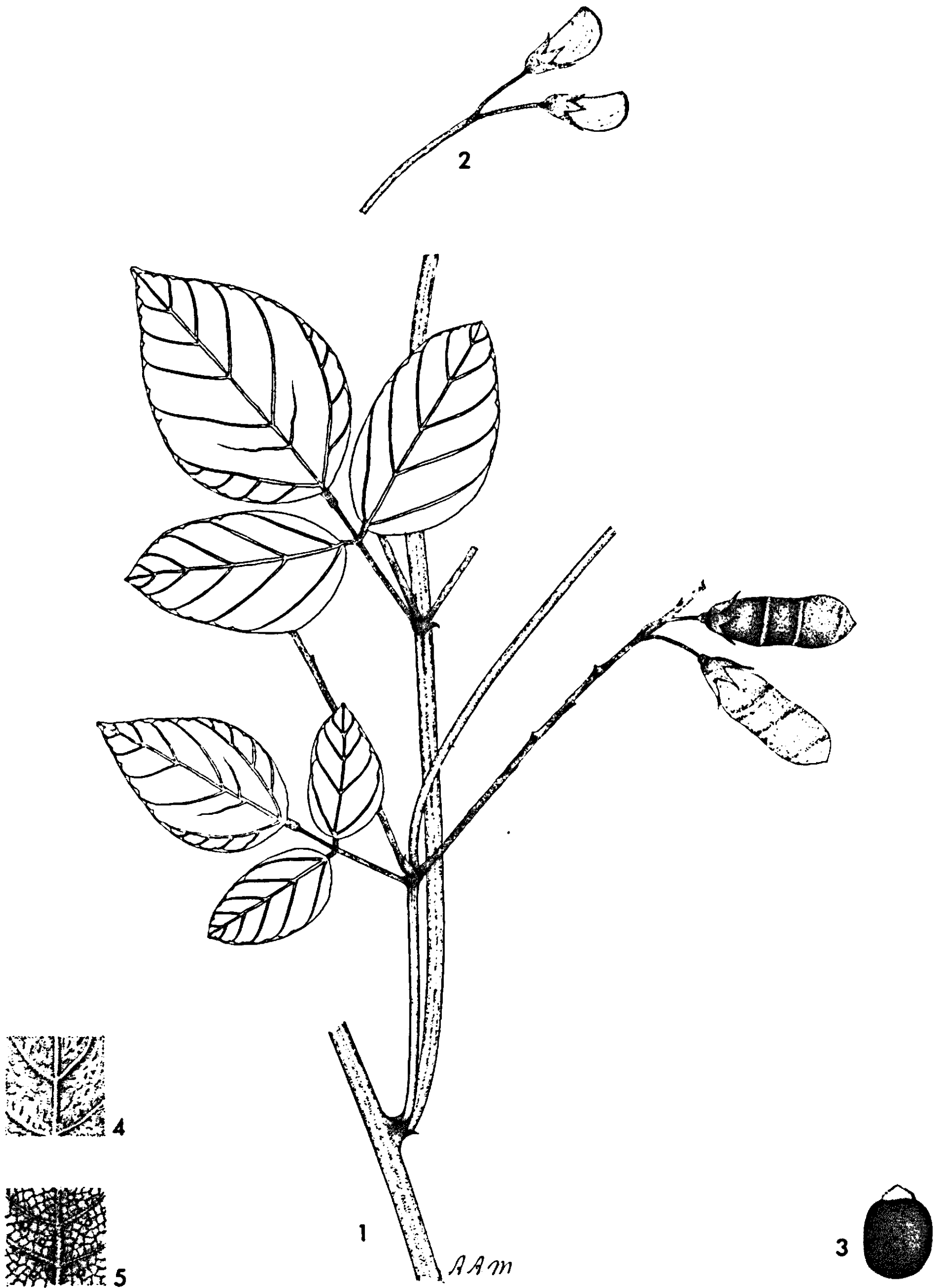


FIG. 31. *C. viscidus*: 1. branch, 1X; 2. flag, 2X; 3. wing, 2X; 4. keel, 2X; 5. stamens and stigma, 2X; 6. pistil, 2X; 7. seed, 3X; 8. detail upper leaflet surface, 2X; 9. detail lower leaflet surface, 2X (1-9: K. F. Kenneally 4807, holo).

Spindly viscid *shrub*, ca 1 m. *Indumentum* sparse, short hairs on veins and striations of branches. *Branches* straggling, striate, brown. Yellow vesicular glands present. *Stipules* triangular-elongate to linear, 2-4 mm long, rather caducous. *Leaves* pinnately trifoliolate, petiole slender, 1.5-3.5 cm long, rachis 0.4-1.2 cm long, petiolules slender, 2-3 mm long. *Leaflets* thin, membranaceous, viscid, thinly pubescent above, pubescent on the veins below, vesicular glands both sides, veins raised below. Top leaflets ovate, 2-3.5 cm long, 1-3 cm wide, apex acute, base truncate to rounded. Side leaflets obliquely ovate, 1.5-3 cm long, 0.8-2.5 cm wide, apex acute, base rounded. *Stipellae* short, 0.5 mm. *Racemes* axillary or terminal, up to ca 15-flowered, peduncles slender, 6-15 cm long, flowers yellow, maroon in bud, corolla caducous. *Bracts* small, hairy ovate scales, up to 2 mm long, very caducous. *Calyx* pubescent, tube ca 2-4 mm, teeth lanceolate, 3-5 mm long, upper ones connate except at the tip, lower one longest. *Vexillum* obovate, ca 12 mm long and wide, apex emarginate, base clawed, auriculate, margins of auricles retroflexed, two callosities near the base. *Alae* obovate, ca 13 mm long, 3 mm wide, base biauriculate. Keel petals oblique, ca 13 mm long, ventrally adnate. *Ovary* pubescent, ca 3 mm long, style 14 mm long, base thinly pubescent, top 5 mm upcurved, stigma terminal, globose. *Stamens* ca 15 mm long, top 4 mm free, upcurved. Anthers dorsifix. *Pods* oblong, thinly pubescent, viscid, 2-3 cm long, 0.6-0.9 cm wide, apex and base oblique acute, base of style (1 mm) persisting, transverse depressions oblique to almost straight, 3-4 seeds. *Seeds* obovoid, ca 5 mm long, ca 4 mm wide, ca 1.5 mm thick, light brown, strophiole divided.

**Distribution:** West Australia.

**Ecology:** On sandstone, near (seasonal?) water.

**Flowering and fruiting:** June.

**Specimens examined:**

WEST AUSTRALIA: Camp Creek, Mitchell Plateau, West Kimberleys (14° 52'S, 125° 46'E), *Kenneally 4807* (holotype: K; isotypes: K, specimen at PERTH not seen); Mitchell Falls, Mitchell Plateau, West Kimberleys (14° 49'S, 125° 40'E), *Kenneally 5018* (paratypes: K, specimen at PERTH not seen).

**Notes:** One of the isotype sheets has a 5-folioled leaf. Such anomalies also exist in pigeonpea.

The seeds received from Ord River Station, West Australia, through CSIRO with the epithet '*viscosa*', gave rise to somewhat similar but rather prostrate plants with broad, flat, 2-seeded pods like those in *Rhynchosia aurea* DC., but only green-reticulate and not purple-variegate. The strophiole is horse shoe-shaped, unlike that in *Cajanus viscidus*, but similar to *C. marmoratus* and *R. aurea*. Leaf size, shape and texture differ from *C. viscidus*. The Ord River specimen belongs to *Rhynchosia*.

*Cajanus volubilis* (Blanco) Blanco, Fl. Filip. ed. 2: 417 (1845).

Basionym: *Cytisus volubilis* Blanco, Fl. Filip. ed 1: 599 (1837).

Neotype: Philippines, Pantay Antipolo, Species *Blancoanae* 142, Merrill (type: US; isotypes: A, BM, CAL, GH, K, L, W).

*Climber, perennial. Branches* brownish pubescent, short hairy, terete, length upto several m. *Stipules* small, ca 2-4 mm long, triangular-acuminate, pubescent, caducous. *Leaves* pinnately trifoliolate, petiole 1.4-5 cm, rachis 0.6-1.5 cm. *Leaflets* membranaceous, not crassus, lower surface greyish pubescent, hairs mainly on the brownish more or less prominent ribs, glandular-punctate, upper surface green, thinly puberulous especially on the veins, top leaflet rhomboid-acuminate, below the middle rounded or narrowing to the rounded or cordate base, apex cuspidate-acuminate, 4.5-10 cm long, 3-6.5 cm wide, side leaflets obliquely ovate, apex acuminate-cuspidate, 4.0-8.5 cm long, 3-5.5 cm wide, petioles 2-4 cm, stipellae 1-3 mm, setaceous. *Racemes* not very crowded, upto 12 cm, 1-2 flowers per node. Flowers yellow?, marcescent. *Bracts* elliptic-elongate, quite large, upto 19 mm long, upto 10 mm wide, apex acuminate, almost glabrous except the margin, pedicels ca 1 cm. *Calyx* grey-puberulous, with some bulbous-based hairs, tube 4-6 mm, teeth triangular-obtuse, 3-5 mm, lowest longest, upper ones almost entirely connate. *Vexillum* obovate, apex emarginate, base clawed, 2 reinforced auricles, 18-22 mm long, 11-16 mm wide. *Alae* obovate, base auriculate, 16 mm long, 4-6 mm wide. Keel petals rounded-oblique, 16 mm long, ventrally joined. *Ovary* 5 mm, densely covered with long adherent white hairs, 6 ovules, style ca 15 mm, about the middle upturned, pubescent except in the curve, stigma capitate. *Stamens* ca 20 mm long, free part ca 5 mm, upcurved. Pods sturdy, oblong, ends rounded, acuminate with base of style, ca 4.5 cm long, 1.2 cm wide, ca 6 seeds, first sparsely clad with long hairs, later only the short-puberulous surface remains. Transverse depressions about at a right angle to the sutures, deep, sutures sometimes somewhat undulate. *Seeds* rounded, broader than long, 5 mm broad, 4.5 mm long, 2 mm thick. *Strophiole* divided, not so large.

**Distribution:** Philippines, Indonesia (Sulawesi).

**Ecology:** Climber in forests and thickets.

**Altitude:** lowland.

**Flowering:** Nov.

**Fruiting:** Dec.



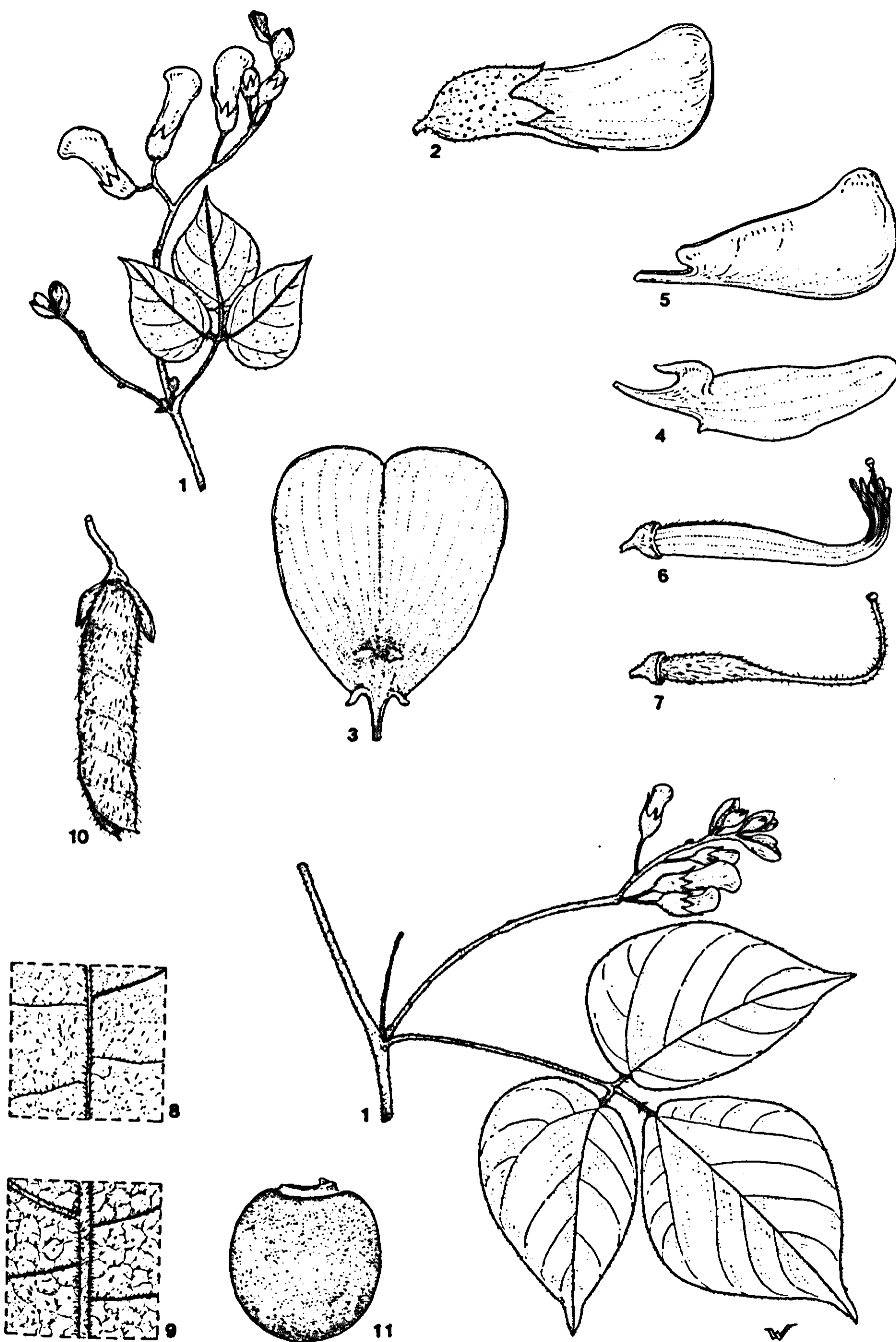


FIG. 32. *C. volubilis*: 1. branch,  $\frac{2}{3}X$ ; 2. flower, 2X; 3. flag, 2X; 4. wing, 2X; 5. keel, 2X; 6. stamens and stigma, 2X; 7. pistil, 2X; 8. detail upper leaflet surface, 4X; 9. detail lower leaflet surface 4X; 10. pod,  $\frac{2}{3}X$ ; 11. seed, 4X (1-11: Merrill, *Species Blancoanae* 142).

### Specimens examined:

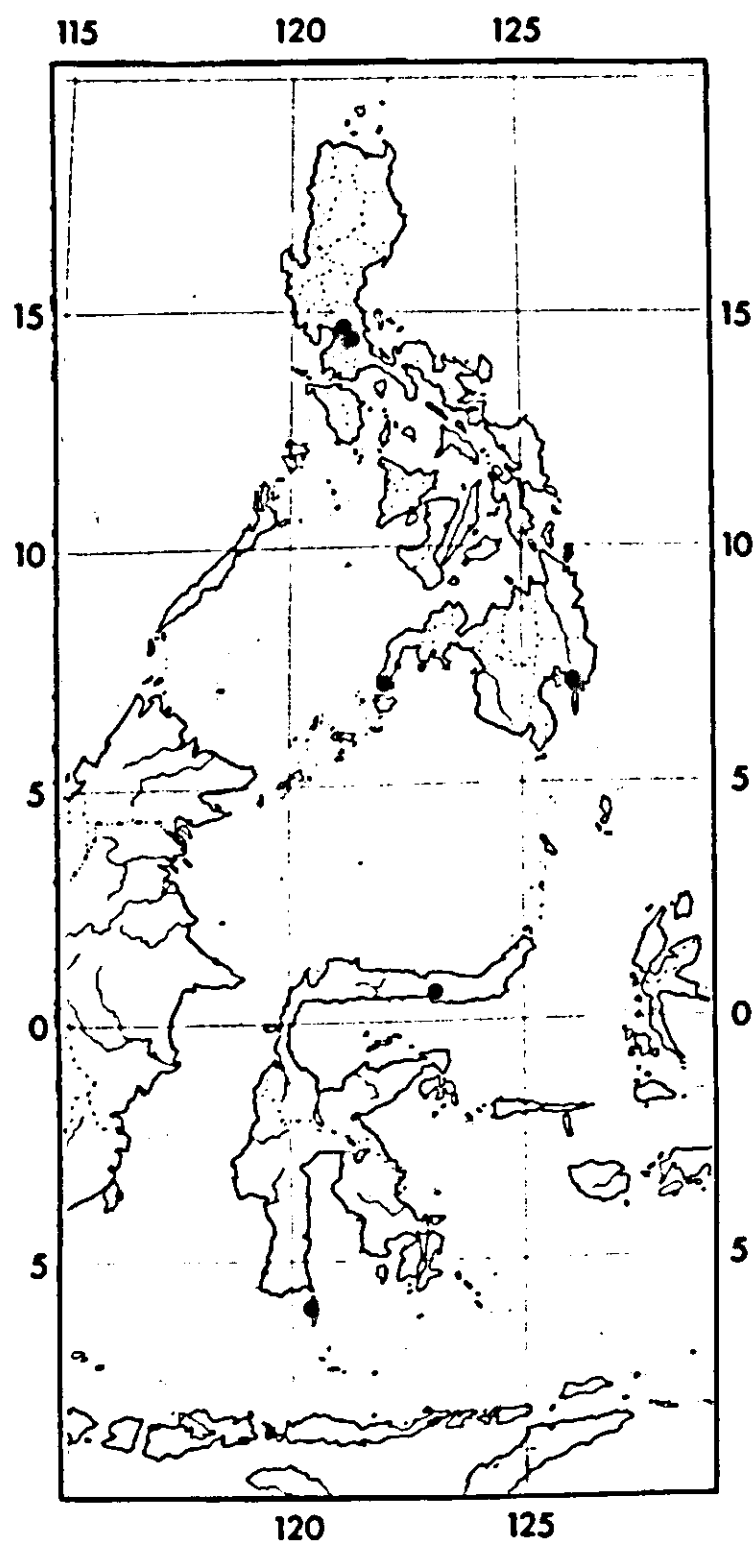
INDONESIA: S Saleyer (Salajar), rocky coast, SE of Sulawesi, *Docters van Leeuwen* 1936 (U); Gorontalo, N Sulawesi, *Riedel s.n.* (W).

PHILIPPINES: Luzon: Montalban, Prov. Rizal, *Merrill Philipp. Pl. 55* (G, U, US); Pantay Antipolo, Prov. Rizal, thickets, forest, *Merrill Sp. Blancoanae* 142 (neotype: US; isotypes: A, BM, CAL, GH, K, L, P, W); Mindanao: Zamboanga, *Merrill* 11624 (K, L, W); Ubian Island, *Merrill* 5399 (L, US); Mati, Davao Prov., *Ramos & Edano* 49140 (MEL); Luzon, *Reillo* 19227 (US).

Notes: *C. volubilis* differs from *C. crassus* by having much thinner leaflets (not 'crassus'), an ovary without conspicuous yellow glands, but with long white hairs and a pod with a thin indumentum with long hairs. The calyx has bulbous-based hairs (as in *C. grandiflorus*) which are absent in *C. crassus*. See also notes in 10.9.

Blanco's original descriptions of *Cytisus volubilis* and *Cajanus volubilis* are identical in editions of the Flora de Filipinas. The description could fit both *C. crassus* and *C. volubilis*, but not a *Dunbaria* since the pod has clear (oblique) depressions.

Philippine Plants 55 (coll. E.D. Merrill) was labelled *Dunbaria cumingii* Benth. This plant is *Cajanus volubilis*, it does not agree with the protologue of *D. cumingiana* given by BENTHAM: its hairs are not thin and grey, racemes are not longer than the leaves, calyx teeth are not triangular, or shorter than the tube. Pods are absent, but in other specimens of *C. volubilis* they are sharply depressed and contain not more than 6 seeds, whereas *D. cumingiana* has 8-10 seeded pods.



MAP 37. *Cajanus volubilis*

## 11 EXCLUDED SPECIES

*Atylosia candicans* Kurz, J. Asiatic Soc. Bengal 43-2: 186 (1874).

= *Rhynchosia avensis* Benth. ex Bak. ? (not *R. arvensis*, Index Kew. I), in Hooker, Fl. Brit. India 2: 222 (1876).

= *Rhynchosia candicans* (Kurz) ? J. Asiatic Soc. Bengal 45-2: 258 (1875)? Con-specificity doubtful, see Prain (1897). At any rate *A. candicans* or *C. candicans* is excluded from *Cajanus*.

*Atylosia crinita* Dunn, J. Bot. 47: 198 (1909), syn. nov.

= *Phaseolus fuscus* Wall., Pl. As. Rar. 1.t.6 (1830); Prain, J. Asiatic Soc. Bengal 66-2: 436 (1897).

= *Dunbaria fusca* (Wall.) Kurz, J. Asiatic Soc. Bengal 43-2: 186 (1874).

*Atylosia cajanooides* Cordem., Fl. Reunion 397 (1895) is a hybrid between *Cajanus cajan* and *C. scarabaeoides*. The type Cordemoy s.n., Bords de la rivière des Marsouins (P, holo) is similar to many hybrids obtained by crossing.

*Atylosia circinalis* Benth. in Miq., Pl. Jungh. 24 (1852).

= *Dunbaria circinalis* (Benth.) Bak. in Hooker, Fl. Brit. India 2: 219 (1876).

*Atylosia punctata* Dalz., J. Linn. Soc., Bot. 13: 186 (1873).

= *Dunbaria conspersa* Benth. in Miq., Pl. Jungh. 24 (1852).

*Atylosia rostrata* Bak. in Hooker, Fl. Brit. India 2: 216 (1876).

= *Dunbaria glandulosa* (Dalz.) Prain, J. Asiatic Soc. Bengal 86-2: 433 (1897).

*Atylosia subrhombea* Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 51 (1867).

= *Dunbaria subrhombea* (Miq.) Hemsl., J. Bot. 207 (1876).

= *Dunbaria villosa* (Thunb.) Makino, Bot. Mag. Tokyo 16: 33 (1902); Ohwi, Fl. Japan 567 (1965).

*Atylosia trichodon* Dunn, J. Linn. Soc., Bot. 35: 491 (1903), belongs to *Dunbaria*. The 8-10 seeded linear pods have depressions but no sharp delineations between the seeds. The flowers, inflorescences and pods make it a *Dunbaria*, although some seeds have a none too small strophiole. Dunn mentioned the likeness to *A. rostrata*, a species also later referred to *Dunbaria*. A study of that genus has to decide whether *A. trichodon* is a new *Dunbaria* or belongs to an existing species. The only specimens seen are China, Yunnan, Szemao W Mts, 5000 ft, *A. Henry 12474* (syntypes: E, K); Szemao E Mts, *A. Henry 12747 A* (syntypes: A, K, in fruit) and Thailand, Doi Sutep, 5000 ft, *A.G. Kerr 2289* (BM, K).

*Cajanus argenteus* Spreng., Syst. ed. 16, 3: 248 (1826).  
= *Cajanus argenteus* (Spreng.) DC. ex Sturm, Flora 14, 59 (1831).  
= *Argyrolobium linneanum* Walp., Linnaea 13: 508 (1839).

*Cajanus glandulosus* Dalz. in Dalz. & Gibs., Bombay Fl. 73 (1861).  
= *Atylosia glandulosa* (Dalz.) Dalz., J. Linn. Soc., Bot. 13: 185 (1873).  
= *Dunbaria glandulosa* (Dalz.) Prain, J. Asiatic Soc. Bengal 66-2: 433 (1897).

*Cajanus helvolus* (L.) Spreng., Syst. ed. 16, 3: 248 (1826).  
= *Phaseolus helvolus* L., Sp. Pl. 724 (1753).  
= *Glycine helvola* (L.) Ell., J. Acad. Sci. Philad. 1: 326 (1818).  
= *Strophostyles helvola* (L.) Ell., Sketch 2: 230 (1822); Hermann, USDA Techn. Bull. 1268: 45 (1962).

*Cajanus megalanthus* (Spreng.) DC., Prodr. 2: 288 (1825).  
= *Astragalus megalanthus* Spreng.

*Cajanus quinquepetalus* Blanco, Fl. Filip. ed. 2: 417 (1845).  
= *Desmodium cephalotes* Wall., Cat. No. 5721 (1831, nomen nudum).  
= *Hedysarum cephalotes* Franch., Ann. Sci. Nat. Sér. 6-15: 264 (1883).

*Cajanus? suaveolens* Grah. ex Wall., Cat. No. 5579 (1831, nomen nudum).  
= *Rhynchosia suaveolens* DC., Prodr. 2: 387 (1825).

*Cajanus wolgaricus* (Fisch.) Spreng. ex Steud., Nom. ed. 2-1: 248 (1841).  
= *Calophaca wolgarica* Fisch., Cat. Hort. Gorenki 2: 68 (1812); DC., Prodr. 2: 270 (1825).

*Dolichos blandus* Grah. ex Wall. (nomen nudum, Wall. Cat. No. 5568) quoted as synonym for *Atylosia mollis* by Baker (1876) belongs most likely to *Rhynchosia*.

## 12 ACKNOWLEDGEMENTS

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Only references mentioned in the text have been entered. The literature compiled with each species is incorporated after the names, abbreviated as is usual in taxonomic papers, and includes many more references. References to the source of vernacular names of pigeonpea (Table 7) are also included, in so far published works are concerned. An annotated bibliography of the pigeonpea was published by ICRISAT (Dahiya, 1980), with 39 references in the section botany, and 1275 in total. Additional references are published in the International Pigeonpea Newsletter (ICRISAT).

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