

A MONOGRAPH OF THE SUBGENUS DOLLINERA  
OF THE GENUS *DESMODIUM*  
(LEGUMINOSAE)

by

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Dollinera is an Asiatic subgenus of the genus *Desmodium*. The subgenus is characterized largely in having monadelphous stamens and many-jointed indehiscent pods. Most of the species of the subgenus are distributed in the subtropical and warm regions from the Himalayas eastwards through Burma, N. Thailand to S. W. China (mostly in Yunnan and Szechuan). Several species, *D. megaphyllum*, *D. multiflorum* and *D. sequax*, extend their geographical areas from the Himalaya-China region southwards to Malaysia and/or eastwards to Taiwan.

*Dollinera* was established by Endlicher as a distinct genus in 1840 distinguished from the genus *Desmodium* mainly by the monadelphous stamens, but he did not express what species were included in his new genus. In 1842, however, Walpers adopted Endlicher's genus citing two species, *Dollinera rufescens* Endl. and *Dollinera sambuensis* Endl. Before the founding of *Dollinera* as a genus these two species had been treated generally under the genus *Desmodium*. Bentham in 1852 merged the Endlicher's genus with *Desmodium* as a section and this view of the status of *Dollinera* had usually been accepted by the subsequent taxonomists (Bentham 1865, Baker 1876, Taubert 1894, Dalla Torre & Harms 1900-1907, Merrill 1910). The study by Schindler (1926) is the only revision of *Dollinera* of the genus *Desmodium*. He elevated it to subgeneric status and divided it into three sections, i.e. sect. *Tiliifoliae*, *Floribundae* and *Khasianae*, based on the presence or absence of the bracts and bracteoles. He described a number of new species and consequently recognized 21 species within his subgenus, of which one species, *D. elegans* (as *D. tiliifolium*), was subdivided into three varieties and five forms.

In the present paper the subgenus *Dollinera* is delimited newly to include several species hitherto not placed properly in the genus *Desmodium*, and is classified in four sections, i.e. sect. *Dollinera*, *Kingianae*, *Sequax* and *Siamensia*. The section *Kingianae* and the section *Siamensia* were not recognized as members of the subgenus by Schindler. The only representative of the section *Siamensia*, *D. siamense*, was described by Schindler under the genus *Phyllodium* as *P. siamense*, but the species is considered to be better placed in the subgenus. The section *Kingianae* comprising two species is a rather isolated group in the structure of pods and the geographical preference, but seems to be natural to include in this subgenus due to the similarity in the vegetative, floral and pollen morphology. Among the subgenus the monotypic section *Sequax* is apparently distinct mainly in the structure of flower and pollen grains. The section *Dollinera*, the largest and the most complicated group compris-

ing nine species, is, furthermore, split to three subsections, i.e. subsect. *Dollinera*, *Khasianae* and *Tiliifoliae*.

The present study aims to provide a basic revision of the subgenus *Dollinera* as a part of my study of the Asiatic *Desmodium*. All species treated in the revision have detailed descriptions of their external and pollen morphology together with a number of illustrations of the specimens, petals, pods, seeds and pollen grains. The seeds and pollen grains are described in this paper mostly for the first time.

This revision is based mainly upon studies on the specimens of the following herbaria: Arnold Arboretum, Harvard University, Cambridge, Massachusetts, U.S.A. (A); Botanical Section, Plant Industry Division, Department of Agriculture, Bangkok, Thailand (BK); The Forest Herbarium, Royal Forest Department, Bangkok, Thailand (BKF); British Museum (Natural History), London, Great Britain (BM); Central National Herbarium, Botanical Survey of India, Calcutta, India (CAL); Royal Botanic Gardens, Edinburgh, Great Britain (E); Gray Herbarium, Harvard University, Cambridge, Massachusetts, U.S.A. (GH); The Herbarium and Library, Royal Botanic Gardens, Kew, Great Britain (K); Department of Botany, Faculty of Science, Kyoto University, Kyoto, Japan (KYO); The New York Botanical Garden, New York, U.S.A. (NY); Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris, France (P); Department of Botany, Faculty of Science, University of Tokyo, Tokyo, Japan (TI); The National Science Museum, Tokyo, Japan (TNS); Herbarium of the University of California, Department of Botany, University of California, Berkeley, California, U.S.A. (UC). Abbreviations of the herbarium names are those of the Index Herbariorum, Part I (Lanjouw and Stafleu, ed. 5, 1964).

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*Desmodium* subgen. **DOLLINERA** (Endl.) Schindl. in Fedde, Rep. **22**: 262 (1926).

*Ototropis* Nees in [Del. Sem. Horti Vratisl. (1838)] ex Linnaea **13**: Litt. 120 (1839), pro parte, excl. sp. cit. *O. rufescens* et *Hedysarum recurvatum* (in obs.); non Benth. (1838).

*Dollinera* Endlicher, Gen. 1285 (1840), pro parte—Walpers, Rep. Bot. Syst. **1**: 736 (1842), pro parte, excl. sp. cit. *Dol. rufescens*.

*Desmodium* sect. *Dollinera* Benth. in Miq., Pl. Jungh. 225–226 (1852), in nota; in Benth. & Hook. f., Gen. Pl. **1**: 520 (1865)—Baker in Hook. f., Fl. Brit. Ind. **2**: 166–168 (1876), ut subgen. *Desmodium* sect. *Dollinera*, pro parte, excl. sp. cit. *D. oblongum* et *D. oblatum*—Taubert in Engler & Prantl, Nat. Pfl.-fam. III, **3**: 328 (1894), pro parte—Merr. in Philip. Journ. Sci. **5**: 83 (1910).

*Desmodium* sect. *Heteroloma* subsect. *Laxiflora* Benth. in Miq., Pl. Jungh. 224 (1852), in adnota, pro parte, incl. *D. sequax* et *D. megaphyllum*; excl. sp. cit. *D. Wightii* et *D. Walkeri*.

*Desmodium* sect. *Heteroloma* Benth. sensu Baker in Hook. f., Fl. Brit. Ind. **2**: 168–

170 (1876), pro parte, incl. sp. cit. *D. sequax*; cet. excl.

Lectotype species: *Desmodium multiflorum* DC. (= *Dollinera sambuensis* (D. Don) Endl. ex Walp.)

Shrubs or occasionally small trees, usually much branched, young branches pubescent and often angular, old ones usually glabrescent and terete. Leaves 3-foliolate or rarely 3- and 1-foliolate, petiolate, stipulate; when 3-foliolate terminal leaflets petiolulate and 2-stipelate, lateral leaflets sessile (but the leaflet-pulvini evident, usually more densely pubescent) and 1-stipelate; when 1-foliolate leaves slightly petiolulate but stipelate. Stipules often early deciduous, usually falcate, scarioso, striate, free, pubescent and often minutely puberulent on the outside, glabrous but usually sparsely puberulent at the base of the inside, pubescent along the margin; stipels scarioso, striate, those of the terminal leaflets often somewhat smaller than those of the laterals, ciliate and pubescent outside, glabrous inside. Inflorescences usually terminal and axillary but rarely only axillary (in sect. *Siamensia*), the terminals on young shoots and branches usually paniculate or occasionally racemose (in sect. *Sequax*, sect. *Siamensia*, and *D. khasianum*), when paniculate varying greatly in form, the axillary ones from the axils of upper leaves usually racemose but sometimes paniculate (in spiciform). Flowers usually fasciculate but sometimes umbellate, usually binate or ternate but often appearing simultaneously 1-3(-4) flower-bud (especially in *D. elegans*, *D. megaphyllum*, *D. yunnanense* & *D. Rockii*), subtended by the bracts. Bracts often early deciduous, scarioso, striate, usually dimorphic, i.e. primary and secondary bracts, pubescent and often minutely puberulent outside, more densely pubescent along the margin, glabrous inside; the primary bract 1, subtending the secondary bracts which subtending the fascicles of flowers; secondary ones present or rarely absent, usually 2 but often appearing 1-4 poorly developed smaller ones which subtending the flower-buds. Bracteoles 2 or reduced to none, usually at or near the base of the calyx but very rarely on midway of the pedicel, when present usually early deciduous, scarioso, striate, subulate or narrowly triangular or narrowly ovate, pubescent outside and along the margin, glabrous inside. Calyx narrowly campanulate, pubescent, 4-lobed, the lobes equal or unequal in length, the upper (=adaxial or dorsal) lobe entire or minutely 2-toothed at the apex (only in sect. *Sequax* rather distinctly 2-toothed), the laterals usually triangular, often shorter than the others, the lower (=abaxial or ventral) one often longer than the others. Standard not auricled, shortly clawed or cuneately tapering to the point, wings inflexed or deflexed, usually more or less auriculate at the upper base of lamina, obtuse at the apex; wings and keel-petals distinctly clawed, thinly membranous, often faintly adherent to each other; keel-petals folded down the base of lamina or the upper of the claw when anthesis, hence usually distinctly shorter than the wings, inflexed, usually swollen to the outside near the middle of lamina, often with a linear appendage on the outside. Stamens monadelphous, the vexillary one free usually above the middle but occasionally below the half (in sect. *Sequax*), the other united most of their length, free part of the filaments unequal in length, glabrous. Pistils slender, usually pubescent; style bent at right angles to the ovary or rarely not so bent (occasionally

in sect. Sequax) and exerted from the androecium, not thickened in the upper part, glabrous; stigma minute, capitate. *Pods* (Figs. 29, 40 & 48) narrowly oblong, indehiscent, sessile or stalked, more than 5-jointed, usually compressed but rarely nearly moniliform (only in sect. Sequax), glabrous or pubescent, the upper (=adaxial) suture shallowly undulate or nearly straight, the lower (=abaxial) suture usually undulate but occasionally not or slightly undulate (in sect. Siamensia and sect. Kingiana), calyx persistent at the base; joints nearly once or twice as long as broad, transversely to transversely broadly oblong or elliptic or nearly quadrangular. *Seeds* (Figs. 29, 40 & 48) transversely elliptic or depressed obovate, hilum with thickened ring-like margin, i.e. rim-arillate. *Seedlings*: Cotyledons epigealous, elliptic, sessile, opposite at the first node; the first and second leaves simple and opposite at the second node, stipulate, broadly ovate; usually succeeding leaves 3-foliolate, alternate, but occasionally the third and the fourth opposite and succeeding alternate. *Pollen grains* (Pls. 13-14 & Fig. 41) tricolporate; colpi long, narrow or opened, with or without margin, often constricted and protruding at the equator, remaining parts usually bordered by the endexine thickening, the membrane granulated; pores rounded or elliptic, when elliptic usually equatorially or rarely meridionally elongated; usually protruding or occasionally flattened, slightly marginate, the membrane granulated or not; exine mostly entire or rarely undulate (in sect. Sequax), mostly fine reticulate or very rarely fine reticulate mixed partly with verrucate or rugulate sculptures (in sect. Sequax), when reticulate lumina  $1\ \mu$  or below in diameter, tectate,  $1-2\ \mu$  thick, the ectexine thicker than the endexine, muri simplibaculate, columellae short.

Key to the sections of the subgenus *Dollinera*.

- |   |   |
|---|---|
| 1 | {<br>Inflorescences only axillary, very short racemose. Pods distinctly stalked<br>..... Sect. Siamensia (p. 317)<br>Inflorescences terminal or terminal and axillary, mostly paniculate, distinctly<br>longer than the above ..... 2   |
|   |   |
| 2 | {<br>Legumes not reticulate-veined, both sutures nearly straight, hence the articles<br>nearly quadrangular. Keel-petals equal or longer than the wings<br>..... Sect. Kingiana (p. 308)<br>Articles of the legume longer than broad. Keel-petals nearly equal or shorter<br>than the wings ..... 3   |
|   |   |
| 3 | {<br>Keel-petals and wings same in length. Pods sessile, nearly moniliform, 2-3.5<br>mm wide, densely ferruginous or brown hooked hairy. Calyx-lobes nearly<br>same in length (1-1.5 mm long); upper lobes distinctly 2-divided at the apex.<br>Stipules linear (4-5 mm $\times$ 0.7-1 mm in size). Vexillary filament connate<br>rather weakly below the middle ..... Sect. Sequax (p. 314)<br>Keel-petals mostly shorter than the wings; wings weakly adhering to the keel.<br>Pods shortly stalked or sessile, compressed, more than 3 mm wide, not only<br>uncinately but also straight hairy. Upper calyx-lobe entire or minutely 2-<br>toothed. Stipules not as the above, mostly narrowly ovate or narrowly<br>triangular ..... Sect. Dollinera (p. 263) |
|   |   |

1. Sect. **Dollinera**

Shrubs or small trees. Leaves usually 3-foliolate but rarely mixed with 1-foliolate leaves (only in *D. yunnanense*); stipules usually narrowly ovate or narrowly triangular. Inflorescences usually terminal and axillary but occasionally only terminal (in *D. yunnanense* and *D. Rockii*). Flowers usually fasciculate but sometimes umbellate. Bracts dimorphic or rarely trimorphic (i.e. primary, secondary and third bracts); secondary bracts present or absent (in *D. khasianum*); third bracts appearing only in umbellet, very small in size. Calyx 4-lobed, the upper lobe entire or minutely 2-toothed at the apex. Wings longer than the keel-petals, auriculate or not; keel-petals auriculate or not (in subsect. Dollinera and subsect. Khasianae). Pods sessile or shortly stalked, usually pubescent with straight, appressed hairs but rarely (in *D. megaphyllum*) both straight and hooked hairy; lower sutures undulate or rather deeply indented (only in *D. confertum*); joints longer than broad, more than 3 mm wide.

Type species: *D. multiflorum* DC.

Key to the subsections of the section Dollinera.

- 1 { Keel-petals auriculate at the base of lamina. Bracteoles present  
 ..... Subsect. Tiliifoliae
- 1 { Keel-petals not auriculate. Bracteoles absent ..... 2
- 2 { Secondary bracts and bracteoles absent. Stipules triangular. Inflorescences  
 racemose, not enveloped by the primary bracts. Calyx-lobes almost same in  
 length..... Subsect. Khasianae
- 2 { Secondary bracts present and bracteoles usually absent. Young parts of  
 inflorescences covered entirely by many overlapping large primary bracts.  
 Lower calyx-lobes slightly longer than the others ..... Subsect. Dollinera

1-(1). Subsect. **Dollinera**

Sect. Floribundae Schindl. in Fedde, Rep. **22**: 268 (1926).

Type species: *D. multiflorum* DC.

Key to the species of subsection Dollinera.

- 1 { Pods stalked, (2-)3-4-jointed, the lower suture deeply incised (isthmus about  
 1/4 as broad as the pods); joints 8-11 x 4-5 mm in size. Styles slightly con-  
 stricted at the base. Stipules triangular ..... *D. confertum*
- 1 { Pods sessile, 4-10-jointed; jointes 3-5 x 2-4 mm in size. Styles not constricted  
 ..... 2
- 2 { Pods (6-)8-9(-10)-jointed. Leaflets narrowly elliptic with an acuminate apex.  
 Young branches slightly angular and densely spreading velutinous or wooly  
 as are the petioles and inflorescence-rachides. Stipules (8-)10-15 mm by  
 1.5-2.5 mm in size ..... *D. kulhaitense*
- 2 { Pods 4-7(-8)-jointed. Leaflets elliptic or obovate with an obtuse or acute  
 (rarely acuminate) apex. Young branches sharply angular and variously hairy  
 (but not spreading) as are the petioles and inflorescence-rachides ..... 3
- 1 { Pods glabrous. Stipules 12-15 mm by 2.5-3.5 mm in size; stipels 3-6 mm by  
 1-2 mm in size. Lower surfaces of leaflets very densely velutinous, hence in-

- 3 { conspicuously reticulate-veined ..... *D. amethystinum*  
 Pods densely appressed sericeous. Stipules (4-)5-11 mm by 1.5-2(-2.5) mm in size; stipels 1-3 mm by 0.3-0.8 mm. Lower surfaces of leaflets densely sericeous more or less glaucous, conspicuously reticulate-veined  
 ..... *D. multiflorum*

1) **Desmodium amethystinum** Dunn in Gard. Chron. ser. 3, **32**: 210 (1902) -Craib, Fl. Siam. Enum. **1**: 403 (1928). [Fig. 27a]

A shrub, usually up to 2 m high; young branches angular and very densely softly white- or brown-velutinous. Stipules rather persistent, narrowly ovate with an acuminate apex, 12-15 mm by 2.5-3.5 mm in size, very densely appressed velutinous outside. Petioles (1.5-)3-5 cm long, very densely velutinous like the young branches. Leaves 3-foliolate; leaflets subcoriaceous, elliptic or ovate, acute or mucronate at the apex, nearly entire along the margin, the upper surface densely velutinous but becoming sparsely hairy with age, the lower surface very densely uniformly white- or brown-velutinous, lateral nerves 8-10 on each side of the midrib and reaching the margin, reticulate-veins inconspicuous; stipels narrowly triangular, 3-6 mm long, 1-2 mm wide at the base, rather sparsely sericeous outside; terminal leaflets usually cuneately obtuse at the base, (5-)7-12 cm long, (3.5-)4-6(-6.5) cm wide; petiolules 1-2 cm long, pubescent like the petioles; lateral leaflets obliquely rotund at the base, (4-)6-8(-14) cm long, (2.5-)3-5 cm wide. Inflorescences terminal and axillary; terminals paniculate, copiously branched, 15-25 cm long; axillary ones racemose; rachis very densely velutinous like the young branch but decreasing gradually the degree of pubescence (usually in rachilla densely spreading velutinous) with age. Flowers mostly 2- but occasionally 3-flowered; flowering pedicels 4-6 mm long, fruiting pedicels 8-10 mm long, rather densely very minutely puberulent. Primary bracts broadly ovate with an acute apex (6-8 mm by 3.5-5 mm in size) to narrowly ovate with an acuminate apex (5-7 mm by 1.5-2 mm in size), very densely velutinous outside; secondary bracts narrowly ovate, acuminate at the apex, 3-4 mm by 0.5-1 mm in size. Bracteoles absent. Calyx rather densely very minutely puberulent and mixed with very sparse longer hairs, 4-lobed; tube about 1 mm long; the upper lobe broadly triangular, entire or minutely 2-toothed at the apex, about 1.5 mm long, 1.5-2 mm wide, laterals triangular, 1.2-1.5 mm long, 1-1.2 mm wide at the base, the lower broadly triangular, 1.5-2 mm long, 1 mm wide. *Corolla* (Fig. 28: b) amethyst-coloured (ex Dunn); standard obovate with an emarginate apex, tapering to the base, 8.5-10 mm long and 5.5-6 mm wide; wings transversely elliptic, 10.5-11.5 mm long (including 1.5-2 mm long claw), 3-3.5 mm wide, auriculate at the lamina-base; keel-petals 8-10.5 mm long (including 1.5-3 mm long claw), 2.5-3 mm wide, acute at the apex. Stamens 8.5-9 mm long. Pistils 9-10 mm long (including the 4-4.5 mm long style), sparsely to moderately very minute puberulent (0.05 mm long) except for the glabrous style; style thickened slightly above the middle. *Pods* (Fig. 29: a) sessile, compressed, 6-7-jointed, glabrous, swollen on the seed, both sutures not thickened but apparently marginate, the upper suture nearly straight or slightly undulate, the lower indented, isthmus usually about 2/3 as broad as the pod, scarcely reticulate-veined;



Fig. 27. a: *D. amethystinum* Dunn (Garrett 53 BKF), b: *D. confertum* DC. (Ludlow, Sherriff & Hicks 21240 TI).

joints transversely elliptic-oblong, 3–4 mm by 4–7 mm in size. *Seeds* (Fig. 29: b) transversely broadly elliptic, reddish brown in colour,  $2.5 \times 2.5$ –3 mm in size. *Pollen grains* (Pl. 13: a–d) tricolporate, subprolate, or prolate spheroidal,  $37$ – $40 \times 30$ – $38$  (average  $38.7 \times 33.3$ )  $\mu$  in size, rhomboidal in the equatorial view; colpi long, narrow, the marginal thickening distinct, slightly intruding, with or without constriction at the equator, the membrane granulated; pores large, about  $5 \times 10$   $\mu$  in size, equatorially elongated, slightly protruding; exine evenly fine reticulate, lumina about 1  $\mu$  in diameter, tectate, about 2  $\mu$  thick, the ectexine thinner than the endexine, muri simplibaculate.

Distr. Thailand and China.

Specim. exam.: **Thailand**. Payap: Doi Angka range of the Pa Ngem, alt. ca. 1120 m (H.B.G. Garrett 53 BKF), Chiangrai, northern slope of Doi Pacho, alt. 1700 m (Iwatsuki & Fukuoka T.3664 KYO). **China**. Yunnan: Szemao Mts. alt. 6000 ft. (A. Henry 12614A CAL, NY–**Isotype**)

In vegetative structure and fruit this species is very similar to *D. multiflorum* which is usually known as *D. floribundum* or *D. sambuense*, but differs consistently in the size of stipules and stipels, the degree of indumentum on pods and leaves, shape of styles, and the equatorial shape of pollen grains. However in floral structure the species is closely related to *D. confertum* especially in the venation pattern of the wings and the shape of styles.

2) **Desmodium confertum** DC. in Ann. Sci. Nat. **4**: 101 (Jan. 1825); Prodr. **2**: 335 (Nov. 1825)–Benth. in Miq., Pl. Jungh. 225 (1852), in adnota–Baker in Hook. f., Fl. Brit. Ind. **2**: 167 (1876)–Prain in Journ. Asiat. Soc. Beng. **66** (2): 396 (1897)–Ohashi in Hara, Fl. E. Himal. 149 (1966). [Fig. 27b]

*Hedysarum dioicum* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 244 (Feb. 1825).

*D. dioicum* (Buch.-Ham. ex D. Don) DC., Prodr. **2**: 338 (Nov. 1825), ut *D.?* *dioicum*–Schindl. in Fedde, Rep. **22**: 268 (1926); in Fedde, Rep. Beih. **49**: 273 (1928).

*Meibomia conferta* (DC.) O. Kuntze, Rev. Gen. **1**: 197 (1891).

A much branched shrub; usually up to 2 m high; young shoots and branches terete but often very slightly angular, finely to densely whitish or yellowish hairy especially along the ridges, afterwards mostly glabrescent. Stipules early deciduous, triangular, acuminate at the apex, 5–7 mm long, 2–4 mm wide at the base, sericeous outside. Petioles 1.5–5 cm long, rather densely to sparsely tomentose. Leaves 3-foliolate; leaflets subcoriaceous to coriaceous, elliptic or obovate, acute or often obtuse or occasionally apiculate at the apex, entire along the margin, the upper surface densely appressed tomentose when young and afterwards becoming glabrous, the lower surface densely appressed sericeous or tomentose, especially on the nerves, and usually glaucous, lateral nerves usually 5–9 pairs and reaching the margin, reticulate-veins prominent, leaflet-pulvini very densely silky hairy; stipels narrowly triangular or filiform, 2–3 mm long; terminal leaflets usually cunate at the base, (3–)6–13(–17) cm long, (1.5–)2.5–7(–10) cm wide; petiolules (1–)1.5–3(–4) cm long, tomentose like the petioles; lateral leaflets oblique and rotund to obtuse at the base, (2.5–)4.5–8(–11) cm long, (1.5–)2–4(–6) cm wide. Inflorescences terminal paniculate and axillary racemose, when young cone-like with overlapping



large primary bracts, often seemingly subsecund especially in fruit, usually 10–20 cm long; rachis densely to rather sparsely spreading pilose and densely very minutely tomentose. Flowers mostly binate; pedicels 3–5 mm long, minutely spreading pubescent (0.2–0.3 mm long) and densely very minute puberulent (below 0.1 mm long). Primary bracts ovate with an acuminate apex, 9–14 mm by 3–5 mm in size, ciliate white hairy (about 1 mm long) and very minutely puberulent outside; secondary bracts occasionally early deciduous, narrowly ovate or narrowly elliptic with an acute apex, 1.5–2.5 mm by 0.7–1 mm in size, ciliate. Bracteoles usually absent but rarely present and very early deciduous, when present 0.8–1.5 mm long about 0.2 mm wide, linear or subulate, puberulent outside. Calyx 3–5 mm long very minutely puberulent and often mixed with longer hairs at the very base and the margin of the lobes, the tube 2–3 mm long, 4-lobed; the upper lobe broadly triangular, entire and obtuse or 2-toothed at the apex, (1.5–)2–2.5 mm long and 2–3 mm wide at the base, the lateral one triangular, nearly same or slightly longer than the upper one, the lower lobe triangular, acute or slightly acuminate at the apex, usually slightly longer than the lateral ones, (2–)2.5–3 mm long. *Corolla* (Fig. 28: c) mauve to purple; standard normally to broadly obovate with a rounded or slightly emarginate apex, (9–)10–14 mm by 5–9.5 mm in size; wings 10–16 mm long (including the 2–2.5 mm long claw), 3–4(–4.5) mm wide, obtuse or rounded at the apex, transversely narrowly elliptic, auriculate at the adaxial base of the lamina, usually almost straight or often slightly deflexed; keel-petals 9–13 mm long (including 4–5 mm long claw), 2.5–3.5 mm wide, acute at the apex. Stamens about 10 mm long, glabrous. Pistils 10.5–12(–13) mm long (including the 5–6 mm long style), inflexed at a right angle near the middle of the style, densely appressed puberulent except the glabrous style. *Pods* (Fig. 29: c) compressed, shortly stalked (2–5 mm long), (2–)3–4-jointed, very densely spreading pale brown or grayish sericeous on both sutures and densely appressed so on the lateral surfaces, the upper suture more or less undulate, the lower suture deeply incised, isthmus  $\frac{1}{2}$ – $\frac{1}{4}$  as broad as the pod, not reticulate-veined, the calyx usually persistent at the base; joints depressed obovate or transversely elliptic, 8–11  $\times$  4–5 mm in size. *Pollen grains* tricolporate, suboblate, oblate spheroidal, prolate spheroidal or subprolate, 30–41  $\times$  30–35 (average 34.9  $\times$  33.0)  $\mu$  in the equatorial view, often almost hexagonal in the outline at the polar view when oblate spheroidal grains; colpi long, narrow, slightly marginate, intruding, the membrane granulated; pores large, about 8  $\times$  15  $\mu$  in size, equatorially elongated, strongly protruding, without constriction at the equator; exine evenly fine reticulate, lumina about 1  $\mu$  in size, decreasing the size of lamina towards the polar area, tectate, about 2  $\mu$  thick, the ectexine thinner than the endexine, muri simplibaculate, columellae short.

Distr. Himalaya (Nepal, Sikkim, Bhutan) and E. India (Assam).

Repres. specim. exam.: **Nepal.** Kathmandu: Pouwa (Hara et al. 6301468 TI); near Kusma, alt. 3000 ft. Gully side in *Shorea* forest (Stainton, Sykes & Williams 9228 BM, TI); Galchi (Bailey's collectors *s.n.* BM); Sim Chautara–Thare, Trisuli Valley, alt. 1000 m. Along sunny road side in *Shorea* forest (Hara, Kurosawa & Ohashi June 2, 1969 TI); Phusri–Dhara Pani (Hara et al. 6301432 TI), Dhankuta, alt. 1200 m (Hara et al. 6301457, 6301474 TI), Dumhan (Hara et al. 6301458 TI), Garhi Danra–Tuwa (Hara et

al. 6301459 TI), Khebang, alt. 1400 m (Hara et al. 6301460 TI), Khebang-Bharomdin (Hara et al. 6301461 TI), Ranga Pani-Ghorwa (Hara et al. 6301462 TI). **Sikkim.** Darjeeling: Runjeet (C. B. Clarke 26300A CAL); Pashok, alt. 1500 ft. (Gamble 7356 CAL), (Prain's collector 164 CAL), Testa (T. Anderson *s.n.* CAL), (Kari 463 TI). **Bhutan.** (Griffith 1458 CAL), (G. King *s.n.* CAL); Mungur (R. E. Cooper 4665 BM), Lhuntsi Dzong, alt. 5000 ft. (Ludlow et al. 20930 BM); Khoma, alt. 5000 ft. Dry hillside (Ludlow, Sherriff & Hicks 21240 BM, TI); Demri Chu, Monyul, alt. 3000 ft. Along river (Ludlow, Sherriff & Taylor 7241 BM, TI). **India.** Assam: Khasia (Griffith 1438 CAL), (Oldham *s.n.* CAL), (C. B. Clarke 6233 CAL); Cherapunji (K. Biswas 3950 CAL), Saleri-But, alt. 5000 ft. In oak and pine forest (Rankin & Pretzlik 82 BM).

This Himalayan species approaches *D. multiflorum* in vegetative characters, but differs distinctly in flowers and legumes. The venation of wing-petals of *D. confertum* and *D. amethystinum* differs consistently from that of wings of *D. multiflorum* as illustrated in Fig. 28: c. The venation of the wings of *D. confertum* shows principally the same pattern of that of the keel-petals of the species, i.e. most of the veins branch off at or near the base of lamina and seemingly extend in rather parallel. While in *D. multiflorum* the venation pattern is apparently different from that of the keel-petals of the species and, also of *D. confertum*, i.e. most of the veins spring from a few central veins rather pinnately and often branch off near the margin of lamina. The latter type of the venation of wings is a general pattern in the subgenus *Dollinera*. The style is always slightly constricted at the base in *D. confertum*, but is not so in *D. multiflorum*. The pods of *D. confertum* are also different greatly from those of *D. multiflorum* as shown in Fig. 29: c. Moreover, *D. confertum* is usually distinguishable from the latter by the less sharply angular young branches, the leathery leaflets, and the larger bracts.

The hairiness on pods in *D. confertum* varies rather greatly in age from blackish brown in colour when young gradually to pale or yellowish brown when mature.

Among the specimens of the species examined a gathering from Bhutan (Ludlow, Sherriff & Hicks 21240) shows an extraordinary variation in the size of flower and the presence of secondary bracts and bracteoles. The standard petals of the collection are 12–14 mm by 8–9.5 mm in size, while many collections from Nepal, Sikkim and Assam are 9–12 mm by 4.5–7.5 mm in size. Also the wings and keel-petals of the Bhutanese specimen are distinctly larger than the others (wings: 13.5–16 mm by 3.8–4.5 mm against 10.5–12.5 mm by 2.8–3.6 mm in size; keel-petals: 11.5–13 mm by 3–3.5 mm against 9–10.5 mm by 2.4–3 mm in size). The pistils of the Ludlow et al. 21240 are 11–12 mm long but those of the others 10.5–11.5 mm long. However the calyx of the Bhutanese specimen tends to show a different variation from the specimens from other regions. In the former specimen calyx-tubes are not shorter than the lower calyx-lobes and the lateral lobes are nearly same or slightly shorter than the upper lobes, i.e. the tube 2.5 mm long, the upper and the lateral lobes 2.2 mm long, the lower lobe 2.5 mm long (all are average length when 20 samples are measured). Whereas in the later specimens calyx-tubes are distinctly shorter than the lower calyx-lobes and the lateral lobes are shorter than the upper lobes, i.e. the tube 2.2 mm long, the upper lobe 2.3 mm long, the lateral lobe 2.0 mm long and the lower lobe 2.8 mm long (all are average length when 41 samples are ex-

amed). Schindler (1926) placed this species in his sect. *Floribundae* of the subgen. *Dollinera*, which was characterized in having no secondary bracts and bracteoles. However, the secondary bracts occur in several specimens, and bracteoles are found only on one sheet from the Bhutanese specimen.

3) ***Desmodium kulhaitense*** C. B. Clarke ex Prain in Journ. Asiat. Soc. Beng. **66** (2): 395 (1897)—Schindl. in Fedde, Rep. **22**: 268 (1926); in Fedde, Rep. Beih. **49**: 281 (1928)—Ohashi in Journ. Jap. Bot. **40**: 364 (1965); in Hara, Fl. E. Himal. 151 (1966). [Fig. 30a]

An erect shrub, 60–150 cm high; young branches slightly angular, densely spreading grayish velutinous or woolly (1–2 mm long) as are the petioles, the petioles, and the lower part of the inflorescence-rachides. Stipules narrowly elliptic-ovate with an acuminate apex, (8–)10–15 mm by 1.5–2.5 mm in size, densely velutinous along the margin and partly on the back. Petioles 3–5 cm long. Leaves 3-foliolate; leaflets subcoriaceous, narrowly elliptic with an acuminate apex, glabrous or very sparsely silky hairy along the midrib above, densely appressed whitish sericeous beneath, reticulate-veins not prominent, lateral nerves 5–8 on each side of the midrib and reaching the margin; stipels narrowly ovate, 2–3 mm by 0.5–0.7 mm in size, slightly pubescent outside; terminal leaflets obtuse at the base, (5–)9–13 (–15) cm by (1.5–)3–4 (–5) cm in size; petiolules 1.5–2.5 cm long; lateral leaflets obliquely obtuse or rotund at the base, (4–)7–10 (–11) cm by (1.5–)3–4 cm in size. Inflorescences terminal and axillary, the terminal one much branched paniculate or rarely simple racemose, the axillary one racemose, 15–25 cm long; the lower part of rachis pubescent like the young branch, the upper part glabrous except for the base of bracts. Flowers binate; pedicels slender filiform, 7–10 mm long when anthesis, afterwards 11–15 mm long in fruit, very sparsely pilose and very minute hooked hairy. Primary bracts scarious, striate, narrowly triangular or narrowly ovate, acuminate to cuspidate at the apex, 8–10 mm by 1.2–1.5 mm in size, densely sericeous along the margin and rather densely sericeous to nearly glabrous on the back; secondary bracts absent. Bracteoles absent. Calyx 4–5 mm long, rather densely very minute uncinately hairy, 4-lobed; tube 2–3 mm long, the upper lobe broadly triangular, minutely 2-toothed or entire with an obtuse apex, 1–1.5 mm long, 1.5–2 mm wide at the base, the lateral ones triangular, acute at the apex, 1.5–2 mm long, the lower lobes narrowly triangular, acuminate at the apex, slightly longer than the others, 2–2.5 mm long, about 1 mm wide at the base. *Corolla* (Fig. 28: d) purple-rose; standard obovate, rounded or slightly emarginate at the apex, shorter than the other petals, 8–11 mm by 5–6 mm in size; wings 11.5–14 mm long including the 1.5–2 mm long claw, 3.5–4 mm wide, straight or slightly incurved, obtuse at the apex; keel 10–11 mm long, 2.7–3 mm wide, acute or apiculate at the apex. Stamens 7.5–8.5 mm long. Pistils 8.5–9.5 mm long. *Pods* (Fig. 29: k) sessile, (6–)8–9 (–10)-jointed, glabrous, the upper suture nearly straight or slightly undulate, the lower one constricted, isthmus usually about 2/3 as wide as the pod, swollen on seeds, reticulate-veined; joints about 5 × 3.5–4 mm in size. *Pollen grains* tricolporate, subprolate or prolate, 29–31 × 22–27 (average 31.2 × 24.3)  $\mu$  and ellipsoidal in the equatorial view; colpi long narrow, marginate, intruding, the membrane granulated, constricted and protruding at the equator; pores elliptic,

about  $6 \times 10 \mu$  in size, elongated equatorially, sometimes constricted at the equator, slightly protruding, no marginal thickening; exine evenly fine reticulate, lumina about  $1 \mu$  in diameter, tectate,  $2 \mu$  thick, the ectexine thicker than the endexine, muri simplibaculate, columellae short.

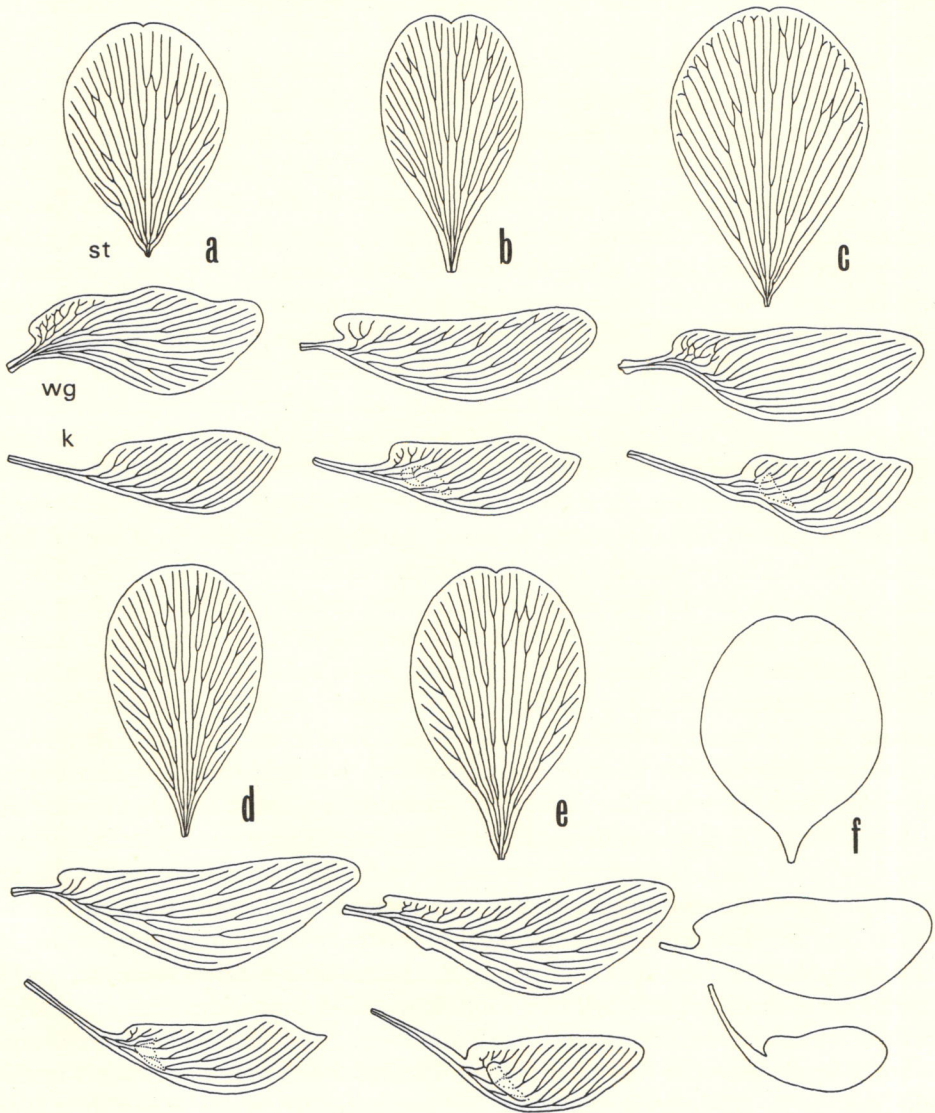


Fig. 28. Petals (st: standard, wg: wing, k: keel) of the species of the subject. Khasianae and subsect. Dollinera of the sect. Dollinera,  $\times 3.5$  a. *D. khasianum* (Hook. f. & Thomson s.n.), b. *D. amethystinum* (Garrett 53), c. *D. confertum* (Pankin & Pretzlik 82), d. *D. kulhaitense* (Hara & Pradhan 6301481), e & f. *D. multiflorum* (e: Hayata s.n., f: Polunin, Sykes & Williams 481).

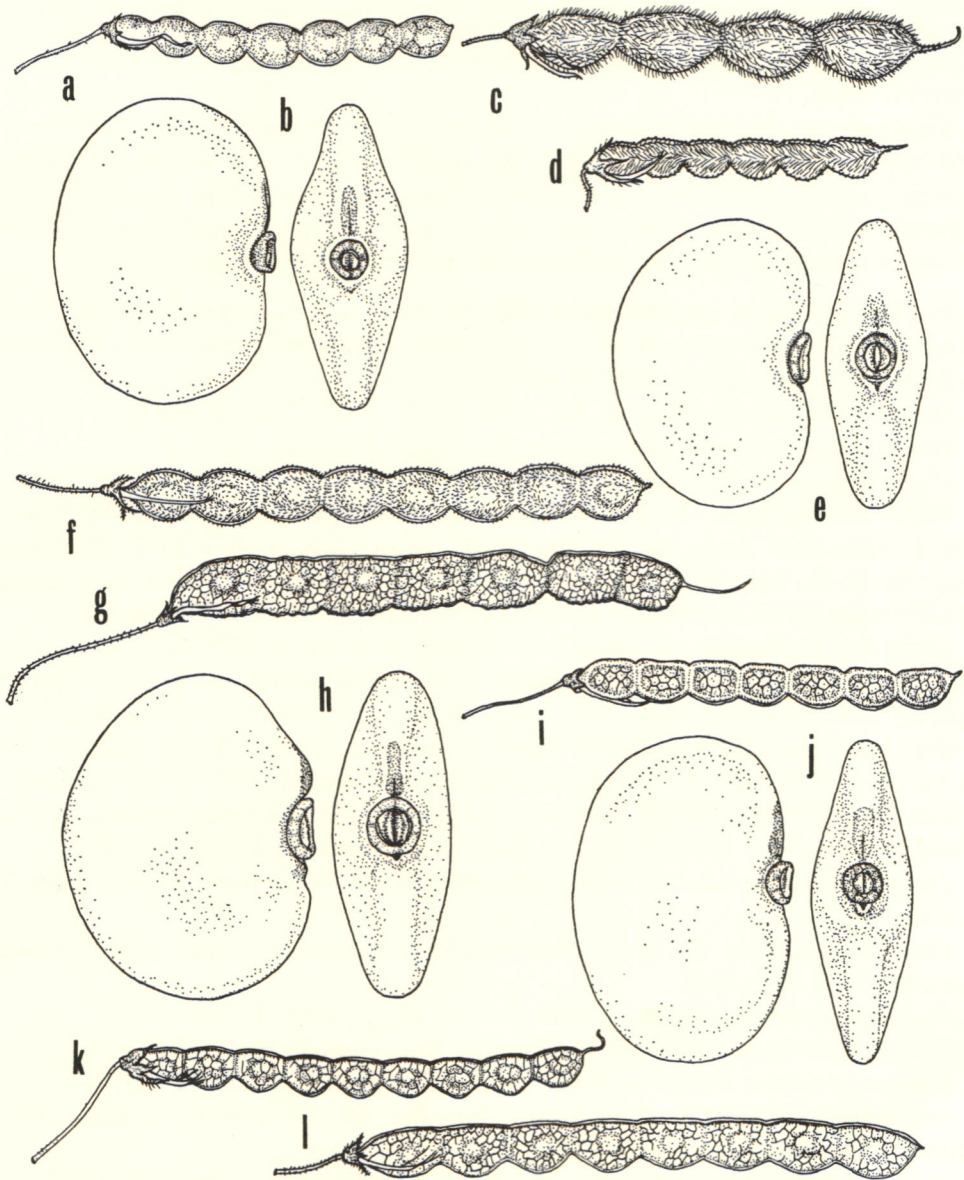


Fig. 29. Pods ( $\times 1.3$ ) and seeds ( $\times 13$ ) of the species of the sect. Dollinera. a-b. *D. amethystinum* (Iwatsuki & Fukuoka T. 3664), c. *D. confertum* (Hara et al. 6301461), d-e. *D. multiflorum* (Tagawa, Iwatsuki & Fukuoka T.1545), f-h. *D. megaphyllum* (f & h. var. *megaphyllum*, Tagawa & Iwatsuki T.4390, g. var. *glabrescens*, Kingdon-Ward 22624), i-j. *D. khasianum* (Kanai, Murata & Togashi 6301475), k. *D. kulhaitense* (Hara & Pradhan 6301481), l. *D. yunnanense* (Delavay 1985).

Distr. Endemic to E. Himalaya (Sikkim).

Specim. exam.: **Sikkim**. Hee, alt. 4000 ft. (C. B. Clarke 13109K Oct. 12, 1870 CAL-**Isotype**); Rungli, alt. 3000 ft. (W. W. Smith 4501 CAL); Bok, alt. 7000 ft. (G. H. Cave *s.n.* Lloyd Bot. Gard., Darjeeling); above Dentam, alt. 5000 ft. (Ribu & Rhomoo 4913 CAL); Penlong La, near Gangtok, alt. 2100 m (H. Hara & K. C. Pradhan 6301481 Sept. 13, 1964 TI).

This endemic Sikkimese species is one of the less variable species of *Desmodium* and appears to be closely related to *D. multiflorum* especially in the structure of flower. From *D. multiflorum*, *D. kulhaitense* is distinctly separable by the many jointed legumes, the narrowly elliptic, acuminate leaflets, the patent velutinous or woolly young branches, petioles and inflorescence-rachis, and the longer stipules.

4) ***Desmodium multiflorum*** DC. in Ann. Sci. Nat. **4**: 101 (Jan. 1825); Prodr. **2**: 335 (Nov. 1825)—Wall., Cat. no. 5705 A, B, C pro parte (1831–32)—Benth. in Miq., Pl. Jungh. 225 (1852), in adnota.

*Desmodium angulatum* DC., l.c. 101 (Jan. 1825); l.c. 335 (Nov. 1825).

*Hedysarum sambuense* D. Don, Prodr. Fl. Nepal. 243 (Feb. 1825).

*H. floribundum* D. Don, l.c. 244 (Feb. 1825).

*Desmodium sambuense* (D. Don) DC., Prodr. **2**: 335 (1825), ut *Sambuense*—Prain in Journ. Asiat. Soc. Beng. **66** (2): 394 (1897)—Craib in Kew Bull. **1911**: 38 (1911)—Gagnep. in Fl. Indo-Chine **2**: 593 (1920), excl. syn. cit. *H. Wallichianum* Spreng. (1827), quae est *D. heterocarpon* var. *strigosum* (excl. syn. cit. D. Don & DC.).

*Desmodium floribundum* (D. Don) Sweet [Hort. Brit. ed. 1, 479 (1827), nom. nud.] ex G. Don, Gen. **2**: 297 (1832)—Baker in Fl. Brit. Ind. **2**: 167 (1876), excl. syn. cit. Spreng—Kurz in Journ. Asiat. Soc. Beng. **45** (2): 232 (1877)—Forbes & Hemsley in Journ. Linn. Soc. **23**: 172 (1887)—Hayata, Icon. Pl. Formos. **1**: 183 (1911)—Craib in Sargent, Pl. Wilson. **4**: 103 (1914); Fl. Siam. Enum. **1**: 406 (1928)—Schindl. in Fedde, Rep. **22**: 268 (1926); in Fedde, Rep. Beih. **49**: 274 (1928)—Steward, Man. Yangtze Valley 181 (1958)—Liu & Chung in Taiwanica **8**: 76, fig. 5 (1962).

*Desmodium dubium* Lindley in Bot. Reg. **12**: t. 967 (1826)—Hook. in Bot. Mag. **57**: t. 2960 (1830).

*Ototropis sambuensis* (D. Don) Nees in [Del. Sem. Horti Vratisl. (1838)] ex Linnaea **13**: Litt. 120 (1839).

*Dollinera sambuensis* (D. Don) Endlicher ex Walp., Rep. **1**: 736 (1842).

*Meibomia floribunda* (D. Don) O. Kuntze, Rev. Gen. **1**: 198 (1891).

*Desmodium Mairei* Pamp. in Nuov. Giorn. Bot. Ital. N.S. **17**: 13 (1910).

*Desmodium nepalense* Ohashi in Journ. Jap. Bot. **40**: 363 (1965); in Hara, Fl. E. Himal. 152 (1966).

A much branched erect shrub, usually 1–2 m high; branches of the old years terete, glabrescent, dark brown with scattered elliptic lenticels, young shoots sharply angular, especially along the ridges densely ascending or often appressed or occasionally spreading pale-yellowish to whitish pubescent. Stipules rather persistent, narrowly ovate to ovate with an acuminate apex, (4–)5–11 mm long and 1.5–2 (–2.5) mm wide. Petioles 1.5–5 cm long, sparsely to densely tomentose. Leaves 3-foliolate; leaflets subcoriaceous, elliptic or obovate, usually obtuse or acute but rarely acuminate at the apex, the upper surface rather sparsely to densely appressed

sericeous but afterwards glabrescent, the lower surface densely appressed or ascending sericeous especially on principal veins and mostly more or less glaucous, lateral nerves conspicuous, usually 6–8 on each side of the midrib and reaching margin, entire along the margin; stipels narrowly triangular, 1–3 mm long and 0.3–0.8 mm wide at the base; terminal leaflets usually cuneate and obtuse or rarely rotund at the base, 3–10(–13) cm by 2–5(–6) cm in size; petiolules 0.7–1.5 cm long; lateral leaflets oblique and rotund or rarely obtuse at the base, 2.5–7(–9) cm by 1.5–3.5(–4) cm in size. Inflorescences terminal and axillary, terminals mostly paniculate but occasionally racemose, axillary ones racemose, usually 6–9 cm but occasionally up to 20 cm long, when young cone-like with overlapping bracts; rachis densely ascending serious and minute uncinately hairy. Flowers binate; pedicels (3–)4–7(–10) mm long, rather sparsely to densely spreading hooked or straight hairy. Primary bracts narrowly ovate to broadly ovate, entire and acuminate or acute at the apex, 7–11 mm by 2–3 mm in size, sparsely to densely sericeous outside; secondary bracts ovate, sericeous along the margin, (1.2–)1.5–3.5 mm by 0.8–1.5 mm in size. Bracteoles absent or very rarely present at the base of the calyx (paired, filiform, 0.4–0.6 mm long, sparsely pubescent). Calyx densely uncinately minute hairy and sparsely to scarcely sericeous, 3–5(–5.5) mm long, 4-lobed, the tube 2–2.5 mm long, the upper lobe broadly triangular, entire or minutely 2-toothed at the apex, 1.5–2(–2.5) mm long, lateral ones triangular, acute at the apex, almost same length to the upper one, the lower triangular, slightly longer than the others, 2–2.5(–4) mm long, acuminate at the apex. *Corolla* (Fig. 28: e & f) mauve, pale pink or pink to purple; standard normally to broadly elliptic or obovate, 7.5–11.5 mm by 4–7.5 mm in size, more or less emarginate at the apex, cuneate at the base; wings narrowly elliptic, slightly inflexed, 8–14(–14.5) mm (including the 1.5–2.5 mm long claw) by 3–4.5(–5) mm in size, obtuse at the apex; keel distinctly smaller than the wings, 7–10(–13) mm long (including the 3–4(–5) mm long claw), 2–3.5 mm wide, acute or obtuse or slightly apiculate at the apex. Stamens 6–7 mm long. Pistils 8.5–9 mm long, sparsely or rather densely appressed pubescent except the glabrous style. *Pods* (Fig. 29: d) sessile, (4–)5–7(–8)-jointed, densely appressed brown-sericeous, the upper suture nearly straight or slightly undulate, the lower indented, isthmus usually about 2/3 as broad as the pod, swollen on seeds, reticulate-veined, calyx often persistent at the base; joints depressed obovate, 3–4 mm × 3.5 mm in size. *Seeds* (Fig. 29: e) transversely elliptic, 1.5–2 × 2.5–3 mm in size. *Pollen grains* (Pl. 13: e–h) tricolporate, oblate spheroidal, prolate spheroidal, subprolate or prolate, 33–47 × 26–39 (average 39.3 × 31.7)  $\mu$  in size; colpi long, narrow, distinctly marginate, slightly intruding; pores almost rounded or elliptic, 6–9 × 10–15  $\mu$  in size, equatorially elongated, slightly constricted and protruding at the equator; exine evenly fine reticulate, lumina about 1  $\mu$  or slightly larger than 1  $\mu$  in diameter, tectate, about 1  $\mu$  thick, the ectexine thinner than the endexine, muri simplibaculate, columellae short.

Distr. Himalaya (N.W. & N.E. India, Nepal, Sikkim, Bhutan), Burma, Thailand, Laos, and China.

Repres. Specim. exam.: **India.** Kumaon: (Hume *s.n.* CAL), Bachgawan, alt. 4500 ft. (N. Gill 54 TI); Simla: (Gamble 4535E, 6408B CAL), (Schlich in 1888 *s.n.* CAL),

Kasauli, alt. 6000 ft. (J. W. Chiddell 43 BM); Ghurwol (G. King *s.n.* CAL), (R. S. Hole 791 CAL); near Musourie (G. King *s.n.* CAL); Assam: Khasia Hills (Griffith 685 CAL), (J. D. Hooker & Thomson *s.n.* CAL), Shillong, alt. 5000 ft. In pine woods (C. B. Clarke 44582E CAL), (F. Kingdon-Ward 18637 BM, A), Naga Hill, Konema (D. Prain *s.n.* CAL), Jaintia Hills, Maolamang alt. about 4500 ft. (Burkill & Banerjee 313 CAL). **Nepal.** Maina, alt. ca. 8000 ft. On earthy ledges among rocks (Polunin, Sykes & Williams 450 BM), alt. 7000 ft. On old cultivation terraces and earth banks (Polunin, Sykes & Williams 481 BM, TI); Tamur Valley, Thapabu Khola, N. of Taplejung, alt. 6000 ft. On open slopes (J. Stainton 1191 BM, TI); near Jagat, alt. 8500 ft. On dry south slope (Stainton, Sykes & Williams 3379 BM, TI); Annapurna Himal: Seti Khola, alt. 6500 ft. (Stainton, Sykes & Williams 6714 BM, TI); Kathmandu: Thankot (K. de B. Codrington 219, 243 BM), Godavari-Phulchauki, alt. 2000 m. Margin of thickets, sunny place (Ohashi June 23, 1967 TI); Taplejung-Garhi Danra (Hara et al. 6301438 TI—**Syntype** of *D. nepalense* Ohashi); Garhi Danra-Tuwa (Hara et al. 6301484 TI—**Holotype** of *D. nepalense* Ohashi). **Sikkim.** Darjeeling (J. S. Gamble 8351 CAL); Gangtok, alt. 4000 ft. (Ribu & Rhomoo 4004 CAL). **Bhutan.** (R. E. Cooper 4561, 4579 BM); Dotena Limpu, alt. 8000 ft. (Cooper 2506, 2654 BM); Linchu, alt. 5000 ft. (Cooper 3400 BM); Valley of Kuru Chu, alt. 6500 ft. On dry hillsides, red soil (Cooper 4377 BM); Lhuntzi Dzong, alt. 5000 ft. Amongst shrubs on hillside (Ludlow, Sherriff & Hicks 20930 BM, TI). **Burma.** Pegu (S. Kurz 1676 CAL); Mogok (A. Rodger 174 CAL); Chin Hills (A. Huk *s.n.* CAL); Shan State, Taungyi (A. Khalil *s.n.* CAL); Mindat Sakan, alt. 4500 ft. Thickets & waste places (F. Kingdon-Ward 22545 BM, TI); Ukhrul, alt. 5000 ft. In thickets (Kingdon-Ward 17787 NY), alt. 6000 ft. Common in open places (Kingdon-Ward 17920 NY, BM, A). **Thailand.** Loei (Dee 232 BKF), Phu Krading (Native collector DE303B A), (D. Bunpheng 681 BKF), alt. ca. 1200 m. Open grassland (T. Shimizu et al. T.9011 KYO), Phu Luang. On moist, sandy ground in open place (M. Tagawa et al. T.1545 KYO), (K. Bunchuai 176 BKF); Chieng Mai, Doi Sutep (A. F. G. Kerr 782 BK, CAL), (B. Hayata *s.n.* Oct. 14, 1921 TI), (K. Iwatsuki et al. T.9379 KYO), below the summit of Doi Chiang Dao, alt. 1900–2175 m. Among bush on limestone ridge (T. Shimizu et al. T.10118 KYO). **China.** Yunnan: (D. J. Anderson in 1868 *s.n.* CAL), (C. Shneider 2492, 2499 GH), (A. Henry 9802 CAL), (Henry 9802A NY), (H. T. Tsai 58997 A); Szemao (A. Henry 10003B TNS); Ping-pien Hsien (Tsai 61464, 62426 A); Mienning, Poshang, alt. 2350 m. In thickets (T. T. Yü 17857 A); Chih-tse-lo, alt. 2500 m. On road side (Tsai 54175 A), alt. 3200 m. In forest (Tsai 5848 A); Der-la, Champu-tung, alt. 2300 m (C. W. Wang 66831 A); Kiukiang Valley, alt. 1400 m. Margin of thickets (Yü 20389 A); Chengkang, Maliling, alt. 1900 m (Yü 16846 A); Che-tse-lo, alt. 3200 m. In forest (Tsai 58479 A); Lichiang Range (McLaren's native collectors 91B, 211B BM); Szechuan: Hsi-ching Hsien (Yü 1224 A); Juei-she Hsien (Yü 1044 A); Kweichow: Tuhshan, border of Kwansi, alt. 400 m. In open places (Y. Tsiang 6478 A, NY); Kwangsi: Yeo Mar Shan, N. Hin Yen, alt. 5000 ft. In open thickets (R. C. Ching 7167 A, NY); Kwangtung: Yao-shan, An-Keng, alt. 2500 ft. (S. Sin 11830 NY); Fukien: Shaown and vicinity, Satasun, alt. 4000 ft. (F. H. Niao 9497 A); Hupeh: (E. H. Wilson 2624 NY), (Henry 2502 CAL). **Taiwan.** (R. Torie *s.n.* TI); Taichung Hsien: Peikoutashan (U. Mori in 1910 TI); Nantou Hsien: Mt. Mushan (Kawakami & Mori in 1906 TI), Mt. Neng-Kao (M. T. Kao 5581 TI), Jeuai, alt. 1000 m. On sunny grassfield along valley (Ando, Tateishi & Watanabe 351 TI).

This species, usually known as *D. floribundum*, resembles *D. amethystinum*, *D. confertum*, *D. kulhaitense* and *D. Hayatae*. From *D. amethystinum*, *D. confertum*, *D. kulhaitense* and *D. Hayatae*, however, *D. multiflorum* differs consistently as noted on



each species, respectively. Sometimes the species approaches to *D. elegans* especially when sterile or often when anthesis. From *D. elegans*, *D. multiflorum* is clearly distinguishable by the sharply angular young branches and inflorescence-rachis, the elliptic or obovate, usually obtuse terminal leaflets, the binate-flowered racemes, persisting bracts subtending the flower-buds on inflorescences, and the usually ebracteolate calyx.

*D. multiflorum* is highly polymorphic in external morphology but is less variable in pollen morphology. In pollen morphology, among the grains examined in this study those from Burma (Kingdon-Ward 22545 TI) show the largest in size,  $44-47 \times 32-36$  (average  $45.4 \times 33.5$ )  $\mu$ , and those from Nepal (Stainton 1191 TI) are the smallest,  $34-38 \times 27-30$  (average  $35.9 \times 28.5$ )  $\mu$  in size. In outer morphology, *D. multiflorum* constitutes somewhat distinct local assemblages. Collections from the Himalayas especially Nepal are referable to the typical form which has acute, elliptic or obovate, glaucous leaflets, without bracteoles, and sparsely to moderately patent hooked hairy on inflorescence-rachis and petioles. In addition to these features the size of keel-petals of the specimens from Nepal is often remarkably smaller than that of the specimens from other regions. The specimen from Burma (Kingdon-Ward 22545) of which pollen grains mentioned above, tends to have sharply acuminate elliptic leaflets, lax flowered racemes, distinctly longer pedicels and larger flowers (standard  $9.5-11.5 \times 4.5-7$  mm in size, wings  $11.5-14.5 \times 3.5-5$  mm and keel-petals  $10.5-13 \times 3-3.5$  mm in size). Specimens from Thailand, however, have densely velutinous, not glaucous leaflets, densely patent hooked hairy on inflorescence-rachis and pedicels, and often minutely bracteolate near the base of the calyx. It proved impossible, however, to subdivide several forms of *D. multiflorum* into varieties, for examination of herbarium material showed that no discontinuity of characters could be found.

1-(2). Subsect. **Khasianae** (Schindl.) Ohashi, stat. nov.

Sect. *Khasianae* Schindl. in Fedde, Rep. **22**: 268 (1926).

Type species: *D. khasianum* Prain

5) ***Desmodium khasianum*** Prain in Journ. Asiat. Soc. Beng. **66** (2): 395 (1897)—Schindl. in Fedde, Rep. **22**: 268 (1924); in Fedde, Rep. Beih. **49**: 268 (1928)—Ohashi in Hara, Fl. E. Himal. 151 (1966). [Fig. 30b]

[*D. serriferum* Wall., Cat. no. 5708 (1831-32), nom. nud., pro parte, excl. A & B, quae est *D. elegans* var. *elegans*].

*D. oxyphyllum* (non DC.) Hook. f. & Thoms. ex Prain, l.c. 396 (1897), pro syn.

An erect, much branched shrub, usually up to 3 m high; branches slender, terete, glabrescent; young shoots or branches appressed whitish sericeous. Stipules early deciduous, triangular, 4.5-5.5 mm long, 2-2.5 mm wide at the base, sparsely pubescent (0.8-1.2 mm long) outside. Petioles 2-3.5 cm long, rather sparsely appressed sericeous when young, afterwards almost glabrescent. Leaves 3-foliolate; leaflets chartaceous when young but usually subcoriaceous when old, elliptic or ovate, acute or shortly acuminate at the apex, the upper surface rather sparsely appressed puberulent but afterwards entirely glabrescent, the lower surface rather uniformly appressed sericeous and more or less glaucous, lateral nerves 5-7 on



Fig. 30. a. *D. kulhaitense* C. B. Clarke ex Prain (Hara & Pradhan 6301481),  
 b. *D. khasianum* (Kanai, Murata & Togashi 6301475).

each side of the midrib and not reaching the margin, finely reticulate veined; stipels subulate to triangular, 1.5–2.5 mm long, to 1 mm wide at the base, glabrous on both surfaces; terminal leaflets cuneate to obtuse at the base, (3–)4–6(–7) cm by (1.5–)2–3(–3.5) cm in size; petiolules 0.5–1.5 cm long; lateral leaflets sessile but evidently pulvinate (about 2 mm long), usually slightly obliquely rounded or obtuse at the base, (2.5–)3–5(–5.5) cm by 1.5–2.5(–3) cm in size. Inflorescences terminal and axillary, racemose, 6–16 cm long. Flowers ordinarily 2- or often 1-flowered fascicles subtended by the primary bract; pedicels (1–)1.2–1.5 cm long. Bracts narrowly elliptic or narrowly ovate, acuminate at the apex, densely appressed sericeous on the back; secondary bracts and bracteoles absent. Calyx 3–3.5 mm long, sparsely appressed sericeous (about 1 mm long) outside, 4-lobed; all lobes nearly same in length (1–1.5 mm long), the upper one broadly ovate, entire at the apex, others triangular with an acute apex. *Corolla* (Fig. 28: a): standard normally to broadly elliptic or obovate, 9–11.5 mm by 6–8 mm in size, slightly emarginate at the apex, cuneate to the base, very minutely clawed; wings narrowly elliptic, 10–12.5 mm long (including the about 1.5 mm long claw), 4–4.5 mm wide, obtuse at the apex, slightly auriculate at the base of lamina, slightly deflexed; keel-petals inflexed, 10.5–11.5 mm long (including the 3.5–4 mm long claw), about 3 mm wide, acute at the apex. Stamens 9–11 mm long. Pistils 11–12 mm long, style 4–5 mm long, glabrous, more or less thickened near the middle; stigma minutely capitate. *Pods* (Fig. 29: i) flat, slightly swollen on seeds, (4–)6–8-jointed, glabrous, both sutures not thickened, the upper suture nearly straight, the lower suture shallowly undulate, isthmus about  $\frac{4}{5}$  as broad as the pod, reticulate veined; joints transversely broadly oblong,  $5\text{--}7 \times 4\text{--}5$  mm in size. *Seeds* (Fig. 29: j) transversely elliptic,  $2\text{--}2.5 \times 3\text{--}3.5$  mm in size. *Pollen grains* (Pl. 14: e–h) tricolporate, prolate spheroidal;  $26\text{--}30 \times 24\text{--}26$  (average  $27.4 \times 25.4$ )  $\mu$  and ellipsoidal in the equatorial view; colpi long, narrow, marginate, the margin jagged, more or less intruding, the membrane granulated; pores elliptic,  $6 \times 8\text{--}9$   $\mu$  in size, equatorially elongated, slightly marginate, more or less flattened, the membrane granulated; exine evenly fine reticulate, lumina less than 1  $\mu$  in diameter, constricted at the equator, tectate, 1.5  $\mu$  thick, the ectexine thicker than the endexine, muri simplibaculate, columellae short.

Distr. Eastern Himalaya (Nepal, Sikkim, Bhutan) and India (Assam).

Specim. exam.: **Nepal.** Birwa–Yektin (Kanai, Murata & Togashi 6301475 TI), Yektin–Batasay (Hara et al. 6301476 TI). **Sikkim.** Ringom, alt. 4000 ft. (G. H. Cave *s.n.* Lloyd Bot. Gard., Darjeeling), Lodoma road, alt. 4500 ft. (Bahadus *s.n.* Lloyd Bot. Gard., Darjeeling). **India.** Assam: Khasia Hills: “Montes Sillet”, i.e., Khasia (Gomez *s.n.*: Wallich, Cat. 5708C [**Type** of *D. serriferum* Wall., pro parte] CAL: Probably **Isotype** of *D. khasianum* Prain), alt. 2–4000 ft. (J. D. Hooker & T. Thomson *s.n.* CAL, TNS), (Griffith 389 CAL), (S. Kurz 281 CAL), Dumpep, alt. 5500 ft. (F. Kingdon-Ward 16039 BM), Chumbi Valley, alt. 1800 ft. (G. L. Searight 233 CAL), Pynursle (K. Biswas 4013 CAL), Mawmluh Forest, alt. 4500 ft. (U. Kanjilal 4555 CAL), Aktoubor, alt. 5000 ft. (G. Mann *s.n.* CAL).

Within the sect. *Dollinera* this species is quite distinct in lacking the secondary bracts and bracteoles and in the shape of wing-petals.

When flowering or sterile *D. khasianum* is somewhat similar to *D. podocarpum* subsp. *oxyphyllum* especially in the shape of leaflets, but easily distinguishable from the subspecies by the more deeply lobed calyx, longer pedicels, larger corolla and shrubby habit.

*D. khasianum* is well delimited by Prain and he cited many specimens in his original description. However, as Prain did not designate the type, I select Gomez *s.n.* as the type collection. This specimen is a part of the type of *D. serriferum* Wall. and the sheet which I have examined in CAL may probably be regarded as an isotype.

1-(3). Subsect. **Tiliifoliae** (Schindl.) Ohashi, stat. nov.  
Sect. Tiliifoliae Schindl. in Fedde, Rep. **22**: 263 (1926).  
Lectotype species: *D. elegans* DC.

Key to the species of the subsection Tiliifoliae.

- |   |   |  |
|---|---|--|
| 1 | { | Pods hooked and straight hairy or very rarely glabrous. Wing-petals narrow, incurved conspicuously upwards, and distinctly longer than both standard and keel. Keel-petals mucronate and slightly hooked at the apex. Stipules 12-16 mm long, 3-4 mm wide, triangular, acuminate or caudate at the apex. All calyx-lobes not shorter than the tube . . . . . <i>D. megaphyllum</i> |
|   |   | Pods not hooked hairy. Wings slightly or not incurved upwards and almost straight. Keel-petals obtuse, acute or slightly mucronate but not hooked at the apex. Stipules usually 4-10 mm long and 0.7-3 mm wide, variable in shape (ovate to narrowly triangular), acute to acuminate at the apex . . . . . 2   |
| 2 | { | Inflorescences terminal and axillary, not so copious as the above. Conspicuously polymorphic species . . . . . <i>D. elegans</i>   |
|   |   | Inflorescences terminal, large paniculate, very copiously branched; rachis very densely and softly velutinous or woolly as are the petioles and the lower surfaces of leaflets . . . . . 3   |
| 3 | { | Plants densely white-tomentose. Leaflets 3-foliolate. Primary bracts 3-3.5 mm long and about 1 mm wide. Flowers larger; standard 14-16 × 10-12 mm in size, wings 15-16.5 × 5-5.5 mm in size and the claw mostly recurved, keel-petals 12-14 × 4 mm in size, acute at the apex . . . . . <i>D. Rockii</i>   |
|   |   | Plants very densely pale yellowish velutinous or woolly. Leaflets 3- or 1-foliolate. Primary bracts 5-10 mm long and 1.5-3.5 mm wide. Flowers smaller; standard 9-12.5 × 7.5-10 mm in size, wings 11-13 × 3-5 mm in size and the claw not recurved, keel-petals 10.5-12 × 3-4 mm in size, acute to apiculate at the apex . . . . . <i>D. yunnanense</i>                            |

6) **Desmodium elegans** DC. in Ann. Sci. Nat. **4**: 100 (Jan. 1825); Prodr. **2**: 335 (Nov. 1825)-Schindl. in Fedde, Rep. **22**: 264 (1926); in Fedde, Rep. Beih. **49**: 274 (1928): *D. elegans* (Lour.) Benth. (1861), quae est *Phyllodium elegans* (Lour.) Desv. (1825), nec *D. elegans* Schlecht. (1838). [Figs. 35 & 36]

*Hedysarum tiliaefolium* D. Don, Prodr. Fl. Nepal. 244 (Feb. 1825).

*H. rufescens* Spreng., Syst. **4** (2): 292 (1827).

*D. nutans* Hook. in Bot. Mag. **55**: t. 2867 (1828)-Schindl., l.c. 264 (1926); l.c. 286 (1928).

*H. nutans* Wall. [Cat. no. 5706 (1831–32), nom. nud.] ex Hook., l.c. (1828), pro syn.

*D. tiliæfolium* (D. Don) Wall., Cat. no. 5707 (1831–32), comb. nud.—G. Don, Gen. Hist. **2**: 297 (1832)—Benth. in Miq., Pl. Jungh. 225 (1852), in adnota—Baker in Hook. f., Fl. Brit. Ind. **2**: 168 (1876)—Prain in Journ. Asiat. Soc. Beng. **66** (2): 397 (1897)—Craib in Sargent, Pl. Wilson. **4**: 104 (1914)—Schindl., l.c. 264–266 (1926), ut *tiliifolium*, incl. var. *argenteum* (Wall. ex Benth.) Schindl., var. *genuinum* Schindl., f. *typicum* Schindl., f. *lanceolatum* Schindl., f. *rhabdocladum* (Franch.) Schindl., f. *glabrum* Schindl., f. *calvum* Schindl., et var. *Potaninii* Schindl.; Schindl., l.c. 303 (1928); in Hand.-Mzt., Symb. Sin. **7**: 569 (1933)—Ohashi in Hara, Fl. E. Himal. 154 (1966).

*D. rufescens* (non DC.) G. Don, Gen. Syst. **2**: 296 (1832), pro parte.

*D. argenteum* Wall. [Cat. no. 5713 (1831–32), nom. nud.] ex Benth. in Miq., Pl. Jungh. 226 (1852), in adnota.

*D. polycarpum* Wall. [l.c. 5710 (1831–32), nom. nud.] ex Benth., l.c. 225 (1852), pro syn., non DC. (1825).

*D. oxyphyllum* (non DC.) Benth., l.c. 225 (1852), in adnota—Baker, l.c. 167 (1876), incl. var. *serriferum* Baker.

*D. serriferum* Wall. [l.c. 5708 A, B (1831–32), nom. nud.] ex Baker, l.c. 167 (1876), pro syn.—Craib in Sargent, Pl. Wilson. **4**: 104 (1914).

*D. rhabdocladum* Franch., Pl. Delavay. 173 (1890).

*D. callianthum* Franch., l.c. 173 (1890).

*D. cinerascens* Franch., l.c. 174 (1890), incl. var. *microphyllum* Fr. (ut. *microphylla*), non A. Gray (1853)—Hutchinson in Bot. Mag. **145**: t. 8805 (1919)—Rehder in Journ. Arn. Arb. **13**: 327 (1932)—Schindl. in Hand.-Mzt., Symb. Sin. **7**: 569 (1933).

*Meibomia tiliæfolia* (D. Don) O. Kuntze, Rev. Gen. **1**: 198 (1891).

*D. glaucophyllum* Pamp. in Nuovo Giorn. Bot. Ital. N.S. **17**: 12 (1910)—Schindl., l.c. 266 (1926); l.c. 276 (1928).

*D. stenophyllum* Pamp. in Nuovo Giorn. Bot. Ital. N.S. **17**: 15, fig. 4 (1910).

*D. Esquirolii* Lévl., Fl. Kouy-Tchéou 232 (1914–15); Cat. Pl. Yunnan 154 (1916)—Rehder in Journ. Arn. Arb. **18**: 207 (1937)—Pet.-Stib. in Acta Hort. Gotob. **13**: 430 (1940)—Merr. in Sunyatsenia **3**: 252 (1937)—Lauener in Not. Bot. Gard. Edinburgh **30**: 243 (1970).

*D. tiliifolium* var. *stenophyllum* (Pamp.) Schindl. in Engler's Bot. Jahrb. **54**: 60 (1916).

*D. spicatum* Rehder in Journ. Arn. Arb. **3**: 41 (1922).

*D. Franchetii* Rehd., l.c. 41 (1922).

*D. wolohoense* Schindl. in Fedde, Rep. **21**: 1 (1925).

*D. Handelii* Schindl. in Hand.-Mzt. in Anz. Akad. Wiss. Wien. Math.-Nat. **62**: 234 (1925).

*D. Forrestii* Schindl. in Not. Bot. Gard. Edinburgh **72**: 131 & in Fedde, Rep. **22**: 267 (1926); in Fedde, Rep. Beih. **49**: 275 (1928).

A subshrub, shrub or small tree, up to 4 m high; usually much branched; young branches terete or striate, persistently or deciduously rather sparsely to very densely pubescent or nearly glabrous, those of the old years terete with scattered lenticels

and glabrescent. Stipules usually early deciduous, ovate to narrowly elliptic-ovate-obovate(-triangular) with an acute or acuminate apex, 4-10 mm by 0.5-3 mm in size, the outside sparsely or densely appressed or ascending pubescent (0.2-1 mm long) and usually very minutely puberulent (below 0.1 mm long), the inside pubescent or puberulent at the base, mostly densely sericeous or velutinous along the margin. Petioles (1-)2-9(-12) cm long, sparsely to very densely pubescent and often puberulent. Leaves 3-foliolate; very variable in the shape, the size and the indumentum; leaflets chartaceous to subcoriaceous, normally to broadly or often very broadly rhomboid-elliptic-ovate or rarely nearly orbicular to very broadly obovate (in var. *nutans*) or narrowly ovate (in var. *stenophyllum*), acute to acuminate or occasionally caudate or rarely mucronate at the apex, both surfaces uniformly or especially on principal nerves variably pubescent (varying greatly in degree from very sparsely to very densely appressed to spreading tomentose, sericeous, velutinous or woolly and often mixed with minute hairs), densely or occasionally sparsely sericeous, velutinous or woolly hairy along the margin, usually glaucous beneath, lateral nerves reaching the margin and 4-9 on each side of the midrib, scarcely to conspicuously reticulate veined, entire or shallowly undulate along the margin; stipels linear or narrowly elliptic-ovate-triangular, acute or acuminate at the apex, 1-3 mm long, densely puberulent on the back, sericeous or velutinous along the margin; terminal leaflets cuneate to acute or occasionally obtuse at the base, 1.5-9(-15) cm by 1-6(-10) cm in size; petiolules (0.5-)1-3 cm long; lateral leaflets equally or obliquely obtuse at the base, 1-6(-9) cm by 0.7-4(-6) cm in size. Inflorescences terminal and axillary, the terminal one usually variably paniculate, 5-50 cm long, the axillary one usually racemose; rachis sparsely to densely minutely hairy (below 0.2 mm long, straight or uncinata) and usually sparsely to very densely longer pubescent (0.2-1 mm long, appressed to spreading). Flowers usually 2- or 3-flowered cymules but accompanying 1-4 flower-buds or occasionally 3-6-flowered umbellules; bracts early deciduous, primary ones narrowly ovate-elliptic-triangular, acute or acuminate at the apex, 2-5(-8) mm by 0.7-1.3(-1.7) mm in size, variably hairy outside, mostly densely silky or velutinous hairs along the margin; secondary bracts subulate or narrowly ovate-triangular or ovate, acute or acuminate at the apex, 0.5-2.5 mm by 0.2-0.8 mm in size, puberulent and often mixed with pubescent on the back, densely to rather sparsely ciliate. Pedicels slender, 4-22 mm long, usually densely minutely puberulent or often hooked hairy (below 0.2 mm long) and often mixed very sparsely to very densely with appressed to ascending or often spreading sericeous, velutinous or woolly hairs (0.8-1.2 mm long) or occasionally nearly glabrous. Bracteoles often early deciduous, subulate to very small sized ovate, acute or acuminate at the apex, 0.3-3 mm long. Calyx very variable in the shape, the size and the hairiness, 2.2-5 mm long; the upper lobe very broadly to shallowly triangular or to depressed ovate, entire or minutely 2-toothed, when entire acute or often obtuse at the apex, lateral ones normally to shallowly triangular, acute or obtuse at the apex, usually shorter but rarely equal or very rarely longer than the tube, the lower one same or longer than the others, normally to very broadly triangular, acute or acuminate at the apex. *Corolla* (Fig. 38 & 39) variable in the shape, the size and the colour, white through pale mauve,

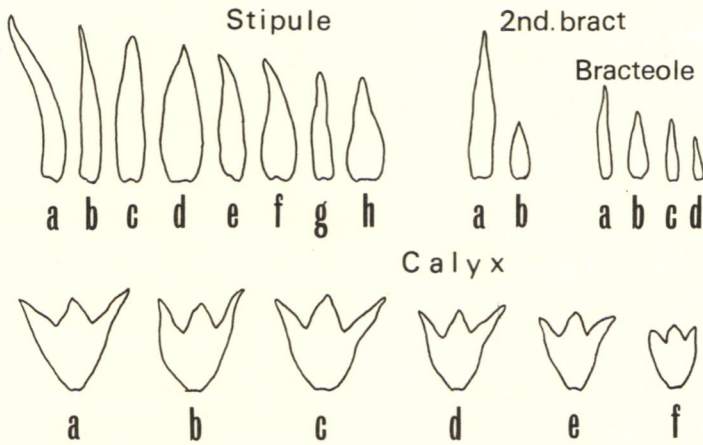


Fig. 31. Variation of the stipule ( $\times 5$ ), secondary bract ( $\times 10$ ), and calyx ( $\times 5$ ) of *Desmodium elegans* in a population near Wangdu Phodrang (alt. 1450 m) in Bhutan.

mauve, purple, bluish-violet to violet; standard ovate-obovate-elliptic, 9–16(–19) mm by 5.5–13 mm in size, rounded or emarginate at the apex, cuneate at the base; wings transversely narrowly elliptic, 10–18(–20) mm by 3–6 mm in size (including the 1.5–3.5 mm long claw), usually auriculate at the adaxial side of the base of lamina; keel 9.5–17 mm by 2.5–5 mm in size (including the 3–5.5 mm long claw), not auriculate at the base, acute at the apex. Stamens 7–13 mm long, glabrous. Pistils 9–15(–17) mm long (including the 2.5–3.5 mm long style), densely appressed sericeous except for the glabrous style. *Pods* (Fig. 40) flat, shortly stalked (often hidden by the persisting calyx) or occasionally sessile, swollen on the seeds, 4–9-jointed, glabrous or sparsely to densely appressed tomentose or sericeous and also often thinly puberulent, both sutures slightly thickened, the upper suture nearly straight or shallowly undulate, the lower suture undulate, isthmus  $1/3$ – $3/5$  as broad as the pod, reticulate-veined; joints transversely oblong or depressed obovate, 7–14 mm by 5–7 mm in size. *Seeds* (Fig. 40) depressed obovate, 2–3  $\times$  3.5–4.5 mm in size. *Pollen grains* (Pl. 14: l–n & Fig. 41: j–q) tricolporate, prolate or subspheroidal (–suboblate–subprolate), 22–37  $\times$  17–36 (average 28.0  $\times$  22.7)  $\mu$  in size, ellipsoidal or occasionally rhomboidal in the equatorial view; colpi long, narrow or slightly opened, with or without margin, when present the margin jagged, constricted and protruding at the equator, the remaining part bordered by the endexine thickening, intruding, the membrane granulated; pores elliptic or rounded, when elliptic equatorially or sometimes slightly meridionally elongated, 5–10  $\times$  5–15  $\mu$  in size, protruding or more or less flattened, slightly marginate, the membrane minutely granulated; exine evenly fine reticulate, lumina equally or below 1  $\mu$  in diameter, tectate, 1–2  $\mu$  thick, the ectexine thicker than the endexine, often decreasing the thickness towards the colpus margin, muri simplibaculate, columellae minute.

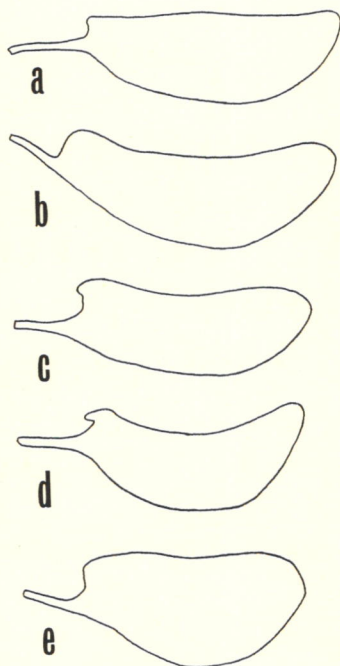


Fig. 32. Variation of the wing-petal ( $\times 3.5$ ) of *D. elegans* in a population near Wangdu Phodrang in Bhutan.

*D. elegans*, as defined above, is distributed in the Himalayas and western China. Throughout its wide range this species is extremely polymorphic in gross morphology but appears to be less variable in pollen morphology.

A range of variation within a small population of *D. elegans* has been examined in Bhutan on the shape and the size of stipule, secondary bract, bracteole, calyx and wing-petal (Figs. 31 & 32). The population is continuously spreading on sunny grassland along the valley near Wangdu Phodrang (alt. 1450 m) together with such shrubs as *Indigofera pulchella*, *Indigofera Dosua*, *Dalbergia tamarindifolia*, *Moghania macrophylla*, *Mallotus philippinensis*, *Woodfordia fruticosa*, *Buddleja asiatica*, etc. As shown in Fig. 31, the size of the stipules varies from 4 to 5.2 mm in length and from 0.6 to 1.3 mm in width, and the shapes of them are narrowly falcate-triangular, narrowly triangular, and narrowly ovate. The secondary bracts show two forms; narrowly triangular with 5 mm by 1 mm in size and ovate with 2 mm by 0.8 mm in size. The bracteoles are narrowly ovate to subulate and their sizes vary from 1.4 to 2.8 mm in length and 0.4 to 0.7 mm in width. The calyces vary from 2.2 to 3 mm in length, the tubes 1.5–2 mm long and the lateral lobes 0.6–1.2 mm long and nearly same or distinctly shorter than other lobes. The variation of the wing-petals is shown in Fig. 32. The combinations of these characters of *D. elegans* vary considerably by individual even in a small population. For example, the stipules "a, b, c", the secondary bracts "b", the bracteoles "b", the calyces "e, f" of Fig. 31, and the wing "a" of Fig. 32 are taken from the same individual (Kanai et al. 10554). While the stipules "d, g, h", the secondary bracts "b", the bracteoles "b, c, d", the calyces "a, d" and the wings "c, d" are collected from another individual (Hara et al. 4438).



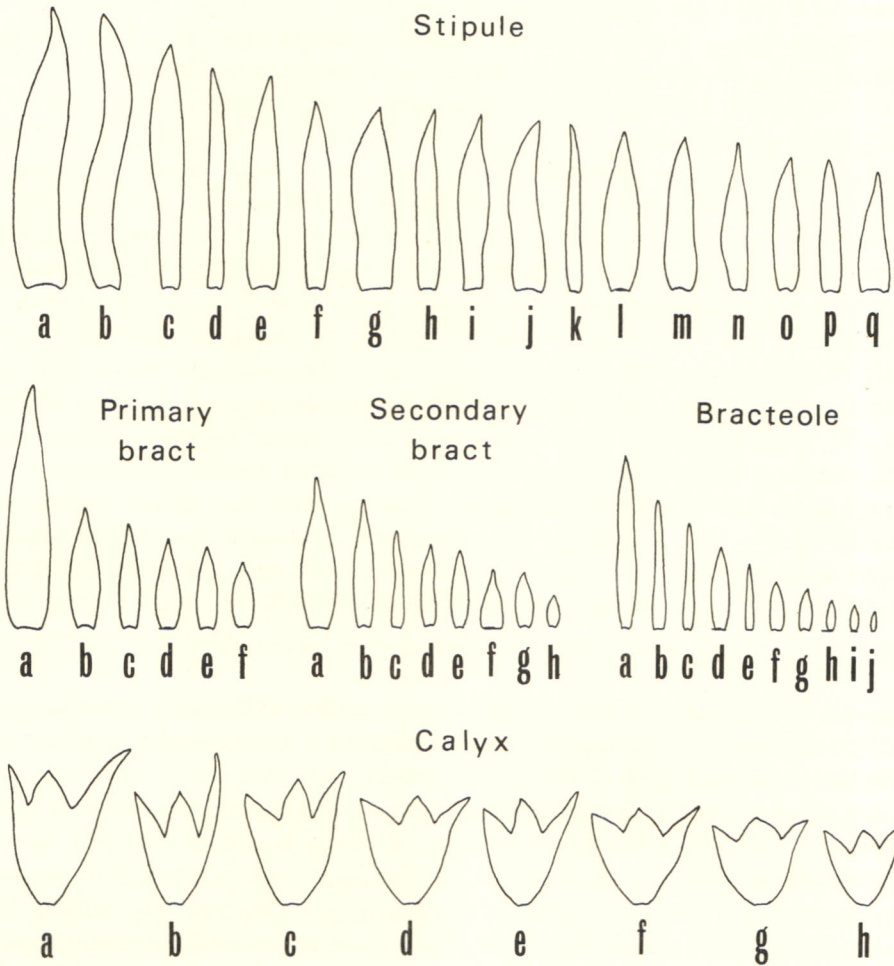


Fig. 33. Variation of the stipule ( $\times 4$ ), primary bract ( $\times 4$ ), secondary bract ( $\times 8$ ), bracteole ( $\times 8$ ), and calyx ( $\times 4$ ) in *D. elegans* in Nepal. [**Stipule** (a & b: Hara et al. in 1969, c & d: Stainton et al. 697, e & n: B. Lyon 35A, f: Stainton et al. 1575, g & j: B. Lyon 2024, h & o: Stainton et al. 914, i: Stainton 6326, k & p: Polunin et al. 4424, l: Polunin et al. 3781, m & q: Gardner 286); **Primary bract** (a: Hara et al. in 1969, b: B. Lyon 2024, c: Stainton et al. 697, d: Polunin et al. 4424, e: Polunin et al. 3781, f: Polunin et al. 2305); **Secondary bract** (a: Stainton et al. 2568, b: B. Lyon 35A, c: McCosh 234, d: Hara et al. in 1969, e & f: Stainton et al. 697, g & h: Stainton et al. 914); **Bracteole** (a: Polunin et al. 3781, b & e: Stainton et al. 2568, c: B. Lyon 35A, d: Stainton et al. 151, f: Polunin 3237, g: Polunin et al. 2305, h: Stainton et al. 2893, i: McCosh 234, j: Stainton et al. 914); **Calyx** (a: Polunin et al. 3781, b: Stainton et al. 2568, c: Stainton 6326, d: Stainton et al. 914, e: B. Lyon 35A, f: Stainton et al. 1575, g: B. Lyon 2024, h: Stainton et al. 697)].

Ranges of variations in the shape of stipule, primary bract, secondary bract, bracteole and calyx are examined on 23 specimens of *D. elegans* (asterisked in the list of the specimens examined) from various localities in Nepal. The results are illustrated in Fig. 33. As shown in the figure, the stipules of the species vary in shape as linear, subulate, narrowly elliptic, narrowly ovate, narrowly triangular or narrowly obovate and vary in size from 4 to 9 mm by 0.6 to 1.3 mm; the primary bracts are variously shaped as narrowly elliptic, narrowly ovate, narrowly triangular, elliptic or ovate and 2–8 mm by 0.4–1.2 mm in size; the secondary bracts are subulate, narrowly elliptic, narrowly triangular, narrowly ovate, elliptic, triangular or ovate in shape and are 0.5–2.5 mm by 0.3–0.6 mm in size; and the bracteoles are narrowly oblong, narrowly elliptic, narrowly ovate in shape and are 0.3–3 mm by 0.1–0.3 mm in size. The calyces vary also greatly in shape from narrowly to very broadly campanulate as shown in the figure. The length of them ranges from 2.2 to 5 mm; their tube 2–3 mm; and the lobes are nearly same or unequal in length (especially lower lobes vary from nearly same to distinctly longer than the others). The size and the shape of flower petals are also variable. So far as the flowers examined (about 50 flowers from 18 specimens of the species), an average sized flower is illustrated in Fig. 38: a. Among the specimens examined a specimen (Polunin, Sykes & Williams 3781) has the largest flowers including the calyx, stamen and pistil. In the specimen the size of standards is 17–17.5 by about 11 mm, that of wings are 19–19.5 by 4.5–5 mm, and that of keel-petals are 15–16 by 4.5–5 mm (Fig. 38: c).

The degree and nature of the indumentum on leaflet, inflorescence-rachis, pedicel and calyx are also very variable by individuals. Such specimens as Polunin, Sykes & Williams 1007 and 3237 (both in BM and TI) have the leaves covered densely with appressed white sericeous hairs on the upper surface and very densely spreading white- or silver-woolly both on the lower surfaces and along margins, the inflorescence-rachides and the pedicels covered densely with spreading or ascending white-woolly hairs, and the calyces very densely ascending woolly outside. While McCosh 234 (in BM and TI) has the leaves sparsely appressed sericeous mixed with straight or uncinat minute hairs on the upper surfaces, moderately appressed sericeous on the lower surfaces, and densely ciliate-sericeous along the margin, the inflorescence-rachides rather sparsely patent uncinat hairy, the pedicels nearly glabrous but very sparsely minute puberulent, and the calyces very sparsely pubescent mixed with rather densely straight and uncinat hairs outside. As described above on the range of the variation of *D. elegans* in Nepal, this species is highly polymorphic even in a rather narrow area within a whole range of its distribution.

Comparing the specimens of the species from Himalaya with those of China, it is apparent that the species in China is more variable than in Himalaya and tends to show a somewhat different pattern of variation. In Himalaya the lateral calyx-lobes are never longer than the tube, whilst in China such specimens as Rock 7184 (A, E) & 9040 (E, K), Feng 1211 (A), Yü 11776 (A), Ching 30273 (A), and McLaren's collector P76 (E) have calyces of which lateral lobes are apparently longer than the tube. The stipules of the species in Himalaya are 4–10 times longer than broad, however, those in China vary from 1.3 (Tsai 52790 A) to 11 (Forrest 2517 E,

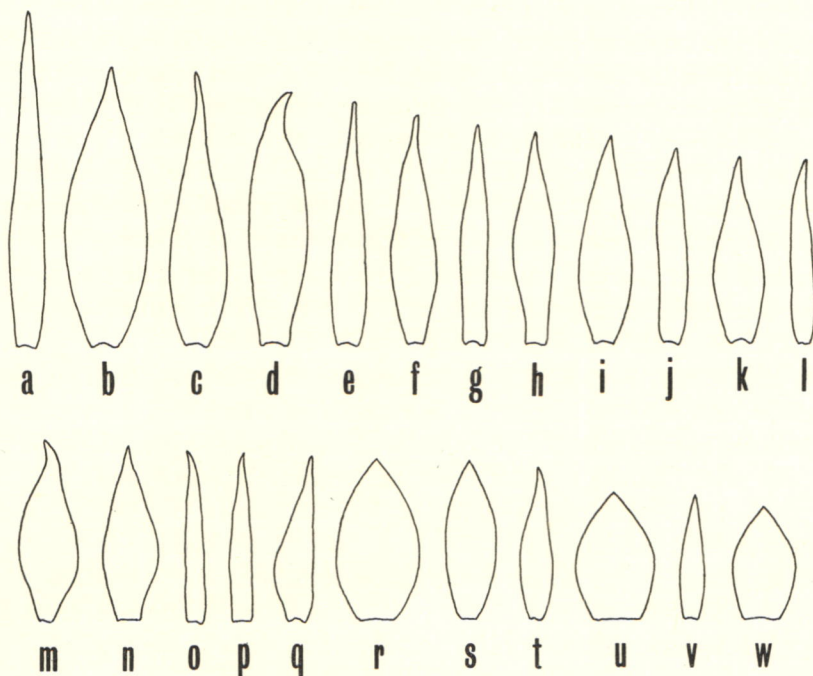


Fig. 34. Variation of the stipule in *D. elegans* in China,  $\times 4$  (a: Forrest 2517; b, d & f: T. T. Yü 6381; j & v: Ching 20790; k, n & q: Yü 6300; l & o: H. T. Tsai 57248; p: Yü 15482; r, s, u & w: Tsai 52790).

TNS) times longer, as shown in Fig. 34. In China, the species exceeds the range of variation shown in Himalaya also in other characters, i.e. bracts, bracteoles, and calyces, and the variation is more complex.

In pollen morphology, nevertheless, it is remarkable that the grains of *D. elegans* from Himalaya and those from China are rather uniform and differ slightly in the pollen size, the shape of pores and the exine thickness. Grains of the species from Himalaya are almost uniform and the pores are equatorially elongated elliptic in shape, protruding, and without granules on the membrane. Whilst those of the species from China are deviate slightly from the variation range of the Himalayan pollen in the grain size and the pore shape. The pores of the Chinese specimens vary in the shape and are distinguished two forms: one is the identical form of the Himalayan species described above and the other is rounded or slightly elongated elliptic in shape, more or less flattened, and granules on the membrane. The exine thickness of the Himalayan grains is mostly about  $2 \mu$  but that of the Chinese is usually about  $1.5 \mu$ . Other characters of the pollen grains from both regions are all nearly identical in *D. elegans*.

Although *D. elegans* varies greatly in external morphology as described above, some characteristic races are usually well recognizable and distinguishable as infraspecific taxa of the species. Schindler (1926) in his comprehensive study of the subgenus *Dollinera* recognized many specific and infraspecific taxa within his sect.

Tiliifolia, which built up on *D. elegans* as *D. tiliifolium*. As shown in the synonymy of *D. elegans* in the present paper, the species in this circumscription includes the following taxa from the section: *D. nutans*, *D. elegans* sensu Schindler, *D. tiliifolium* and its all infraspecific taxa, i.e., var. *argenteum*, var. *genuinum*, f. *typicum*, f. *lanceolatum*, f. *rhabdocladum*, f. *glabrum*, f. *calvum*, and var. *Potaninii*, *D. cinerascens*, *D. glaucophyllum*, *D. Forrestii*, *D. stenophyllum*, *D. wolohoense*, and *D. callianthum*. Among them, however, *D. nutans*, *D. stenophyllum*, *D. wolohoense*, and *D. callianthum* are considered to be better to treat as subspecies or varieties of *D. elegans*.

Subsp. *stenophyllum* (Pamp.) Ohashi (Fig. 37: a) from Yunnan is the most characteristic and distinct in having the glabrous, narrowly elliptic leaflets with an acuminate apex and the glabrous, slightly larger pods (Fig. 40: l).

In its typical form (Fig. 37: b) *D. callianthum* is specifically distinct in having smaller leaves and flowers, copiously branched inflorescences, somewhat longer, filiform pedicels, always apparently apiculate or mucronate apex of the keel-petals (Fig. 39: b), and shallowly constricted and minutely hairy pods (Fig. 40: h). However, such specimens from Yunnan or Tibet as Maire 40, 230 & *s.n.* (all E), Monberg 99 & 1912 (all E) and Yü 7285 (A) show intermediate features between the typical form and subsp. *elegans* in the shape of inflorescence as well as leaves and the hairiness of leaflets and pods. Two collections from Yunnan (Forrest 16863 E and Feng 2774 A) have distinctly larger leaflets than those of the typical form. Such specimens of subsp. *elegans* as Wang 66364, 66429 & 75443 (all A), Yü 13335 (A), Smith 2324 (A), Fang 1499 (NY), 3683 (E, TNS) & 5518 (E), and Maire 7217 (NY) are somewhat similar to *D. callianthum* in having smaller leaflets and/or filiform pedicels. Accordingly it may better be treated as a subspecies of *D. elegans*.

Within subsp. *elegans*, var. *nutans* (Hook.) Ohashi found on western Himalaya is different from other races in the shape of its terminal leaflets and in the amount and nature of its indumentum. The terminal leaflets of this variety are nearly orbicular to very broadly obovate with usually rounded and often with mucronate apex covered especially on the lower surfaces by very densely white-woolly hairs as are the young branches, the petioles, and the petiolules, and the inflorescences are large and copiously branched wide panicles. The lateral lobes of its calyx are often obtuse at the apex. A form belonging to var. *elegans*, "argenteum" which has been recognized as distinct species or variety, becomes often very near to var. *nutans* in the degree and nature of the indumentum and in well-developed inflorescence. Such specimens as Lace 1427 and 1722 (both in CAL) are clearly referable to var. *elegans* but appear to be an intermediate between these varieties in the characters described above. Although var. *nutans* has hitherto been not reported from China, a collection of var. *elegans* from Yunnan (Yü 13447 A) is very similar to the former variety. This collection shows an extreme form in having nearly orbicular leaflets with a rounded apex covered very densely with pale yellowish woolly hairs, but such gathering from China as Fang 3506 (E) connects between the form and var. *elegans*.

Among the races of subsp. *elegans* endemic to China, var. *wolohoense* (Schindler) Ohashi is considerably distinct by the small-sized leaflets, the long pedicels and calyx-lobes, and the glabrous pods. These features, however, are often very similar to those of subsp. *callianthum*. For example, Forrest 10180 (E), Yü 6300, 6301 &

6381 (all A) are a form very near to the subspecies. Accordingly, these features seem to be inadequate to maintain its specific status. As several characters are not described in the original description, the following supplementary description of the variety is given here. Leaves thinly chartaceous, 1.2–2.5 times longer than wide, the upper surface uniformly minute puberulent and only on nerves sparsely appressed longer pubescent, the lower mostly on nerves sparsely pubescent (about 0.5 mm long). Stipules narrowly elliptic or linear, conspicuously striate, 4–7 mm long and about 1 mm wide, rather densely puberulent. Pedicels 1.3–2.2 cm long in anthesis, nearly glabrous but mixed with sparse minute hairs. Bracteoles very early caducous, narrowly elliptic, about 0.8 mm long and 0.1 mm wide, glabrous inside, rather densely puberulent outside. The lower calyx-lobes longer than the tubes (usually 1.5–2 times longer) and lateral lobes usually triangular, 2.2–2.8 mm long, nearly same or distinctly longer than the tube (0.2–0.8 mm longer). Pods 3–5(?)-jointed, sparsely pubescent (about 0.3 mm long) but later glabrescent, reticulate veined; joints depressed obovate,  $8-9 \times 4-4.5$  mm in size.

When describing *D. cinerascens*, Franchet compared the species with *D. elegans* sens. str. (as *D. oxyphyllum* sensu Bentham or Baker) and noted "il en diffère par les folioles constamment élargies, à réseau de nervures très élevé en dessous et par la pubescence cendrée assez abondante qui recouvre toutes ses parties." These diagnostic characters are, however, very continuously variable in *D. elegans* and, thus, cannot be maintained. The type specimens of *D. cinerascens* (Delavay 2732 P) and its variety, var. *microphyllum* (Delavay 3182 P), are quite identical to *D. elegans* (Fig. 36: a & b). In the explanation of *D. cinerascens* figured in Curtis' Botanical Magazine tab. 8805 (1919), Hutchinson distinguished the species from *D. elegans* by the more rounded leaflets, persistent stipules, and usually quite simple, pilose hairy racemes. These characters are, also, not available as diagnostic. In the description, moreover, the calyx of *D. cinerascens* is explained wrongly as "subaequaliter 5-lobus," and the stipules of the species are not ovate as in the figure but narrowly triangular.

A typical form of *D. glaucophyllum* has narrowly rhomboid-elliptic terminal leaflets with uniformly whitish velutinous hairs on the lower surfaces, long axillary racemes, and the 6–9-jointed long pods with the distinctly indented lower sutures. The isotype specimens (Maire 118 CAL) is a less pubescent form and its calyx, young branches, lower surfaces of leaflets, inflorescence-rachis, and pedicels are sparsely covered with straight silky hairs, whereas Yü 6721 (A) is densely velutinous on those parts. Through the later form the typical forms of this species continued to subsp. *elegans*.

Within the subgenus *Dollinera*, according to Schindler (1926), one of the diagnostic character of *D. Forrestii* is "calycis laciniae omnes tubo distincte longiores, acutae." Having examined carefully the type specimen (G. Forrest 4226 E, TNS), the calyx-lobes are never longer than the tube and especially the laterals are apparently shorter than the tube and the other lobes. The form hitherto attributed to *D. Forrestii* resembles much *D. cinerascens*, a synonym of *D. elegans*, and has the angular young branches with ascending white-sericeous along the ribs, the subcoriaceous leaflets with densely and softly silky hairs on the upper surfaces and densely ascending or patent sericeous hairs especially on the nerves of the lower surfaces, the terminal leaflets rhombic to ovate with acute or obtuse apex, the narrowly triangular

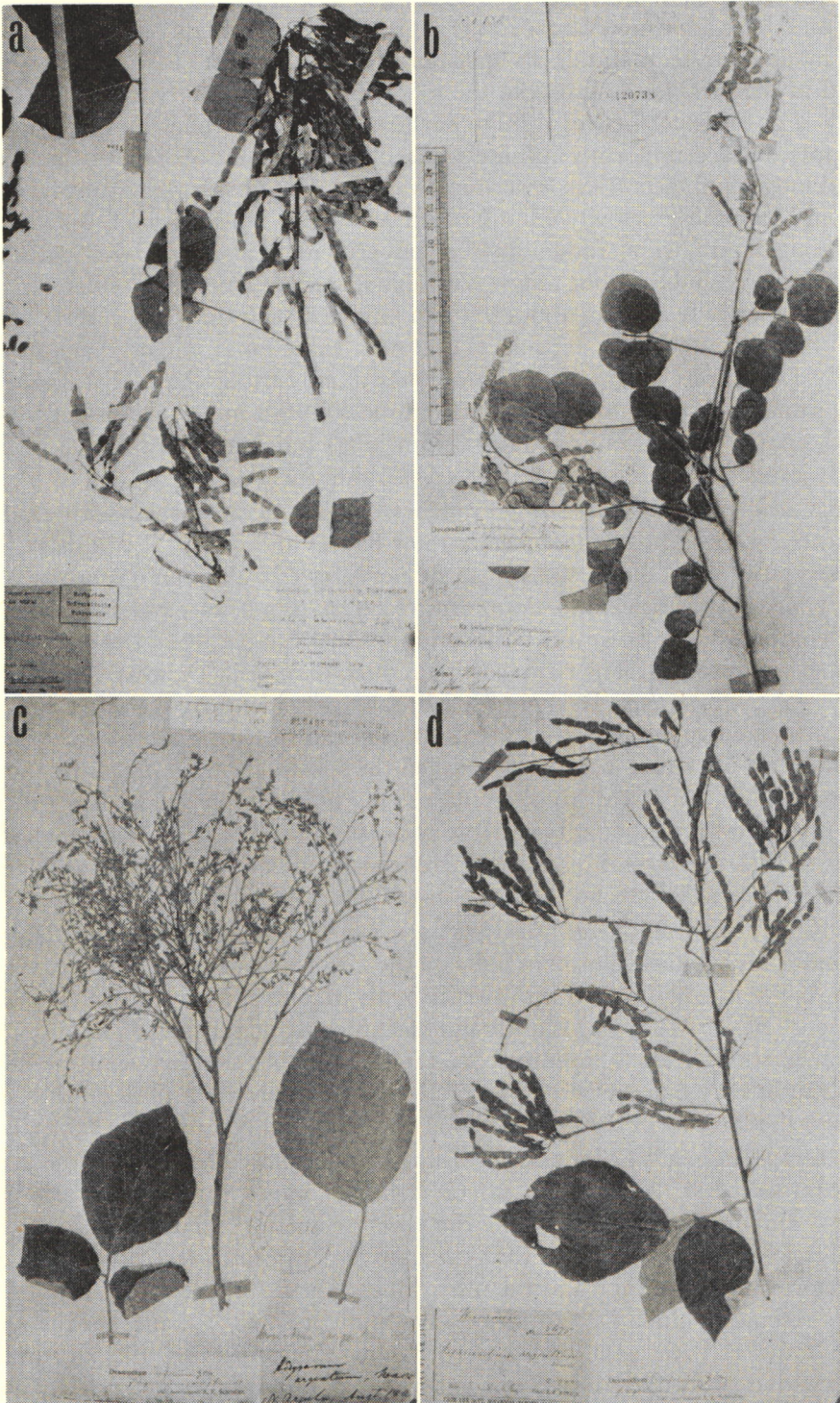


Fig. 35. *D. elegans* DC. (a: Polunin, Sykes & Williams 8200, b: Potanin *s.n.* Syntype of *D. tiliifolium* var. *Potaninii*, c: Wallich?, d: Duthie 5475).



Fig. 36. *D. elegans* DC. (a: Delavay 2732 Lectotype of *D. cinerascens*, b: Delavay 3182 Holotype of *D. cinerascens* var. *microphyllum*, c: Forrest 4226 Holotype of *D. Forrestii*, d: Maire 118 Isotype of *D. glaucophyllum*).



Fig. 37. Intraspecific taxa of *D. elegans* DC. a: subsp. *stenophyllum* (Pamp.) Ohashi, b: subsp. *callianthum* (Franch.) Ohashi, c: subsp. *elegans* var. *Handelii* (Schindl.) Ohashi, d: subsp. *elegans* var. *nutans* (Hook.) Ohashi.



stipules, the pedicels covered with spreading sericeous and straight or uncinat minute hairs like the hairiness of calyx. Therefore this species cannot be separable from *D. elegans*.

Key to the subspecies and varieties of *D. elegans*.

- 1 { Terminal leaflets glabrous, narrowly ovate (4–6 times longer than broad),  
acuminate at the apex. Pods entirely glabrous . . . . . subsp. *stenophyllum*
- 1 { Terminal leaflets not as the above (less than 4 times longer than broad)  
. . . . . 2
- 2 { Pods very sparsely and minutely puberulent and often nearly glabrescent  
. . . . . 3
- 2 { Pods distinctly pubescent and often puberulent . . . . . 4
- 3 { Upper surfaces of leaflets only minutely puberulent; teminal leaflets mostly  
narrowly ovate (2–3 times longer than broad) and small in size (3.5–4.5 cm  
long and 1.2–2.2 cm wide). Calyx lobes not shorter than the tube. Pedicels  
when anthesis 1.3–2.2 cm long, rather sparsely minutely puberulent  
. . . . . var. *wolohoense*
- 3 { Terminal leaflets normally to broadly elliptic or ovate (1.2–2 times longer than  
broad), acute or obtuse at the apex . . . . . subsp. *callianthum*
- 4 { Terminal leaflets nearly orbicular to very broadly obovate (0.7–1.2 times  
longer than broad), usually rounded often with mucronate apex. Plants  
densely silver-gray pubescent. . . . . var. *nutans*
- 4 { Terminal leaflets not as the above (1.2–3 times longer than broad), usually  
acute but varying from obtuse to acuminate or often caudate at the apex  
. . . . . 5
- 5 { Pods densely spreading white-velutinous and sericeous. Terminal leaflets  
rhomboidal, sharply acute at the apex . . . . . var. *Handelii*
- 5 { Pods appressed pubescent . . . . . var. *elegans*

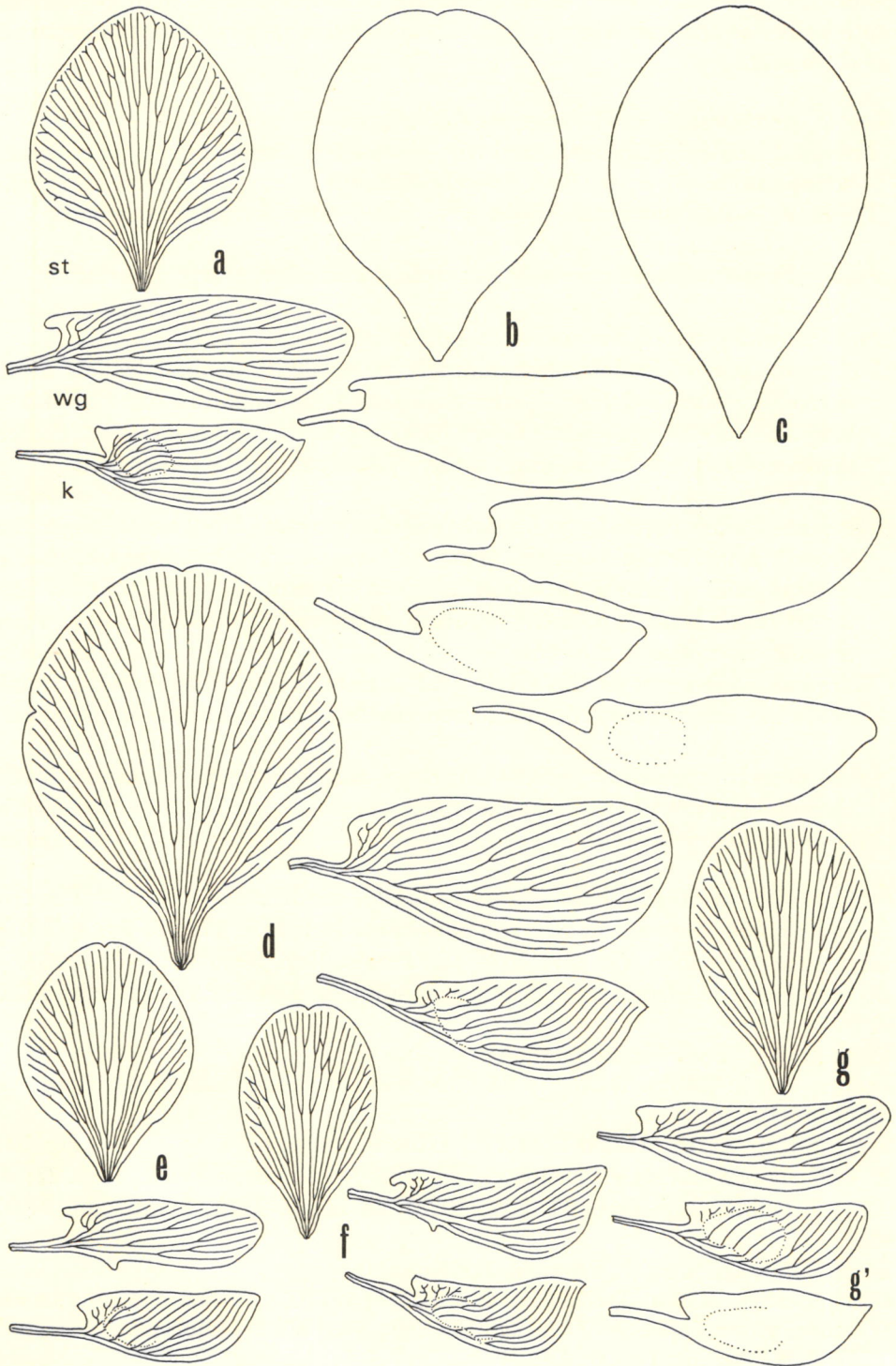
6-1) Subsp. **stenophyllum** (Pamp.) Ohashi, comb. nov. [Fig. 37a]  
*D. stenophyllum* Pampan. in Nuovo Giorn. Bot. Ital. N.S. **17**: 15, fig. 4 (1910)–  
Schindl. in Fedde, Rep. **22**: 267 (1926); in Fedde, Rep. Beih. **49**: 300 (1928).

*D. tiliifolium* var. *stenophyllum* (Pamp.) Schindl. in Engler's Bot. Jahrb. **54**: 60  
(1916).

Distr. China (Endemic to Yunnan).  
Specim. exam.: **China**. Yunnan: Ghi Than, east of Tali Laki Lat. 25°48' N, alt. 9000  
ft. In open scrub by streams (G. Forrest 13525 E).

6-2) Subsp. **callianthum** (Franch.) Ohashi, comb. nov. [Fig. 37b]  
*D. callianthum* Franch., Pl. Delavay. 173 (1890)–Schindl. in Fedde, Rep. **22**: 267  
(1926); in Fedde, Rep. Beih. **49**: 269 (1928); in Hand.-Mzt., Symb. Sin. **7**: 570  
(1933).

Distr. Tibet and China (Yunnan, Szechuan).  
Specim. exam.: **Tibet**. Tse-kou (R. P. Monbeig 1912 E). **China**. Yunnan: In silvis  
ad Ta-chao, prope Tapin-tze (Delavay 3195 Sept. 28, 1888 P–**Holotype** & **Isotype** of  
*D. callianthum* Franch.); Pe Yen Tsin (P. S. Ten 538 E); Likiang: Fongkou (K. M. Feng  
2957 A); Muli: Consinliang near Ngerya, on the border of Chungtien, alt. 2300 m. On



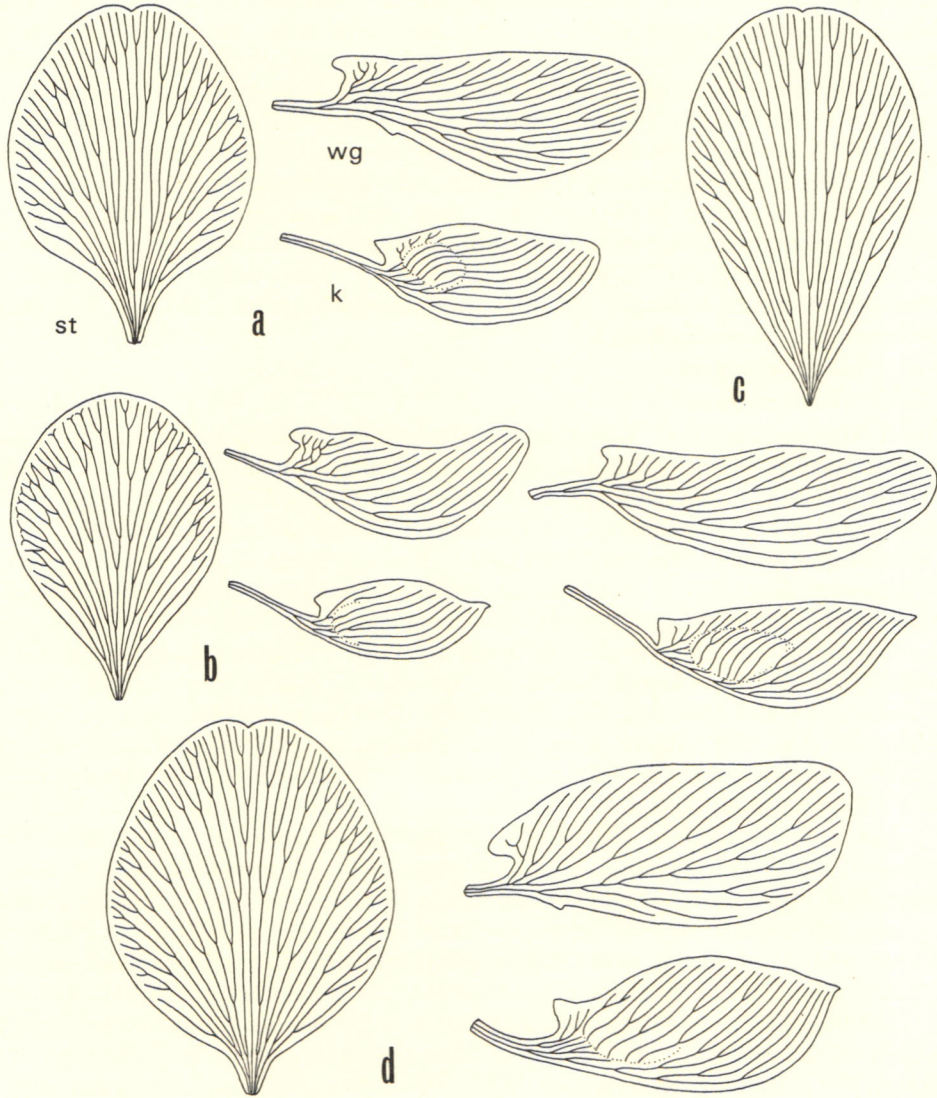


Fig. 39. Petals (st: standard, wg: wing, k: keel) of the infraspecific taxa of *D. elegans*,  $\times 3.5$ . a: var. *nutans* (Polunin, Sykes & Williams 2305), b: subsp. *callianthum* (Forrest 16863), c: var. *wolohoense* (Rock 4555), d: var. *Handelii* (Forrest 10102).

Fig. 38. Petals (st: standard, wg: wing, k: keel) of *D. elegans* var. *elegans* ( $\times 3.5$ ) showing variations of the shape and size. a: Nepal (Polunin, Sykes & Williams 3237), b: Nepal (Stainton, Sykes & Williams 151), c: Nepal (Polunin, Sykes & Williams 3781), d: China (Rock 9040, a form referable to *D. spicatum*), e: China (Delavay 2732 Lectotype of *D. cinerascens*), f: China (Maire 118 Isotype of *D. glaucophyllum*), g: (Forrest 4226 Holotype of *D. Forrestii*, g': a variation of the keel-petals, with an acute apex).

open hillside (Feng 2774 A); Decent to the Yangtze from the eastern boundary of the Lichiang valley (G. Forrest 10755 E, BM); Mt. Long Shan, alt. 8000 ft. Open dry situation amongst scrub (Forrest 12737 E); Tongtehuan (R. P. Maire *s.n.* in 1914 BM, E); Long-tan, alt. 2500 m (E. E. Maire 399 E, MAK); Ma-li-ouan, alt. 2990 m (E. E. Maire *s.n.* E); Mt. Siao-ou-long, alt. 2600 m (E. E. Maire 40 E); no exact locality (E. E. Maire 10080 NY); Haba, alt. 2650 m (Handel-Mazzetti 4419 E); without exact locality (T. T. Yü 7452 A); Weihsi, W. of Tungchuling, alt. 3000 m. Among thickets (T. T. Yü 10724 E); Louchien-tong (S. Ten 178 E); Jung-peh mountains, lat. 26°42' N, alt. 9–10000 ft. Open dry situations in thickets (Forrest 16863 E); Laies-plaine de Ta-kiao, alt. 2900 m (E. E. Maire 230 E), without exact locality (Monberg 99 E). Szechuen: In glareosis supra vicum Lumapu, alt. 1750 m (Handel-Mazzetti 2114 E). Kweichow: Gan-chouen (A. Cavalerie 3998 K).

6-3) Subsp. **elegans**

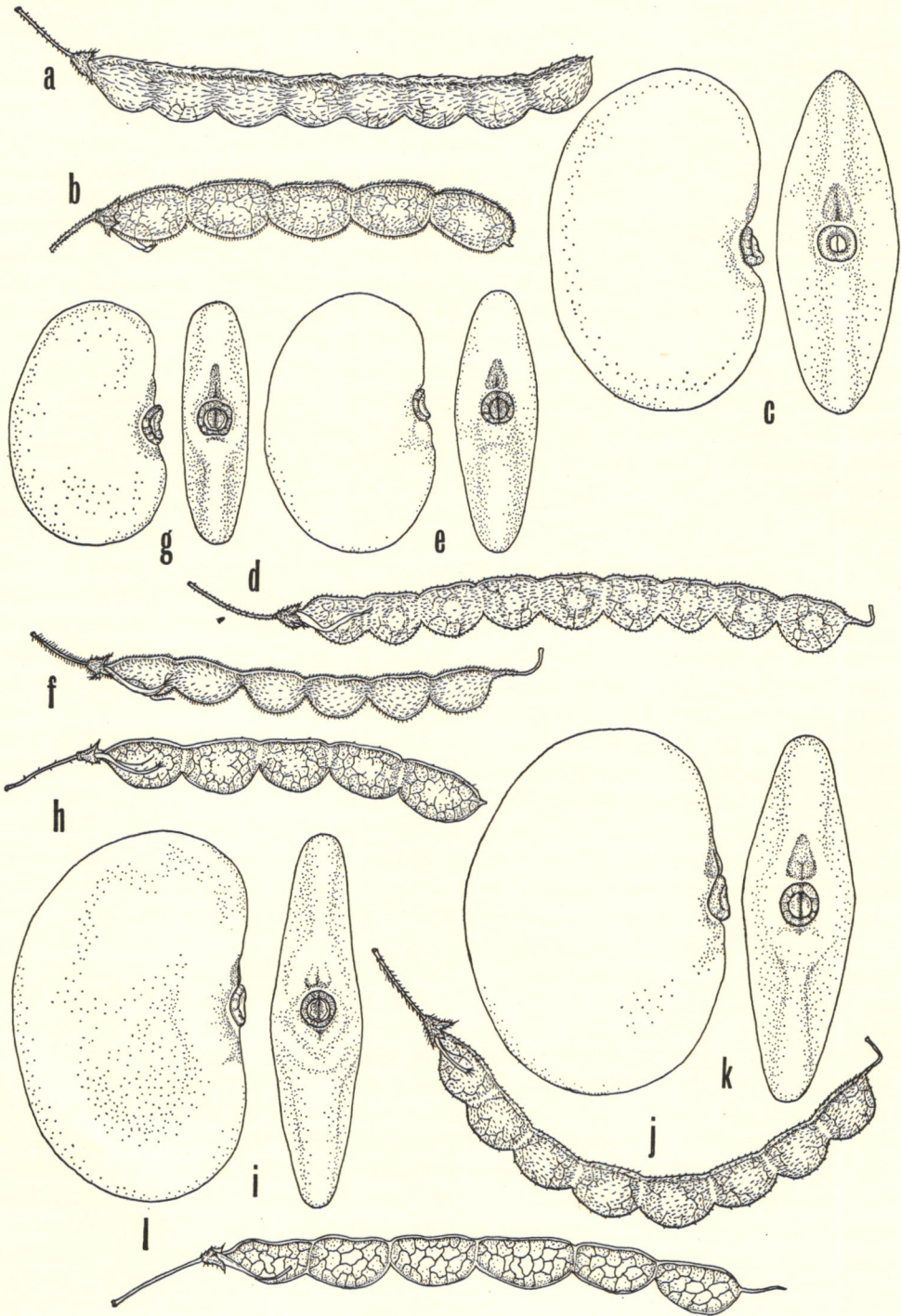
6-3-1) Var. **elegans**

[Fig. 35 a–d]

Distr. Afghanistan, N.W. India, Himalaya (Nepal, Sikkim, Bhutan), and China.

Repres. specim. exam.: **Afghanistan.** Kurum Valley (Aitchieson 810 CAL). **India.** (Falconer 447 CAL), Kumaon: (J. F. Duthie 5475 CAL), Pithoragah (Inayat 24324 CAL), (Collett 48 CAL); Chamba (C. B. Clarke 23535B CAL), (J. H. Lace 1427 CAL); Chitral: Mirgor Valley (Gatacre 17123 CAL); Bashahr Pangi (Lace 363 CAL); Kashmir: Shalunir Bagh (G. A. Gamble *s.n.* CAL), Eismakhan (Clarke 31173B CAL); Simla (Gamble 289 CAL); Ghuruwal (G. King *s.n.* CAL); Mussorie (King in 1869 CAL), (B. C. Sen 38 TI); Pangee (Stoliczka *s.n.* CAL); Hazara (Inayat 19320 CAL); Nainital (Lata *s.n.* TI). **Nepal.** Marsiandi, alt. 8000 ft. Among rank herbage in open pine forest (Lowndes 1408 BM, TI); Luma, alt. 8500 ft. In thickets (Polunin, Sykes & Williams 381 BM, TI\*), Bheri River, Below Tarakot, alt. 9500 ft. (Polunin et al. 1007 BM, TI\*), Hurta-Narku, alt. 7000 ft. (Polunin et al. 3237 BM, TI\*), Phylgaon, alt. 4500 ft. (Polunin et al. 3781 BM, TI\*), Dozam, alt. 8500 ft. (Polunin et al. 4279 BM, TI\*), Jumla, South bank of Tila River, alt. 7600 ft. (Polunin et al. 4424 BM, TI\*), Gargiankot, alt. 8500 ft. (Polunin et al. 5513 BM, TI\*); Mayangdi Khola, alt. 4500 ft. Tangled with other shrubs at edge of cultivation (Stainton, Sykes & Williams 151 BM, TI\*), Lete, alt. 8000 ft. Among shrubs and trees (Stainton et al. 697 BM, TI\*), Chimgaon, alt. 9000 ft. At edge of field (Stainton et al. 914 BM, TI\*), Ghasa, Kali Gandaki, alt. 7500 ft. Moist shrubs (Stainton et al. 1575 BM, TI\*), Taglung, alt. 9000 ft. (Stainton et al. 1683 BM, TI\*), near Muna, alt. 6000 ft. On exposed south & east facing dry slopes (Stainton et al. 2568 BM, TI\*), Lumsum, alt. 7000 ft. In open forest (Stainton et al. 2893 BM, TI\*), Taglung, Kali Gandaki, alt. 10000 ft. On steep grass bank (Stainton et al. 8200 BM, TI\*); Humla, Mumya Lagna, alt. 9500 ft. (Stainton 6326 BM, TI\*); Trisuli river, Syabrubensi, alt. 5000 ft. Open stony hillside in full sun (S. Bowes Lyon 35A BM, TI\*), above Dhunche-Gosainkund, alt. 2700 m. At the margin of *Quercus semecarpifolia* forest (Hara et al. in 1969 TI\*); Helok-Baroya Khimty (Kanai, Murata & Togashi 6301482 TI); Kathmandu: Phulchauki, alt. 2000 m. In open *Quercus semecarpifolia* forest (Ohashi in 1967 TI\*), (Hara, Kurosawa & Ohashi in 1969 TI\*); Likhu Khola, Kyama, alt. 7500 ft. (D. McCosh 234 BM, TI\*); Buri Gandaki River, 16 miles above Arught Bazar, alt. 4000 ft. Stony river terrace (P. C. Gardner 286 BM, TI\*). **Sikkim.** (G. King *s.n.* CAL), Choongthang (D. Prain *s.n.* CAL). **Bhutan.** Shamgong Dzong, Mangde Chu, alt. 2500 ft. In *Pinus longifolia* forest (Ludlow, Sherriff & Hicks 18573 BM, TI); Yuwak-Wangdu Phodrang (Hara et al. 4438 TI), Wangdu Phodrang-Samtengang (Hara et al. 3778 TI), (Murata, Ohashi & Yamazaki 10001 TI), (Kanai et al. 10554 TI). **China.** Yunnan: In collibus calcareis prope Yang-in-chan, supra Lankong (Delavay 2732 Sept.

5, 1887 P—**Lectotype** of *D. cinerascens* Franch.); In umbrosis circa Tchao-tong supra Hokin (Delavay 3182 Sept. 1, 1887 P—**Holotype** of *D. cinerascens* var. *microphyllum* Franch.); Dry, open situation on scrub in side valleys on the eastern flank of the Tali Range, lat. 25°40' N., alt. 7–9000 ft. (G. Forrest 4226 Aug.–Sept. 1906 E—**Lectotype** of *D. Forrestii* Schindl.; TNS—**Isotype**); no detailed locality (G. Forrest 10180, 10950 BM; 2517 TNS); Hills around Yung-heh, alt. 6–7000 ft. Margins of forests and in thicket (Forrest 21184 E); no detailed locality (C. Schneider 3230 GH); Jungpehting–Yangtze, prope Tainasko, alt. 2000 m (C. Schneider 3541 E); Yunnan-sen, Tertres de la plaine (Maire 118 CAL—**Isotype** of *D. glaucophyllum* Pamp.) Siou-ou long, alt. 2990 m (E. E. Maire 23 E); Tertres de Ma-li-ouan, alt. 2990 m (E. E. Maire 422 E), (Maire 498 TI); Tea-kiao (E. E. Maire 2304, *s.n.* E); Pan-long-Le, alt. 2400 m (E. E. Maire 3235 NY); no detailed locality (E. E. Maire 3522, 6458, 7217, 10083, 10084 NY); Tong-tehouan (E. E. Maire *s.n.* E); Yi-liang Hsien, alt. 1500 m, on open slope (H. T. Tsai 52180 A); Yung-jen Hsien, alt. 2500 m. On marginland of forest (Tsai 52790 A), alt. 2000 m (H. T. Tsai 52856 A); Pin-Ohuan Hsien, alt. 2400 m. In ravine (Tsai 52912 A); Long-ping Hsien, alt. 2600 m (Tsai 53706, 54037, 56146 A); no detailed locality (Tsai 57248, 57471, 57574 A); Wei-si Hsien, alt. 2800 m (Tsai 59853 A), Kang-pu, alt. 1930 m (C. W. Wang 64144, 67634 A); Sikang, Dzer-nar, Tsa-wa-rung, alt. 2500 m. Pine wood (Wang 65443A A), alt. 3000 m. Mountain slope (Wang 66364 A), Oak woods (Wang 66429 A), Mekong, Tsa-wa-rung, alt. 2600 m (Wang 65486 A); Huan-fu-ping, alt. 3500 m (C. W. Wang 69322 A); Li-kiang Hsien, alt. 2500 m. Mountain slope (C. W. Wang 70877 A); no detailed locality (C. W. Wang 71243 A); Jenn-yeh Hsien, Meng-la, alt. 1000 m (C. W. Wang 80578 A); Likiang, Laschib (R. C. Ching 20792 A), Laschiba. In mixed forests (R. C. Ching 21795 A), Tsgekou on Yangtze (R. C. Ching 21592 A), Snow Range (R. C. Ching 30273 A), Snow Range. In mixed forrest (R. C. Ching 30570 A); no detailed locality (T. T. Yü 6004, 6089, 6321, 6721, 6744, 7285, 8714, 10320 A; 10579 A, BM, E; 11476, 13335 A; 13447, 15482 A, BM, E); N. flank of Haba Snow Range (K. M. Feng 2232 A); Chungtien, Lachiho, alt. 2850 m. By stream in wooded side valley (K. M. Feng 2739 A); E. flank of Likiang Snow Range, alt. 2700–2900 m (K. M. Feng 3018 A); Li Chung (McLaren's collectors P76 E); Sung Kuei (McLaren's collectors C243 E); Lichiang Range (McLaren's collectors 243c BM); Yunpe (P. Simeón Ten 130 E); Pe-Yen-tsin, Kauty (P. Simeón Ten 463, 562 E); Yangtze watershed, western slope of Likiang Snow Range (J. F. Rock 4184 A, E); Eastern slope of Likiang Snow Range, Yangtze watershed. Rocky slopes. 95–10000 ft. (Rock 9040 E, K); Cult. at Golden Gate Park, San Francisco (A. Eastwood *s.n.* in Oct. 1916 A); no detailed locality (Monberg 99 E); Sikang: near Ta Hsiang Ling, Han Yuen Hsien, alt. 2600 m (C. Y. Chiao 1880 A). Szechuan: near Tachienlu (A. E. Pratt 211, 695 CAL—**Syntype** of *D. tiliifolium* var. *Potaninii* Schindl.), (J. A. Soulie 112 CAL—**Syntype** of *D. tiliifolium* var. *Potaninii* Schindl.); Wenchuan Hsien (W. P. Fang 1499 A, NY, E, TI); Kangtin-Hsien, Tatsienlu, 8500–9000 ft. (Fang 3506 A, E, NY), At roadside (Fang 3683 E, TNS); Mow-Hsien, Mow-chow (Fang 5518 E; 5544 A, E, TI); Omei-Hsien. In thickets (Fang 6011 E); Pao-hsing Hsien (K. L. Chu 3111, 3640 A); Lo-shan Hsien. Tang-fang. By the road side (S. C. Sun & K. Chang 1612 A); Moupin (T. S. Wen 529, 545 A); Yutong, 4500 ft. Roadside (Wang & Wen 708 A); Kiating Fu (E. H. Willson 2927, 2928 A), alt. 1–3000 ft. Thickets (E. H. Wilson 9108 A); Wen-chuan Hsien (H. Smith 2324 A); O-Pien Hsien, alt. 1300–1600 m (Y. Liu 2163 A). Kweichow: Picheh, Tui-po. In open hill side (Y. Tsiang 9044 A), Lou-Ma-Ho, Tsingchen. Side of river (S. W. Teng 90326 A). Kansu: Heiho (Potanin *s.n.* July 21. 1885 CAL—**Syntype** of *D. tiliifolium* var. *Potaninii* Schindl.).



6-3-2) Var. **Handelii** (Schindler) Ohashi, comb. nov. [Fig. 37c]

*Desmodium Handelii* Schindl. in Hand.-Mzt. in Anz. Akad. Wiss. Wien. Math.-Nat. **62**: 234 (1925); Schindl. in Fedde, Rep. **22**: 267 (1926); in Fedde, Rep. Beih. **49**: 278 (1928); in Hand.-Mzt., Symb. Sin. **7**: 570 (1933).

Distr. China (Yunnan, Szechuan).

Specim. exam.: **China**. Yunnan: Descent to the Yangtze from the eastern boundary of the Lichiang valley, lat. 27°15'N, alt. 9–10000 ft. (Forrest 10102 E); between Likiang, Tungshan, Tuinaoka, and Tsilikiang, dry Yangtze drainage basin (J. F. Rock 8517 E, A), Yangtze watershed, western slopes of Likiang Snow Range (Rock 4184 E), N. flank of Haba Snow Range (K. M. Feng 1211 A). Szechuan: In regione subtropica convallis fluminis Yalung ad affluentem versus Yen Yuen. In glareosio supra vicum Lumapu, alt. 1750 m (Handel-Mazzetti 2113 May 10, 1914 K—**Isotype** of *D. Handelii* Schindler).

This variety is very closely related to var. *elegans* but differs from it in shape of leaflets and hairiness on pods, young branches and lower surfaces of leaflets. These parts of var. *Handelii* are covered very densely with white or creamy white velutinous hairs. However, as var. *elegans* is extremely highly polymorphic, and such specimens of the variety from Yunnan as Rock 4184 (A) and Yü 11476 (A) approach to var. *Handelii* in the hairiness. These specimens differ from the latter variety in the shape of leaflets and by such specimens as Rock 9040 (K, E) and McLaren's collector P76 (E) they are connected with the typical form of var. *elegans*. The relationship of var. *Handelii* to var. *elegans* may be compared to that of var. *nutans* to var. *elegans*.

6-3-3) Var. **nutans** (Hook.) Ohashi, comb. nov. [Fig. 37d]

*D. nutans* Hook. in Bot. Mag. **55**: t. 2867 (1828)—Schindl. in Fedde, Rep. **22**: 264 (1926); in Fedde, Rep. Beih. **49**: 286 (1928).

*Hedysarum nutans* Wall. [Cat. no. 5706 (1831–32), nom. nud.] ex Hook., l.c. (1828), pro syn.

Distr. N. W. India and W. Nepal.

Repres. specim. exam.: **India**. North-west (Royle *s.n.* CAL), (Hook. f. & Thomson *s.n.* CAL); Chamba (C. B. Clarke 23538B, 24096F CAL), (J. H. Lace 1722 CAL), Trella (N. C. Nair 32184 CAL); Serahan (Stoliczka *s.n.* CAL); Bashahr (Lace 455 CAL), **Nepal**. Suli Gad, alt. 9500 ft. (Polunin, Sykes & Williams 2305 BM, TI\*).

6-3-4) Var. **wolohoense** (Schindl.) Ohashi, comb. nov.

*D. wolohoense* Schindl. in Fedde, Rep. **21**: 1 (1925); l.c. **22**: 267 (1926); in Fedde, Rep. Beih. **49**: 308 (1928).

Distr. China (Yunnan, Szechuan).

Specim. exam.: **China**. Yunnan: Lichiang Range, lat. 27°40'N., alt. 10–11000 ft. Open thickets (G. Forrest 10180 E); Yangtze watershed, in the Prefectural District of Likiang, eastern slopes of Likiang Snow Range (J. F. Rock 4555 E), Yangtze drainage basin, east of Likiang (Rock 8978 E); without detail locality (Rock 11542 NY), (T. T. Yü 6300, 6301 & 6381 A).

∩ Fig. 40. Pods ( $\times 1.3$ ) and seeds ( $\times 13$ ) of *D. elegans*. a–f & j–k: subsp. *elegans*; a–c & j–k: var. *elegans* (a & c: Polunin, Sykes & Williams 5513, b: Murata, Ohashi & Yamazaki 10554, d–e: Chiano 1880, j–k: Fang 5518), f–g: var. *Handelii* (f: Handel-Mazzetti 2113 Isotype of *D. Handelii*, g: Forrest 10102), h–i: subsp. *callianthum* (Delavay 3195 Holotype of *D. callianthum*), l: subsp. *stenophyllum* (Forrest 13525).

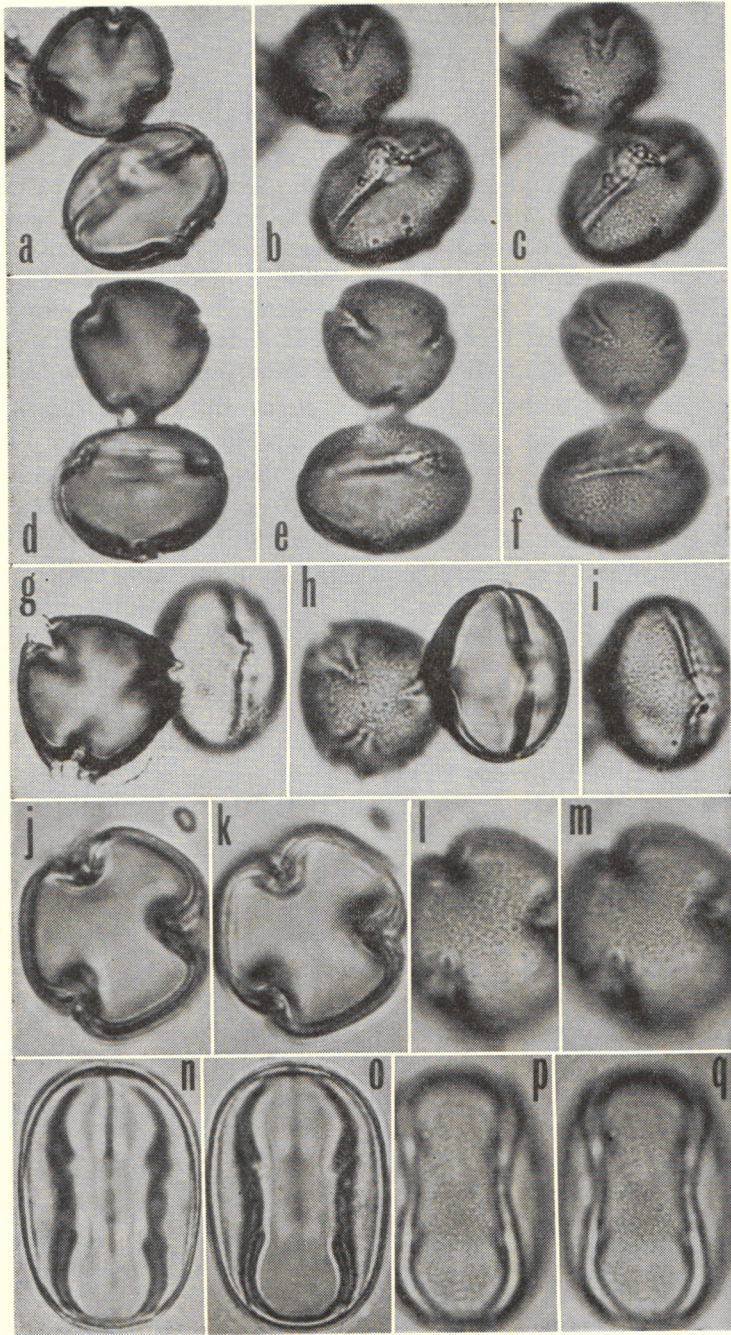


Fig. 41. Pollen grains of the species of the subject. Tillifoliae of the sect. Dollinera,  $\times 1000$ . a-f: *D. yunnanense* (a-c: subsp. *praestans*, McLaren's collectors P. 118; d-f: subsp. *yunnanense*, Delavay 1985), g-i: *D. Rockii* (Forrest 13093 Syntype), j-q: *D. elegans* (subsp. *elegans* var. *nutans*, Polunin, Sykes & Williams 3237).



7) ***Desmodium megaphyllum*** Zollinger in Nat. & Geneesk. Arch. Neerl. Ind. **3**: 58 & 77 (1846)—Miq., Fl. Ind. Bat. **1** (1): 245 (1855); Ind. Bat. Suppl. **1**: 113 (1860)—Prain in Journ. Asiat. Soc. Beng. **66** (2): 139 & 399 (1897), incl. var. *typica* Prain—Gagnep. in Fl. Indo-Chine **2**: 592 (1920)—van Meeuwen in Reinwardtia **6**: 100 (1961) & 253 (1962)—Backer & Bakh. f., Fl. Java **1**: 606 (1963).

[Fig. 43a]

*D. scandens* Bl. ex Miq., Fl. Ind. Bat. **1**, **1**: 246 (1855), pro syn.

*D. rubescens* Bl. ex Miq. l.c. 246 (1855), pro syn.

*D. karensium* Kurz in Journ. Asiat. Soc. Beng. **45** (3): 228 & 232 (1877)—Prain in Journ. Asiat. Soc. Beng. **66** (2): 397 (1897)—Schindl. in Fedde, Rep. **21**: 1 (1925); **22**: 267 (1926); in Fedde, Rep. Beih. **49**: 280 (1928)—Craib, Fl. Siam. Enum. **1**: 410 (1928).

*Meibomia megaphylla* (Zoll). O. Kuntze, Rev. Gen. **1**: 196 & 198 (1891).

*D. Prainii* Schindl. l.c. **21**: 2 (1925); **22**: 267 (1926); l.c. **49**: 292 (1928).

A much branched shrub, usually 1–3 m high; branches terete and glabrescent, lenticellate, usually reddish or dark brown in colour, young parts more or less angular, sparsely to densely ascending or appressed whitish pubescent and sometimes mixed with minute hairs. Stipules usually caducous, triangular, caudate or acuminate at the apex, 12–16 mm by 3–4 mm in size, rather densely pubescent outside, glabrous inside. Petioles 3.5–8 cm long, sparsely to rather densely pubescent. Leaves 3-foliolate; leaflets chartaceous to subcoriaceous, normally to broadly ovate to occasionally rhomboid or rarely nearly orbicular, acuminate or occasionally acute at the apex, the upper surface sparsely to rather densely minutely puberulent (0.2–0.5 mm long), the lower surface densely appressed or spreading sericeous (about 1 mm long) or sparsely shortly pubescent, lateral nerves conspicuously 5–9 on each side of the midrib and reaching the margin, reticulate-veins usually prominent, entire to shallowly undulate along the margin; stipels narrowly triangular or narrowly ovate, (3–)5–6.5 mm by 0.5–1 mm in size, pubescent outside, glabrous inside; terminal leaflets cuneate or occasionally obtuse at the base, (7–)9–14(–18) cm by (4.5–)6–9(–11) cm in size; petiolules 1–4 cm long, pubescent like the petioles; lateral leaflets obliquely rounded at the base, 6–9(–13) cm by 3–6(–6.5) cm in size. Inflorescences terminal and axillary, the terminals always large paniculate, the axillaries racemose, or paniculate (9–)20–40 cm long; rachis rather densely to densely or rarely sparsely pubescent or hirsute (usually spreading and about 1 mm long) and often mixed with uncinatate or minute straight hairs. Flowers 2–3-flowered cymules but usually accompanying poorly developed 1–3 flowers, subtended by the secondary bracts. Primary bracts narrowly ovate to ovate, acuminate to caudate at the apex, 5–8 mm by 1.5–2 mm in size, ciliate and sparsely pubescent outside; secondary bracts narrowly ovate or narrowly triangular with an acuminate apex, about 3 mm by 0.5 mm in size but usually bearing 1–3 smaller ones, ciliate-pubescent and sparsely pubescent outside. Pedicels 4–17 mm long, nearly glabrous or sparsely to rather densely spreading pubescent and/or uncinatate hairy and rather densely spreading minute puberulent. Bracteoles subulate, 0.8–1.5 mm by 0.1–0.2 mm in size, sparsely pubescent. Calyx 4–4.5 mm long, nearly glabrous or appressed sericeous (1–1.5 mm long) and minutely puberulent outside, 4-lobed; tube about

2.5 mm long; the upper lobe broadly triangular to deltoid, entire and acuminate or occasionally minutely 2-toothed at the apex, 2.5–3 mm long, 2 mm wide at the base; the laterals triangular, acuminate at the apex, 2–2.5 mm long, 1 mm wide at the base; the lower one triangular, acuminate at the apex, 2.5–3 mm long, 1 mm wide at the base. *Corolla* (Fig. 42: d) pale mauve to purple or violet or rarely white; standard elliptic or broadly elliptic, often somewhat rhomboidal, rounded or obtuse at the apex, 10–13 mm by 6–8 mm in size; wings incurved upwards and distinctly longer than both standard and keel-petals, 12.5–14 mm long including the 2–2.5 mm long claw, 3–3.6 mm wide; distinctly auriculate at the base of the lamina, obtuse at the apex; keel 8.5–11.5 mm long (the claw 3.5–4 mm long), 2.5–3.5 mm wide, mucronate and slightly hooked at the apex, auriculate at the base. Stamens 10–10.5 mm long. Pistils 11–12 mm long (including the 4.5–5 mm long style), appressed pubescent except on the style; style slightly thickened near the middle. *Pods* (Fig. 29: f & g) flat, shortly stalked (about 2 mm long), (4–)6–8-jointed, pale brown in colour, swollen on the seeds, uncinately hairy and rather sparsely spreading pubescent or sometimes glabrescent or nearly glabrous (in var. *glabrescens*), both sutures thickened and indented, isthmus  $\frac{3}{5}$  or often nearly  $\frac{1}{2}$  as broad as the pod, thinly reticulate-veined or not; joints transversely broadly elliptic-oblong, 6–9(–10) mm long, 5–8 mm wide. *Seeds* (Fig. 29: h) transversely elliptic, 2.5–2.8 × 3–3.5 mm in size. *Pollen grains* (Pl. 14: o–r) tricolporate or often zonocolporate, subprolate or prolate, 25–36 × 18–26 (average 30.8 × 22.2)  $\mu$  in size, equatorially ellipsoidal in outline; colpi long, narrow, strongly or normally marginate, constricted or transverse and protruding strongly or intruding slightly at the equator, the membrane granulated or not; pores more or less rounded or slightly elliptic, 7–8  $\mu$  in diameter, more or less flat or intruding; exine evenly fine reticulate, lumina less than 1  $\mu$  in diameter, tectate, 1–1.5  $\mu$  thick, the ectexine almost as thick as the endexine, muri simplibaculate, columellae short.

Distr. E. India (Assam), Burma, Thailand, Malaya, Sumatra, Java, and S. China.

Key to the varieties of *D. megaphyllum*.

- |   |  |                         |
|---|--|-------------------------|
| { | Leaflets densely sericeous beneath, inflorescence-rachides, pedicels and calyces more or less densely longer spreading or hooked hairy mixed with puberulent hairs. Pedicels 4–10 mm long. Pod-segments 6–7 × 5–6 mm in size, minute hooked hairy mixed with longer patent pubescent hairs | var. <i>megaphyllum</i> |
|   | Leaflets sparsely shortly pubescent beneath, inflorescence-rachides, pedicels and calyces sparsely hairy or nearly glabrous. Pedicels 9–17 mm long. Joints 8–9(–10) × 7–8 mm in size, glabrescent or nearly glabrous   | var. <i>glabrescens</i> |

7-1) Var. **glabrescens** Prain in Journ. Asiat. Soc. Beng. **66** (2): 399 (1897).

*D. Prainii* var. *glabrescens* (Prain) Schindl., l.c. 3 (1925); l.c. 292 (1928).

Specim. exam.: **Burma**. Amherst, Daioua Range (J. H. Luce 5616 CAL), Tavoy, Maungpok peak, alt. 3000 ft. (Rogers 321 CAL), Esakan, Mt. Victoria, alt. 6000 ft.

Thickets and on the path side (F. Kingdon-Ward 22624 BM, TI); N. Pegu (Batu 715, 716 CAL).

7-2) Var. ***megaphyllum***

Repres. specim. exam.: **India.** Assam: Di Chu Gorge, Lohit Valley, alt. 7000 ft. On boulder screes, in forest (F. Kingdon-Ward 20114 BM, TI). **Burma.** S. Shan State, Lwekaw (A. Khalil *s.n.* in 1894 CAL); Kwg Lung, alt. 4000 ft. (R. W. MacGregor 814, 931, 1221 CAL); Kachin Hills (S. Mokim *s.n.* CAL); Mogok Hills, alt. 4000 ft. (A. Rodger 218 CAL); Madoe Hills (King's collector 126 CAL); Batang padang, 2000 ft. (L. Wary Jr. 1441 CAL); Chattia Hills (J. C. Prazer 23 CAL); Shan (A. Huk *s.n.* CAL); Toungoo, Thandaung, alt. 4000 ft. (J. H. Lace 5041 CAL); South Pegu (Botu 715 CAL); Pegu, Bookee Ridges, alt. 4500 ft. (S. Kurz 1676C CAL—Probably **Isotype** of *D. karenium* Kurz); Thandaung, alt. 4000 ft. (F. G. Dickason 6716 A). **Thailand.** Payap: Doi Sutep, alt. 5000–5500 ft. (Kerr 1577 BK), alt. 900 m (C. Chermisrivathana 566 BK), alt. 800–1000 m (Ogawa & Yoda 212–50, 212–54 TI), alt. 1500 m (Sørensen, Larsen & Hansen 927 BKF); In sunny slope by path (Iwatsuki & Fukuoka T.3210 KYO); Chieng Mai, middle elevation of Doi Chiangdao, alt. 1400–1800 m. On dry sunny slope at foot of limeston cliff (Tagawa & Iwatsuki T.4390 KYO); Doi Inthanon, alt. 1350–1900 m. On grass field on mountain slope (Tagawa et al. T.2629 KYO); Phetchabun, Phu Miang (Shimizu et al. T.11741 KYO); Udawn: Loei, Phu Kradung, alt. 1100 m (Tagawa et al. T. 917 KYO), Phitsanulok, alt. 1400 m. In thicket in sunshine (Shimizu et al. T.11644 KYO); E. Tong, Taknun, Kanburi (C. Chermisrivathana 680 BK, TI). **Java.** Tjibodas (S. Kurz 939 CAL). **China.** Yunnan: (D. Anderson in 1868 *s.n.* CAL), Szemao Mts. (A. Henry 11728 NY), alt. 5000 ft. (A. Henry 11685A,B,C,D CAL), alt. 4000 ft. (A. Henry 11728A CAL, NY, TNS); Lan-Tsang Hsien, alt. 1500 m. Border of woods (C. W. Wang 76574 A); Che-li Hsien, Dahmeng-lung, Meng-soong, alt. 1850 m (Wang 78285 A); Lu-se, alt. 1750 m (H. T. Tsai 56775 A).

This species is apparently near to *D. elegans* but easily distinguishable by the larger, well-branched terminal inflorescences, usually ovate, acuminate leaflets, the larger, triangular stipules with a long acuminate apex, the long, incurved wings, and the slightly mucronate and often hooked apex of the keel-petals.

In the pollen morphology of the species, it is noteworthy that the zonocolporate grains are frequently observed and the colpi are often transverse at the equator. Such pollen type and the structure of colpi have hitherto been not reported in the genus *Desmodium*.

*D. karenium* was considered as conspecific with this species by van Meeuwen (1961) based on external morphology. Comparing the pollen grains of *D. karenium* with those of *D. megaphyllum*, both grains are very similar to each other but differ in the grain size and the colpium structure. So far examined, grains of *D. megaphyllum* are  $29.6 \times 21.4 \mu$  in the mean size and their colpi are constricted and strongly protruding at the equator, whereas those of *D. karenium* are  $32.0 \times 22.9 \mu$  in the average size and the colpi are transverse and slightly intruding at the equator. These differences in pollen morphology, however, seem to be not greatly important to separate both species. Therefore I followed van Meewen and regarded *D. karenium* as a synonym of *D. megaphyllum*.

8) ***Desmodium Rockii*** Schindler in Fedde, Rep. 22: 266 (1926); in Fedde, Rep. Beih. 49: 296 (1928).

[Fig. 43b]

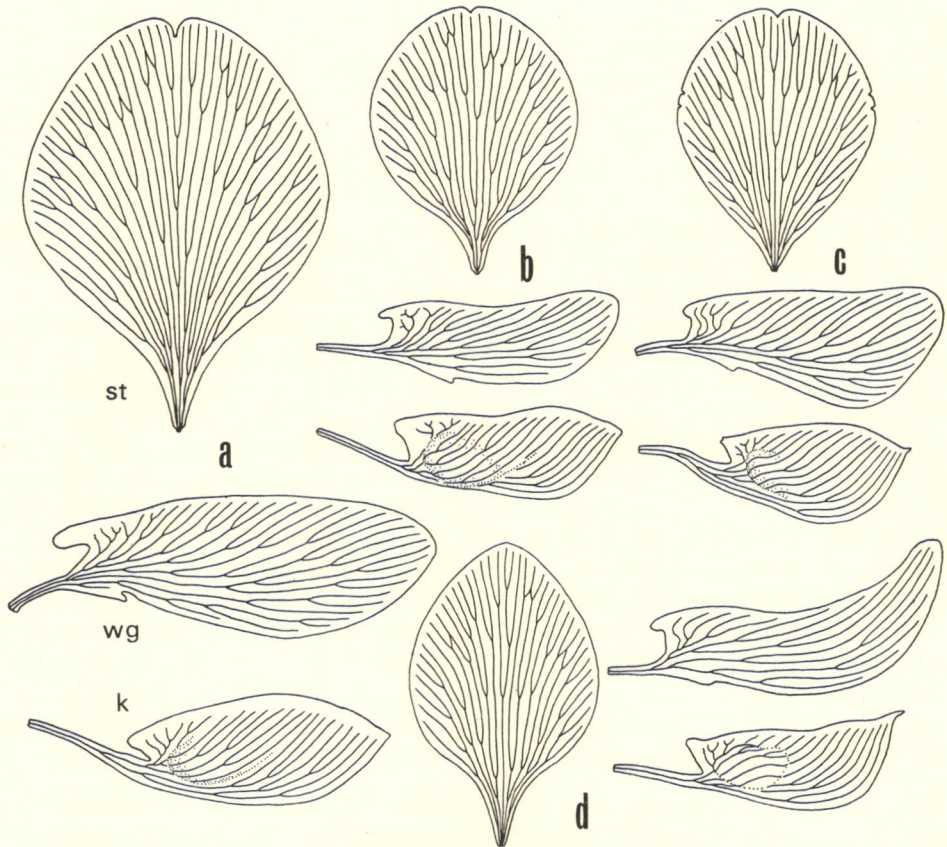


Fig. 42. Petals (st: standard, wg: wing, k: keel) of the species of the subject. Tiliifoliae,  $\times 3.5$ . a: *D. Rockii* (Forrest 13093), b-c: *D. yunnanense* (b: subsp. *yunnanense*, Delavay 1985 Neotype; c: subsp. *praestans*, McLaren's Collector 118), d: *D. megaphyllum* (Dickason 6716).

A shrub up to 2.5 m high; young branches densely softly white-tomentose. Stipules caducous, narrowly ovate with an acuminate apex, 8–9 mm by 2.5–3 mm in size, densely tomentose outside, glabrous inside. Petioles 2–3 cm long, very densely tomentose as are the petiolules and the leaflet-pulvini. Leaves 3-foliolate; leaflets coriaceous, rugose, broadly obovate or nearly orbicular, rounded or retuse to emarginate at the apex, the upper surface rather densely minute puberulent and on principal nerves densely appressed tomentose, the lower surface very densely white-tomentose, lateral nerves prominent, 5–8 on each side of the midrib and reaching the margin, conspicuously cancellate-veined, slightly undulate especially the upper part of the margin; stipels narrowly ovate or narrowly elliptic with an acuminate apex, 3.5–4.5 mm long, minutely puberulent outside; terminal leaflets cuneate or obtuse at the base, 4.5–7.5 cm by 4–7 cm in size; petiolules 5–10 mm long; lateral leaflets rounded and slightly oblique at the base, 3.5–5 cm by 3–4 cm



Fig. 43. a: *D. megaphyllum* Zoll. (Wary Jr. 1441 CAL), b: *D. Rockii* Schindl. (Forrest 13093 Syntype).

in size. Inflorescences terminal, paniculate, densely branched, to 16 cm long; rachis densely tomentose. Flowers 3–5-flowered fascicles but mixed with 1–3 poorly developed flowering-buds at the same node, subtended by the secondary bracts, pedicels 5–6 mm long when anthesis, densely ascending tomentose. Primary bracts early deciduous, narrowly ovate or ovate, acuminate at the apex, 3–3.5 mm long, about 1 mm wide, minutely tomentose outside; secondary bracts variably size from poorly developed small one to fully developed normal one, the normal one similar to the primary ones, 1–1.5 mm long. Bracteoles early deciduous, narrowly ovate with an acuminate apex, about 1 mm by 0.2 mm in size, ciliate and appressed tomentose outside. Calyx 3.5–4.5 mm long, densely appressed tomentose outside; the upper lobe broadly ovate, minutely 2-toothed at the apex, about 2 mm long and 3 mm wide at the base, the laterals broadly triangular with an acute apex, about 1.5 mm long, 1.5 mm wide at the base, the lower one triangular with an acuminate apex, 1.5–2 mm long, about 1.5 mm wide at the base. *Corolla* (Fig. 42: a) pink to pale violet; standard broadly elliptic or somewhat broadly rhomboidal, cuneate to the base, rounded to deeply emarginate at the apex, 12–15.5 mm by 8–10.5 mm in size; wings 12.5–16 mm by 4–5.5 mm in size, the claw mostly recurved and 2–3 mm long, obtuse at the apex, conspicuously auriculate at the base; keel-petals distinctly smaller than the wings, 12–13.5 mm long (including the 4–4.5 mm long claw), 3–4 mm wide, acute at the apex, conspicuously auricled at the base of blade. Stamens 10–11.5 mm long. Pistils 13–13.5 mm long (including the 3–4 mm long style), densely appressed puberulent except for the style. Pods and seeds unknown. *Pollen grains* (Fig. 41: g–i) tricolporate, subprolate or prolate spheroidal,  $22\text{--}25 \times 19\text{--}21$  (average  $23.9 \times 19.5$ )  $\mu$  and ellipsoidal in the equatorial view; colpi long, narrow, marginate with a jagged margin, constricted and protruding slightly at the equator, the membrane granulated; pores elliptic, about  $5 \times 7$   $\mu$  in size, equatorially elongated, slightly marginate, more or less flattened; exine evenly fine reticulate, lumina about 1  $\mu$  in diameter, tectate, 1.5  $\mu$  thick, the ectexine thicker than the endexine, muri simplibaculate, columellae short.

Distr. Endemic to China (Yunnan).

Specim. exam.: **China**. Yunnan (G. Forrest 13093, fl. E–**Syntype**).

*D. Rockii* appears to be a distinct species, though its mature legumes are unknown, but approaches *D. elegans* in the structure of flowers and *D. yunnanense* in its copiously branched panicles. *D. Rockii* resembles especially *D. elegans* in the shape of wings. Accordingly it may be related most closely to *D. elegans* but it needs a further critical study based on ample materials.

In the original description Schindler cited two specimens: Rock 10456 and Forrest 13093, but no type specimen was selected. In the present study one of the duplicate of the Forrest 13093 (E) was examined, but I did not designate it as lectotype. Schindler described immature pods as densely short appressed sericeous probably based on the Rock's sheet, for Forrest 13093 was collected during anthesis. Judging from its specific name, moreover, Schindler would be based mainly on the Rock's sheet when he described this species. So, it seems necessary to determine the lectotype after Rock 10456 is examined.

9) **Desmodium yunnanense** Franch., Pl. Delavay. 172 (1890). [Fig. 44]

A shrub or small tree, 1–5 m high; branches terete, young parts very densely and

uniformly pale yellowish velutinous or woolly as are the petioles and the rachides of inflorescences, older parts glabrescent. Stipules narrowly ovate with an acuminate apex, 7–10 mm by 1.5–2.5 mm in size, densely velutinous outside. Leaves 3-foliolate but often 1-foliolate, stipulate, stipelate, petiolate; petioles 1–6 cm long; stipels (even when 1-foliolate 2 stipels present near the base of leaflets), narrowly ovate with an acuminate apex, 3.5–4.5 mm by 0.5–1 mm in size, densely velutinous outside. Leaflets subcoriaceous, broadly to very broadly ovate or obovate, obtuse or rounded or often shortly mucronate at the apex, truncate to acute or rounded or occasionally shallowly cordate at the base, the upper surface densely or rather rarely moderately tomentose and often mixed with minute hairs, the lower surface very densely white- or pale yellowish-woolly and mostly conspicuously glaucous beneath, lateral nerves 5–9 on each side of the midrib and reaching the margin, prominently reticulate-veined, shallowly undulate along the margin; terminal leaflets when 3-foliolate and leaves when 1-foliolate (5–)7–20(–22) cm by (4–)5–17 cm in size; lateral leaflets when present 4–10 cm by 3.5–10 cm in size. Inflorescences terminal, usually very copiously but occasionally loosely branched paniculate, 10–40 cm long. Flowers 3–6-flowered fascicles (mostly cymules but often umbellet) subtended by the secondary or the third bracts. Primary bracts subtending the secondary bracts and the fascicles of flowers, narrowly ovate to ovate, usually entire and acuminate at the apex, 5–10 mm by 1.5–3.5 mm in size, densely tomentose outside; secondary bracts narrowly ovate, acute or acuminate at the apex, normally 2–3 mm by 0.7–1.4 mm in size, but usually appearing poorly developed smaller ones, densely tomentose on the back, glabrous on the face. Pedicels (4–)6–10 mm long, densely ascending or spreading velutinous or tomentose. Bracteoles subulate or narrowly ovate, 0.7–1.2 mm long, densely tomentose outside. Calyx 3–4(–5) mm long, densely tomentose outside, 4-lobed; lobes equal to or shorter than the tube (1.5–2 mm long), the upper one broadly ovate, entire and acute at the apex, 1.5–2(–2.5) mm long, 1.5–2(–2.5) mm wide at the base, the laterals slightly shorter than the others, acute or obtuse at the apex, 1.2–2(–2.5) mm by about 1.5 mm in size, the lowers longer than the others, ovate or triangular, acute or acuminate at the apex, 1.8–2.5(–3) mm by 1.2–2 mm in size. *Corolla* (Fig. 42: b & c) purple to magenta; standard nearly orbicular or broadly elliptic, (9–)10–11(–12.5) mm by 7.5–9(–10) mm in size, more or less emarginate at the apex; wings 11–12(–13) mm (including the 2.5–3 mm long claw) by 3–3.5 mm in size, auriculate at the base of lamina; keel-petals 10.5–12 mm (including the 3.5–4 mm long claw) by 3–4 mm in size. Stamens 10, 10–11.5 mm long. Pistils 11–13 mm long (including the 3–4 mm long style), pubescent except for the style. *Pods* (Fig. 29: 1) flat, 7–9(–10)-jointed, almost entirely glabrescent when mature or densely uniformly appressed pubescent when young, slightly swollen on the seeds, the upper suture thickened and nearly straight, the lowers indented, isthmus  $1/2$ – $1/4$  as broad as the pod, thinly or without reticulate-veined; joints depressed obovate, 6–10 × 4.5–5 mm in size. *Pollen grains* (Fig. 41: a–f) tricolporate, prolate spheroidal or subprolate, 22–26 × 16–22 (average 24.1 × 19.1)  $\mu$  and ellipsoidal in the equatorial view; colpi long, narrow, marginate, jagged along the margin, constricted and slightly protruding at the equator, the membrane granulated; pores rounded or elliptic, 4–7 ×



Fig. 44. *D. yunnanense* Franch. (a: subsp. *praestans* (Forrest) Ohashi, McLaren's collector P.118; b: subsp. *yunnanense*, Delavay 1985 Neotype).



5–7  $\mu$  in size, when elliptic equatorially elongated, more or less marginate more or less flattened; exine evenly fine reticulate, lumina less than  $1\mu$  in diameter, tectate, 1–1.5  $\mu$  in thickness, the ectexine thicker than the endexine, muri simplibaculate, columellae distinct.

Distr. China (Yunnan, Szechuan).

Key to the subspecies.

- |   |   |   |
|---|---|---|
| 1 | { | Leaves always 3-foliolate; terminal leaflets obovate with truncate or acute base; petioles (2.5–)4–6 cm long. Pods glabrescent . . . . . subsp. <i>yunnanense</i>                                 |
|   |   | Leaves often 1-foliolate; terminal leaflets ovate with rotundate or occasionally shallowly cordate base; petioles 1–3 cm long. Pods densely appressed pubescent . . . . . subsp. <i>praestans</i> |

9-1) Subsp. **praestans** (Forrest) Ohashi, comb. nov. [Fig. 44a]

*D. praestans* Forrest in Not. Bot. Gard. Edinb. **10**: 28 (1917)–Schindl. in Fedde, Rep. **22**: 266 (1926); in Fedde, Rep. Beih. **49**: 292 (1928)–Hand.-Mzt., Symb. Sin. **7**: 570 (1933)–Sealy in Bot. Mag. **174**: N. S. t. 407 (1963).

Specim. exam.: **China**. Yunnan: (G. Forrest 15178 CAL); Mountains in the N. E. of the Yangtze bend, alt. 1000 ft. (G. Forrest 10387 BM); Lichiang Range, Top of the mountain in Yungning (H. McLaren's native collector 118, P.118 BM); Pe Yentsin (P. S. Ten 103 E); Abstieg zum Yangtze, bei Tschaubin (C. Schneider 427 A); Szechuan: Yien-pien Hsien. Mountain slope, rocky place (T. T. Yü 1648 A).

9-2) Subsp. **yunnanense** [Fig. 44b]

*D. yunnanense* Franch. sensu str.: Franch., Pl. Delavay. 172 (1890)–Schindl. in Fedde, Rep. **22**: 266 (1926); in Fedde, Rep. Beih. **49**: 308 (1928)–Hand-Mzt., Symb. Sin. **7**: 569 (1933).

Specim. exam.: **China**. Yunnan. Bois de Ta-long-tan, pres de Tapin-tze (A. Delavay 1985 July 26, 1886 P–**Neotype** and **Isotype** of *D. yunnanense*).

*D. praestans* and *D. yunnanense* are not specifically distinct in gross and pollen morphology. Therefore, it seems to be better to recognize the two at the subspecific rank. In gross morphology the two subspecies differ from each other only in the characters shown in the key and, moreover, the pollen grains of both are quite similar in shape and size. So far as examined, grains of subsp. *yunnanense* are 22–25  $\times$  16–22 (average 23.7  $\times$  18.8)  $\mu$  in size with equatorially elongated pores of 4–5  $\times$  5–6  $\mu$  in size, and those of subsp. *praestans* are 23–26  $\times$  18–22 (average 24.5  $\times$  19.4)  $\mu$  in size with almost round pores of 6–7  $\mu$  in diameter.

In subsp. *praestans*, the leaves are unifoliolate or trifoliolate, but the unifoliolate leaf has, though often early deciduous, two stipels at the base of both sides of its pulvinus (e.g. McLaren's native collectors L P118 BM). In this subspecies, thus, the 1-foliolate leaf is apparently derived from 3-foliolate leaf by the reduction of lateral leaflets, and this decrement of leaflets occurs rather often in the genus *Desmodium* as well as *Codariocalyx*.

According to Sealy (1963), the androecium of the subsp. *praestans* comprises usually eight fertile stamens and two sterile processes.

In his original description in *Plantae Delavayanae*, Franchet (1890) did not cite any specimens of the species, but three sheets in the same collection number, Delavay

1985, borrowed from P, are identified by him. So far as I know no specific type is designated, I selected one sheet of the Delavay 1985 in P as neotype (Fig. 44b).

2. Sect. **Kingianae** Ohashi, sect. nov.

Carina alis apparentior longiora. Legumen anguste oblongum, vix constrictum, articulis subquadratis, non reticulatum.

Type species: *D. Kingianum* Prain

This section is characterized distinctly by the longer keel-petals than the wings, nearly quadangular pod-joints on which no reticulate-veined and scarcely constricted legumes, but seems to be closely related to the section *Dollinera* in the same subgenus.

Key to the species of the section *Kingianae*.

- |   |   |  |
|---|---|--|
| 1 | { | Pods less than 5 mm wide and densely minute uncinatae white-hairy mixed with straight hairs. Flowers 6–7 mm long; vexillum 7–8 mm long and 4.5–5 mm wide; wings 4.5–5.3 mm long and 1.2–1.7 mm wide, not or slightly auriculate at the base, claw 0.5–1 mm long; keel-petals 5.5–6.5 mm long and about 2 mm wide, not auriculate at the base, claw about 2 mm long, subacute at the apex. Calyx 3.5–4 mm long. Leaflets broadly to very broadly ovate, acute at the apex, flat and slightly repand or undulate along the margin; terminal leaflets 0.8–1.2 times longer than broad. Stipules narrowly ovate with an acuminate apex. Young branches and inflorescence-rachides more or less angular, densely minute puberulent and later nearly glabrescent<br>..... <i>D. Kingianum</i>  |
|   | { | Pods more than 5 mm wide and not uncinatae hairy but very densely appressed yellowish silky hairy. Flowers 11–13 mm long; vexillum 11–13 mm long and 5.5–6.5 mm wide; wings 11–12 mm long and about 1.8 mm wide, conspicuously auriculate at the upper side of the base of lamina, distinctly long clawed (4.5–5 mm long); keel-petals 12–13 mm long and 3.5–4 mm wide, auriculate at the base, claw 4–5 mm long, conspicuously mucronate at the apex. Calyx 6–8 mm long. Leaflets elliptic, rounded at the apex, distinctly revolute and entire along the margin; terminals 1.5–2 times longer than broad. Stipules very broadly to shallowly triangular, caudate or acuminate at the apex. Young branches and inflorescence-rachides conspicuously angular, densely ascending yellowish sericeous along the ribs ..... <i>D. Hayatae</i> |

10) **Desmodium Hayatae** Ohashi, sp. nov.

[Fig. 45]

Frutex circiter 1 m altus (ex Hayata), ramosus, rami novelli distincte angulati, pilis subadpressis vel ascendentibus vestiti. Stipulae striatae, latissime vel depresso triangulares, apice caudatae vel acuminatae, 5–8 mm longae et 2–3 mm latae, extus sparse pilosae, ciliatae; stipellis linearibus vel lanceolatis, ad 4 mm longis. Folia petiolata, 3-foliolata; foliola subcoriacea, supra brevissime uncinatae-pilosa, subtus subadpresse sericea, margine revoluta et integra; nervis lateralibus validis 7–10 utrinsecus costam validam praedita, inter eos reticulata; terminalia elliptica vel obovata, basi rotundata vel obtusa, apice obtusa ad rotundata vel emarginata, (2.5–)4.5–8(–11) cm longa et (1.5–)3–5.5(–6) cm lata; lateralalia paullo minora, basi

obliqua, (2-)3.5-7(-8) longa et (1.5-)2-3.5(-4) cm lata. Inflorescentiae terminales et axillares racemosae, 7-30 cm longae; rhachi pilis rectis ascendentibus dense et aliis microscopicis uncinatis crebre vestita. Bracteae primariae anguste ovatae vel anguster triangulares, acuminatae, extus sparse puberulae, circiter 4 mm longae et 1 mm latae, caducae; secundariae lanceolatae vel anguste ovatae, acuminatae, 2-2.5 mm longae et circiter 0.7 mm latae. Pedicelli patentes pilosi, 3-6 mm longi. Bracteolae lanceolatae vel anguste ovatae, acuminatae, circiter 1.5 mm longae, extus sparse pilosae, ciliatae. Calyx 6-8 mm longus, pilis longis subpatentibus pauce et aliis microscopicis uncinatis dense ornatus, ultra dimidio 4-fidus, basi gibbosus, tubus circiter 3 mm longis; laciniis posticis integris, latissime triangularibus, 1.5-2 mm longis et 1.5-2 mm latis, lateralibus tubo brevioribus, triangularibus, circiter 1.5 mm longis, anticis longioribus, anguste triangularibus, 3-5 mm longis. *Corolla* flava (sec. Hayata), 11-13 mm longa; vexillum obovatum, 12.5-13.5 mm longum 6-6.5 mm latum, apice rotundatum; alae unguiculatae, 10.5-11.5 mm longae 1.5-2 mm latae, lamina anguste oblonga, ungue 4.5-5 mm longae; carinae incurvae, unguiculatae, 12-13 mm longae 3.5-4 mm latae (ungue 5-5.5 mm longae), apice distincte mucronata. Stamina monadelphia, vexillari a dimidio libero, ceteris alte connatis; antherae ovoideae. Pistillus 12.5-13 mm longus; ovarium breviter dense adpresse pilosum; styli 6.5-7 mm longi. *Legumen* indehiscens, breviter stipitatum, 5-7-articulatum, dense adpresse flavido-sericeum, margine supero vix constrictum, margine infero leviter constrictum, isthmi 9/10 latitudine leguminis paullo angustiores; articulis quadratis vel transverse late oblongis vel transverse late ellipticis, 5-6 mm longis et 5-5.5 mm latis, vix reticulatis. *Semina* transverse elliptica, 2.5-3 mm longa et circiter 3.5 mm lata.

Hab. Thailand. Pang Kiah-Me Ka Chian (B. Hayata *s.n.* Oct. 31, 1921: **Typus** in Herb. Univ. Tokyoensis (TI)); Doi Chiengdao (Put 4487 Dec. 22, 1931 BK).

Distr. Endemic to Thailand.

This species takes its specific name from the late Prof. Bunzo Hayata at the Department of Botany, University of Tokyo, who was a pioneer of the study on the flora of Taiwan and collected a number of good specimens from Taiwan and Indo-China. He proposed a unique taxonomic concept of "Dynamic system of plants."

In general appearance this species shows a considerable similarity and, also, seems to be closely related to *D. multiflorum*, but these two species differ from each other in several important features as follows:

1. The pods of *D. Hayatae* (Fig. 48: c) are densely covered with yellowish-silky hairs and are slightly or scarcely constricted as the isthmus nearly same as broad as the pods, whilst those of *D. multiflorum* are densely clothed with brown-sericeous hairs and are incised as the isthmus about 2/3 as broad as the pods.

2. In *D. Hayatae* the articles of legumes are quadrangular or transversely broadly oblong-elliptic (5-6 × 5-5.5 mm in size) and not reticulate-veined, whilst those of *D. multiflorum* are depressed obovate (3-4 × 2-3.5 mm in size) and distinctly reticulate veined.

3. The seeds of *D. Hayatae* (Fig. 48: d) are 2.5-3 × 3.5 mm in size, whereas those of *D. multiflorum* are 1.5-2 × 2.5-3 mm in size.

4. The keel-petals of *D. Hayatae* (Fig. 47: b) are mucronate like a beak at the



Fig. 45. *Desmodium Hayatae* Ohashi, sp. nov. a: habit,  $\times 0.6$ , b: portion of stem showing a stipule and indumentum,  $\times 3$ , c: portion of leaf showing stipels,

apex and distinctly longer than the wings, whilst those of *D. multiflorum* are acute at the apex and distinctly shorter than the wings.

5. The calyx of *D. Hayatae* (Fig. 45: h & i) is 6–8 mm long with its about 3 mm long tube and its distinctly longer lower lobe (3–5 mm long), whilst that of *D. multiflorum* is 3–5 mm long, the tube is about 2 mm long, and the lower calyx-lobe is nearly same or slightly longer than the others.

6. In *D. Hayatae* the bracteoles (Fig. 45: g) are always persistent and are narrowly ovate with acuminate at the apex (about 1.5 mm long), whilst in *D. multiflorum* those are usually absent and when present are filiform (0.4–0.6 mm long).

7. Primary bracts of *D. Hayatae* (Fig. 45: d) are narrowly ovate or triangular (2.5–4 mm long and about 1 mm wide), whereas those of *D. multiflorum* are narrowly to broadly ovate (7–11 mm long and 2–3 mm wide).

8. Leaflets of *D. Hayatae* are always revolute along the margin as in *D. siamense* but those of *D. multiflorum* are flat and not revolute along the margin.

11) ***Desmodium Kingianum*** Prain in Journ. Asiat. Soc. Beng. **66** (2): 398 (1897)—Craib, Fl. Siam. Enum. **1**: 410 (1928)—Schindl. in Fedde, Rep. Beih. **49**: 281 (1928). [Fig. 46a]

*D. ? pseudarthrioides* Schindl. in Engler, Bot. Jahrb. **54**: 61 (1916)—Gagnep. in Fl. Indo-Chine **2**: 588 (1920).

A much branched shrub, 70–150 cm high; branches more or less angular, densely pubescent. Stipules narrowly elliptic with an acuminate apex, 5–7 mm long. Petioles 2.5–5 cm long, pubescent but afterwards becoming glabrescent. Leaves 3-foliolate; leaflets thick chartaceous, broadly or very broadly ovate with an acute apex, obscurely repand or slightly undulate along the margin, the upper surface sparsely pubescent but becoming nearly glabrescent with age, the lower surface uniformly densely gray sericeous, lateral nerves prominent, 7–9 on each side of the midrib and reaching margin, conspicuously reticulate-veined; stipels narrowly ovate with an acuminate apex, 4–5 mm long by 0.9–1.2 mm wide, pubescent and puberulent outside; terminal leaflets rotund to truncate or occasionally shallowly cordate at the base, (7–)8–12 cm long, (6–)8–12 cm wide; petiolules 2–2.5 cm long, pubescent like the petioles; lateral leaflets oblique and rotund at the base, 5–10 cm long, 4.5–6 cm wide. Inflorescences terminal and axillary paniculate, usually 25–30 cm long; rachis densely spreading straight and uncinately hairy with minute hairs. Flowers usually binate; pedicels 2–3 mm long, densely spreading straight and hooked hairy but later becoming nearly glabrescent. Primary bracts narrowly ovate with an acuminate apex, 4–5 mm long, pubescent outside; secondary bracts ovate, about 0.7 mm by 0.2 mm in size. Bracteoles unknown (? absent or very early

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a petiolule and leaflet-pulvini,  $\times 3$ , d: primary bracts showing a range of variation,  $\times 6$ , e: secondary bracts showing a range of variation,  $\times 6$ , f: pedicel with bracteoles,  $\times 6$ , g: bracteoles showing a range of variation,  $\times 6$ , h: calyx opened showing lobes (the lower lobe (right) longer than the others),  $\times 3$ , i: flower with a bracteole at the base of the calyx,  $\times 3$ , j: stamens,  $\times 3$ , k: pistil,  $\times 3$ , All from the holotype in TI. Each shape of the petals see Fig. 47: b and mature pod and seed see Fig. 48: c–d.



Fig. 46. a: *D. Kingianum* Prain (Khalil *s.n.* Isotype), b: *D. sequax* Wall. (Blinkworth; Wallich 5712 Isotype).

deciduous). Calyx 3.5–4 mm long, straight and uncinete hairy and densely minute puberulent, 4-lobed, tube about 1.5 mm long, the upper lobe triangular, about 2 mm long, about 1.5 mm wide at the base, entire at the apex, the laterals triangular, 2–2.5 mm long, about 1.5 mm wide at the base, the lower narrowly triangular, 2.5–3.5 mm long and 1.5–2 mm wide at the base. *Corolla* (Fig. 47: 1) white, 6–7 mm long; standard normally to broadly obovate to rarely orbicular, 7–7.5 mm long and

4.5–5 mm wide, rounded or slightly emarginate at the apex, shortly clawed; wings shorter than the keel, narrowly oblong, auriculate at the base of lamina, rounded at the apex, 6.5–7 mm long and about 2 mm wide, claw about 0.7 mm long; keel-petals 7–7.5 mm long, 2–2.5 mm wide, subacute or obtuse at the apex, not auriculate at the base. Pistils appressed pubescent on the ovary. Pods (Fig. 48: a) sessile, compressed, 4–6-jointed, densely mostly spreading straight velutinous and uncinately hairy and puberulent, swollen on the seed, both sutures slightly thickened, the upper suture nearly straight, the lower slightly undulate or almost straight, isthmus nearly same as broad as the pod, not reticulate veined; joints quadrangular or transversely broadly oblong, 4.5–5.5 mm long, 4.5–5 mm wide. *Seeds* (Fig. 48: b) transversely broad elliptic, reddish brown in colour,  $2.5\text{--}2.8 \times \pm 3$  mm in size. *Pollen grains* (Pl. 14: i–k) tricolporate, suboblate, spheroidal, prolate spheroidal, subprolate or prolate,  $25\text{--}32 \times 21\text{--}31$  (average  $28.3 \times 26.4$ )  $\mu$  in size; colpi long, slightly opened, weakly marginate with a jagged margin, the membrane granulated; pores elliptic,  $4\text{--}7 \times 10\text{--}12$   $\mu$  in size, equatorially elongated, strongly marginate, without constriction at the equator, slightly protruding, the membrane granulated; exine fine reticulate, lumina less than  $1$   $\mu$  in diameter, tectate,  $2$   $\mu$  thick, the ectexine almost as thick as the endexine, columellae short.

Distr. Burma, Thailand, Cambodia, and Laos.

Specim. exam.: **Burma.** Southern Shan States, Saga (A. Khalil *s.n.* in 1893 CAL. **Isotype** of *D. Kingianum* Prain). **Thailand.** Menam Pasala, Keng Koi, alt. ca. 50 m. In mixed deciduous forest (Kerr 7959 BK); Muak Lek, Saraburi, alt. ca. 200 m (Kerr 9086 BK); Chai Badan, In evergreen forest (M. C. Lakshnakara 251 BK); Ban Nang Pru, Aronyaprated. In evergreen forest (S. Sutheesorn 1991 BK, TI).

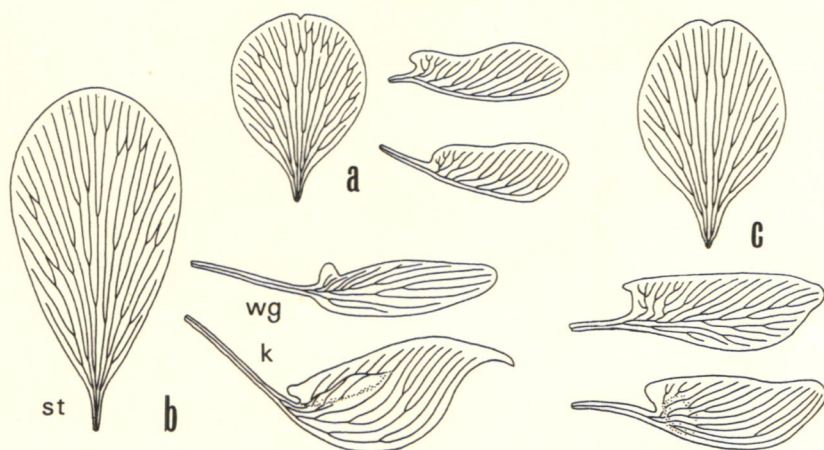


Fig. 47. Petals (st: standard, wg: wings, k: keel) of the species of the sect. *Sequax* and sect. *Kingianae*,  $\times 3.5$ . a: *D. Kingianum* (Kerr 9086), b: *D. Hayatae* (Hayata *s.n.* Holotype), c: *D. sequax* (Kaulback 409).

This very distinct but rare plant was properly placed near *D. elegans* (as *D. tiliaefolium*) by Prain (1897) in the original description based probably on vegetative structures. But the two species are quite different especially in the flower and the fruit.

The legumes of *D. Kingianum* recall those of *Pseudarthria* as later Schindler adopted the name for his *D. pseudarthrioides* and differ rather greatly from those of other *Desmodium*. Even when they ripen fully, both sutures are not separate but only the lateral surfaces are split.

3. Sect. **Sequax** Ohashi, sect. nov.

Folia 3-foliolata; foliola margine sinuata. Stipulae lineares, 4–5 mm longae et

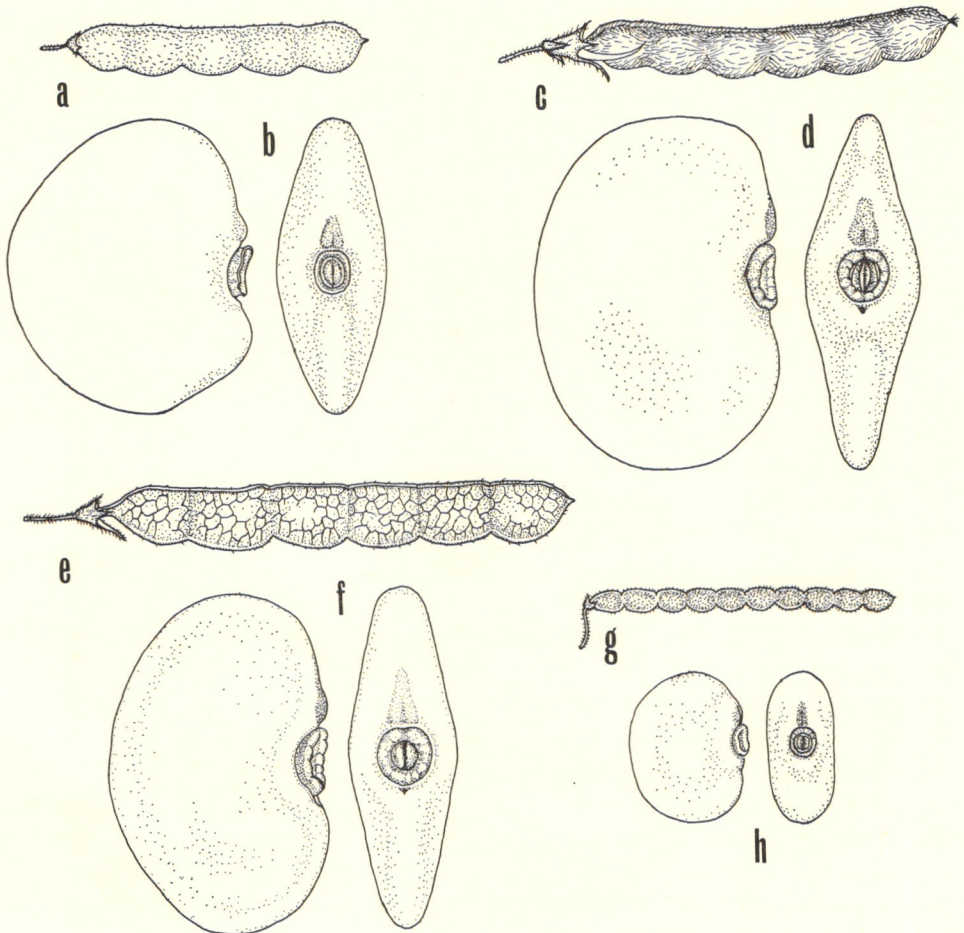


Fig. 48. Pods ( $\times 1.3$ ) and seeds ( $\times 13$ ) of the species of the sect. Kingianae, sect. Siamensia and sect. Sequax. a-b: *D. Kingianum* (Sutheesorn 1991), c-d: *D. Hayatae* (Put 4487), e-f: *D. siamense* (Kerr 4634 Isotype), g-h: *D. sequax* (Hara et al. 6301439).



0.7–1 mm latae. Calyx subaequaliter 4-lobatus, laciniis posticis profunde bifidis. Alae carinam fere aequantes. Legumen sessile, fere moniliforme, (6–)8–13-articulatum, sine reticulatum, articulis 2.5–4 mm longis et 2.5–3.5 mm latis, dense uncinato pilosis. Semina transverse late elliptica, 1.5–1.8 mm longa et 1.9–2.2 mm lata, leviter compressa.

Type species: *D. sequax* Wall.

The section Sequax, here newly described, includes only one species, *D. sequax*. In the general features the section relates to the section Dollinera, but differs conspicuously in stipules, flowers, legumes, seeds and exine sculpture of the pollen grains.

The section seems to be related to *D. megaphyllum* of the section Dollinera of the subgenus Dollinera.

12) **Desmodium sequax** Wallich, Pl. Asia. Rar. **2**: 46, t. 157 (1831)–Benth. in Miq., Pl. Jungh. 224 (1852), in adnota–Baker in Fl. Brit. Ind. **2**: 170 (1876)–Kurz in Journ. Asiat. Soc. Beng. **45** (2): 231 (1877)–Prain in Journ. Asiat. Soc. Beng. **66** (2): 400 (1897)–Gagnep. in Fl. Indo-Chine **2**: 594 (1920)–Schindl. in Fedde, Rep. **22**: 267 (1926); in Fedde, Rep. Beih. **49**: 272 (1928)–Merr. in Contr. Arn. Arb. **8**: 76 (1928)–van Meeuwen in Reinwardtia **6**: 100 (1961) & 259 (1962)–Backer & Bakh. f., Fl. Java **1**: 606 (1963)–Ohashi in Hara, Fl. E. Himal. 154 (1966).

[Fig. 46b]

*Desmodium strangulatum* var. *α. sinuatum* Miq., Fl. Ind. Bat. **1** (1): 255 (1855).

*Desmodium dasylobum* Miq., Fl. Ind. Bat. Suppl. 305 (1861).

*Desmodium sinuatum* (Miq.) Blume ex Baker in Fl. Brit. Ind. **2**: 166 (1876)–Prain, l.c. 394 (1897)–Matsum. in T. Ito & Matsum., Tent. Fl. Lutch. 416 (1899)–Craib in Sargent, Pl. Wilson. **4**: 104 (1914).

*Desmodium hamulatum* Franch., Pl. Delavay. 175 (1890).

*Meibomia sequax* (Wall.) O. Kuntze, Rev. Gen. **1**: 197 (1891).

*M. dasyloba* (Miq.) O. Ktze., l.c. 197 (1891).

*M. sinuata* (Miq.) O. Ktze., l.c. 198 (1891).

*Desmodium grossicrenatum* Franch. ex Prain in Journ. Asiat. Soc. Beng. **66** (2): 394 (1897), sub syn.

*Desmodium ancistotrichum* K. Schum. & Laut., Fl. Deut. Schutzgeb. Südsee 358 (1901).

*Desmodium sequax* var. *sinuatum* (Miq.) Hosokawa in Journ. Soc. Trop. Agric. **4**: 313 (1932)–Liu & Chuang in Taiwania **8**: 93, fig. 20 (1962).

*Dollinera sequax* Schindl. ex Hochr. in Candollea **6**: 483 (1936).

A much branched shrub, up to 2 m high; young shoots and branches nearly terete to slightly striate, densely to rather sparsely spreading to ascending ferruginous pubescent and occasionally mixed with minute uncinulate hairs. Stipules linear with an acuminate apex, 4–5 mm by 0.7–1 mm in size, densely pubescent and ciliate outside. Petioles 1.5–5 cm long, usually densely tomentose. Leaves 3-foliolate; leaflets subcoriaceous, usually rhomboid or obtrullate or often ovate, acute to acuminate at the apex, cuneate to obtuse at the base, apparently undulate or coarsely crenate to sublobate along the margin, rather densely appressed minute tomentose or glabrescent above, more densely so and often mixed with minute

uncinate hairs beneath, lateral nerves (usually 4–7 on each side of the midrib and reaching margin) and reticulate-veinlets prominent; stipels filiform, 1–4 mm long; terminal leaflets (4–)6–10(–14) cm by (3–)4–6(–8) cm in size; petiolules 0.7–1.5 (–2) cm long; tomentose like the petioles; lateral leaflets (1.5–)3–6(–8) cm by 1–4 (–5.5) cm in size, pulvini 2–4 mm long. Inflorescences terminal and axillary, racemose or rarely paniculate, usually 6–11 cm long but occasionally up to 15 cm long, rachis densely spreading or ascending hirsute (0.5–1 mm long) and minutely tomentose. Flowers usually binate but occasionally a poorly developed flower-bud between them. Bracts early deciduous; primary bracts narrowly ovate, acuminate at the apex, 3–4 mm by 0.7–1 mm in size, pubescent and minutely hooked hairy outside; secondary bracts narrowly triangular, about 1 mm long, puberulent on the back. Flowering pedicels 3–5 mm long, fruiting pedicels 4–8 mm long, densely spreading pubescent and puberulent. Bracteoles similar to the secondary bracts, early deciduous, 0.5–0.7 mm long. Calyx minutely uncinat hairy and rather densely appressed puberulent, 2.5–3 mm long, 4-lobed, all lobes nearly same in length (1–1.5 mm long), the upper one very broadly triangular, 2-toothed at the apex, others triangular with an acuminate apex. *Corolla* (Fig. 47: c) pink or rose-purple to reddish violet or purple; standard normally to broadly elliptic with an emarginate apex, cuneate to the base, 7–10 mm by 4–7 mm in size; wings narrowly elliptic, 6.5–10 mm (including the 1.5–2.5 mm long claw) by 1.5–3 mm in size, auriculate on both sides of the lamina, obtuse at the apex; keel 7–10 mm (including the 2–3.5 mm long claw) by 2–3 mm in size, slightly auriculate at the base of lamina, obtuse at the apex. Stamens 7.5–8.5 mm long. Pistils 7–10 mm long. *Pods* (Fig. 48: g) sessile, nearly moniliform, (6–)8–13-jointed, densely ferruginous or brown hooked hairy, swollen on the seeds, both sutures nearly equally indented, isthmus about  $1/2$ – $2/3$  as broad as the pods, not reticulate-veined; joints  $2.5$ – $4 \times 2.5$ – $3.5$  mm in size. *Seeds* (Fig. 48: h) transversely broadly elliptic,  $1.5$ – $1.8$  mm  $\times$   $1.9$ – $2.2$  mm in size. *Pollen grains* (Pl. 14: a–d) tricolporate; subprolate or prolate spheroidal;  $28$ – $35 \times 22$ – $35$  (average  $31.9 \times 27.7$ )  $\mu$  and ellipsoidal in the equatorial view; colpi long, narrow, marginate, intruding, the margin jagged, constricted at the equator; pores almost rounded to elliptic,  $5 \times 5$ – $12$   $\mu$ , elongated equatorially, marginate; exine undulate, fine reticulate or partly fine reticulate to verrucate or rugulate, lumina less than  $1$   $\mu$  in diameter, tectate, about  $2.5$   $\mu$  thick, the ectexine thicker than the endexine, muri simplibaculate, columellae short.

Distr. India, Himalaya, Burma, Tonking, China, Malaysia, and Taiwan.

Repres. specim. exam.: **India.** Kumaon (R. Blinkworth; Wallich 5712 CAL–**Isotype** of *D. sequax* Wall.); Assam: Khasi Hill (Hook. f. *s.n.* CAL), (C. B. Clarke 18661 CAL), (S. Kurz 125 CAL), (H. Collett 80 CAL); Jowai (King's collector *s.n.* CAL); Kohima (Clarke 41612 CAL); Di Chu Gorge, Lohit Valley, alt. 7000 ft. (F. Kingdon-Ward 20114 BM), Walong, alt. 4000 ft. In marshy ground under trees, deep shade (Kingdon-Ward 20227 BM, TI). **Nepal.** Kathmandu: Godavari, alt. 1500 m. Margin of evergreen forest (Hara et al. 6301578 TI); Kakani (Hara et al. 6301579 TI); Durat-Yarsu (T. Namba 0930078 TI); Garhi Danra-Tuwa (Hara et al. 6301439 TI); Tuwa-Taplethok (Hara et al. 6301437 TI); Taplethok-Helok (Hara et al. 6301438 TI); Tapejung-Garhi Danra (Hara et al. 6301436 TI). **Sikkim.** Rinchingpong-Gassing (T. Anderson *s.n.* Oct. 2, 1862 GH). **Burma.** Sankai Pai (S. M. Toppin 6096 CAL); Maymyo (J. H. Lace 4313

CAL), Bhamo (Cubitt 289 CAL), Kachin Hills (S. Mokim 115 CAL), North Triangle, Ilkinlum, alt. 4000 ft. (Kingdon-Ward 21254, 21402 BM, A, TI), Ukkrul, alt. 6000 ft. (Kingdon-Ward 17952 NY), Hkawng Caw, alt. 2500 ft. (R. Kaulback 409 BM, TI), Nam Tamai Valley, alt. 3000 ft. (Kaulback 101 BM). **China.** (G. Forrest 10778 BM), Yunnan: (A. Henry 934 CAL), Szemao Mts. (Henry 12476 NY, CAL), Shang-pa, alt. 2800 m (H. T. Tsai 58646 A), Chenkang, alt. 2850 m (T. T. Yü 17072 A), Ping-pien Hsien (Tsai 61227, 61259, 61302, 61411, 61522 A), Mekong-Salwin Divide (Yü 22684 A); Szechuan: near Tachienlu (A. E. Pratt 422 CAL), Kiating, Ta-fu-ssu (L. Y. Tai T. 975 A), Mt. Omei: (W. P. Fang 3267 A), Niis-hsin-ssu (Tai T. 433 A), Ching-yin-ko (S. C. Sun & K. Chang 1424 A), Tachengssu (Sun & Chang 1195 A), Wanhsing chuang (H. C. Chow 8377 A); Lo-shan Hsien & Vicinity (F. T. Wang 23551 A). Hupeh: Enshih Hsien (Ho-Ch'ang Chow 1803 NY). **Taiwan.** (T. Makino in 1896 TI), (R. Torie *s.n.* TI), (Nakahara 440 TI); Taipei Hsien (K. Miyake in 1899 TI), (Fukuyama in 1931 TNS), Urai (Tanaka & Shimada Herb. no. 13435 TI), (I. Sasaki *s.n.* in 1963, 144 TI), Mt. Taihei (Y. Yamamoto in 1925 TI); Hsinchu Hsien (T. Kawakami 1257 TI); Taitung Hsien: Hwalien (I. Sasaki 849 TI); Taichung Hsien: (Satake & Imazeki in 1940 TNS), Keito (I. Sasaki 640 TI); Ilan Hsien: (Tamura & H. Koyama 23745 TNS); Ssuyuan-akou-Nanshan (T. Shimizu & C. C. Chunag 20460 TI); Nanshan, alt. 1140 m (C. Hsu 5773 TI); Chaiyi Hsien (Kawakami & Mori 1748 TI); Ali Shan, Chiayi County, alt. 2200 m. On roadside (C. C. Chuang 2970 TI), Bunkiko, alt. 1500 m (U. Faurie 1352 TI, KYO). **New Guinea.** (Rodatz & Klink 155 CAL). **Java** (S. Kurz *s.n.* CAL).

The pollen grains of this species are extremely variable especially in exine sculpture. Among the pollen materials of the species from Nepal (Hara et al. 6301578 TI), though only one grain, monocolpate is observed. The exine sculpture of the materials is all fine reticulate, while the grains from Taiwan (I. Sasaki 849 TI) are all tricolporate but their surfaces are mixture of fine reticulate, verrucate or rugulate exine sculptures. In this case, 100 % fine reticulate, verrucate or rugulate grains are scarce and most of them are about 70% for fine reticulate and about 30% for verrucate or rugulate on the entire surface of the grains. In both materials from Nepal and Taiwan, moreover, the surface of the grains is undulate even if the exine sculptures are fine reticulate.

#### 4. Sect. **Siamensia** Ohashi, sect. nov.

Inflorescentiae axillares, racemosae, 1.5–2.5 cm longae. Legumen breviter stipitatum, stipite 3–4 mm longo, 5–6-articulatum, articulis transverse ad transverse late oblongis vel fere quadratis.

Type species: *D. siamense* (Schindl.) Craib

This new section described rather conveniently to cover a very isolated, much modified species, *D. siamense* (Schindl.) Craib, restricted to the open grassy forest of northern Thailand, which cannot be properly incorporated elsewhere. Although the flower of the species is unknown, the stipitate, many jointed, large pods, the dimorphic bracts (i.e., primary and secondary), and the form of stipules and leaves provide apparently reliable features to belong to the subgenus *Dollinera*. However, from the sect. *Dollinera* and the sect. *Sequax* of the subgenus it differs distinctly in having only short axillary inflorescences and scarcely constricted, broad pods.

*D. siamense* was first attributed by Schindler to the genus *Phyllodium*, though he left a doubt as *Phyllodium* ? *siamense* in the original description. The species is, however, entirely different from the members of *Phyllodium* in the morphology of



Fig. 49. *D. siamense* (Schindl.) Craib (Kerr 4634 Isotype).

legumes, inflorescences and leaves. The leaves of *D. siamense* are very similar to those of *D. multiflorum* as already pointed out by Schindler (1927).

- 13) ***Desmodium siamense*** (Schindl.) Craib, Fl. Siam. Enum. **1**: 417 (1928).  
[Fig. 49]

*Phyllodium* ? *siamense* Schindl. in Fedde, Rep. **23**: 360 (1927).

A much branched shrub; branches terete with many small lenticels, reddish brown in colour, glabrescent; young ones sharply angular, densely ascending sericeous (about 0.5 mm long) on the ridges and rather densely puberulent (about 0.1 mm long) with scattered silky hairs on other parts. Stipules persistent, narrowly triangular, 5–6 mm long, 1.5–2 mm wide at the base, rather densely puberulent outside and sericeous along the margin. Petioles 1–3 cm long, sulcate above, densely ascending or spreading sericeous. Leaves 3-foliolate; leaflets coriaceous, elliptic or obovate with an obtuse apex, the upper surface uniformly very minute hairy (below 0.1 mm long) and covered by thick waxy (?) layer, the lower surface rather densely appressed sericeous along the midrib and on lateral and marginal nerves, pilose on reticulate-veins, lateral nerves conspicuous, (7–)9–12 on each side of the midrib and reaching the margin, reticulate-veins prominent, entire and revolute along the margin; stipels subulate or narrowly triangular, 1–2 mm long; terminal leaflets cuneate and obtuse at the base, 3–5.5 cm by 2–3 cm in size; petiolules 4–10 mm long, densely sericeous like the petioles; lateral leaflets slightly oblique and rounded or obtuse at the base, 2.5–3.5 cm by 1.5–2 cm in size. Inflorescences only axillary racemose, 1.5–2.5 cm long; rachis densely spreading puberulent and pilose. Flowers probably binate, subtended by secondary bracts; fruiting pedicels 5–7 mm long, densely spreading puberulent and sparsely pilose. Primary bracts subtending the two secondary bracts, narrowly ovate, acuminate at the apex, 2.5–3 mm by 0.5–0.8 mm in size, pubescent on the back; secondary bracts similar to the primary ones but smaller (1.5–2 mm by 0.3–0.5 mm in size). Bracteoles narrowly ovate, acuminate at the apex, 2–2.5 mm long, pubescent on the back, glabrous on the face. Calyx 5–5.5 mm long, densely uncinately minute hairy and sparsely sericeous on the outside, 4-lobed; tube 2–2.5 mm long, the upper lobe triangular, entire and acute at the apex, about 2.5 mm long, 1.5 mm wide at the base, laterals triangular, about 2 mm long, 1 mm wide at the base, the lower longer than others, narrowly triangular, 3–3.5 mm long, about 1 mm wide at the base. Flowers unknown. *Pods* (Fig. 48: e) 5–6-jointed, distinctly stalked (3–4 mm long, glabrous), flat, swollen on the seed, nearly glabrous except for both sutures (sparsely appressed sericeous), the upper suture thickened and nearly straight, the lower suture shallowly undulate, isthmus nearly same or slightly narrower than the width of pod, conspicuously reticulate-veined; joints transversely broad to transversely oblong or nearly quadrate, 6–10 × 5–7 mm in size. *Seeds* (Fig. 48: f) about 4 mm long and 7 mm wide.

Distr. Endemic to northern Thailand.

Specim. exam.: **Thailand**. Payap: Me Ping Rapids, Keng Soi, alt. ca. 4000 m. Open grassy jungle (A. F. G. Kerr 4634 Nov. 23, 1920 K-**Holotype** of *Phyllodium siamense* Schindl.; BK-**Isotype**).

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