



FASCICLES OF FLORA OF INDIA

FASCICLE 22

Salvadoraceae	Sonneratiaceae
Goodeniaceae	Campanulaceae
Ellisophyllaceae	Aponogetonaceae

Edited by
P.K. Hajra
and
M. Sanjappa

BOTANICAL SURVEY OF INDIA

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P.K. Hajra
and
M. Sanjappa
with assistance from
(M. Gangopadhyay
and
T. Chakrabarty)



BOTANICAL SURVEY OF INDIA

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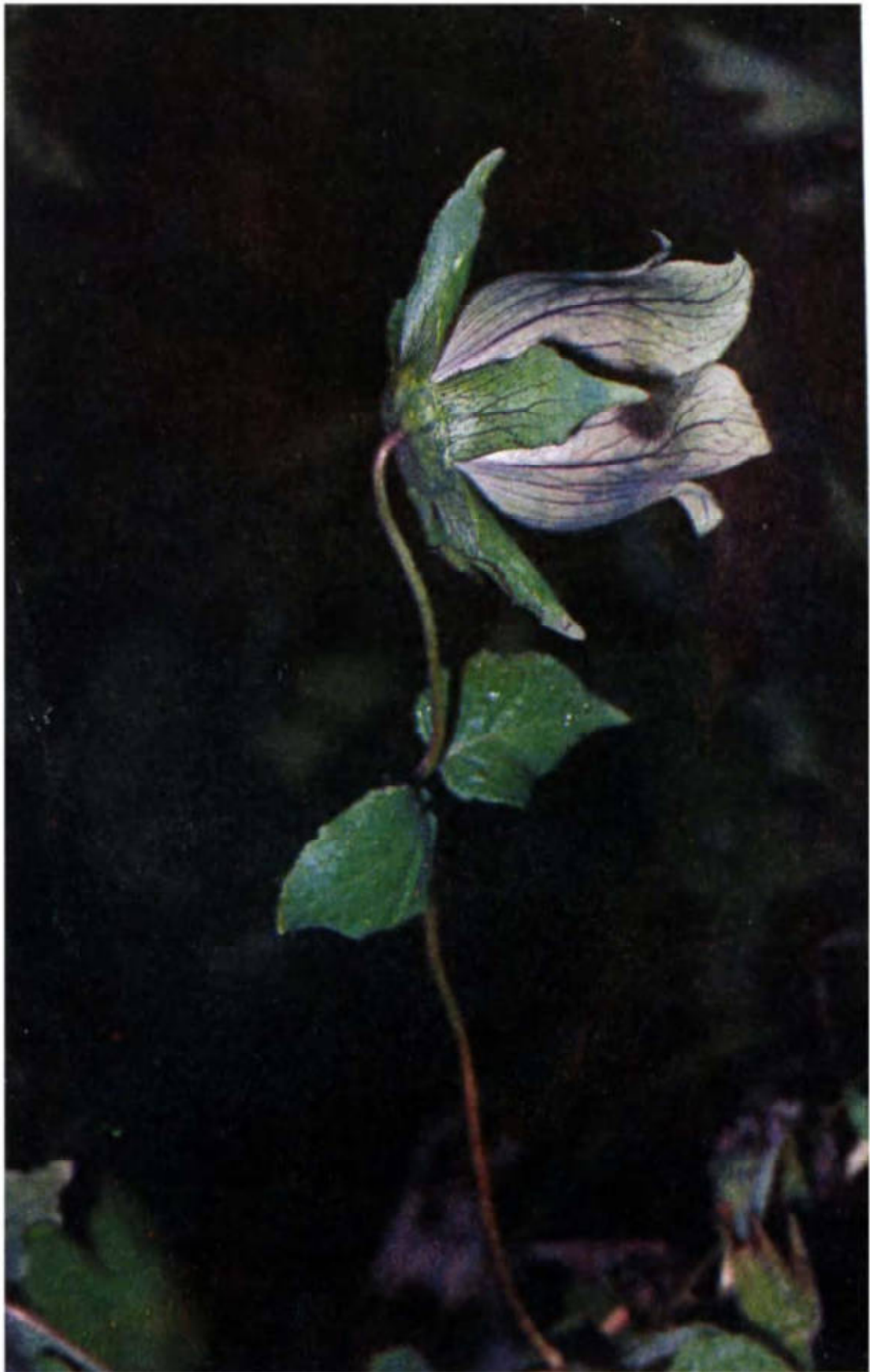
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Codonopsis ovata Benth



Cyananthus lobatus Wall. ex Benth.



***Cyananthus microphyllus* Edgew.**



Duabanga grandiflora (Roxb. ex DC.) Walp.



Plate 1. *Salvadora persica* L. fruiting twigs.



Plate 2. *Scaevola sericea* Forst.f. ex Vahl—flowering twigs.

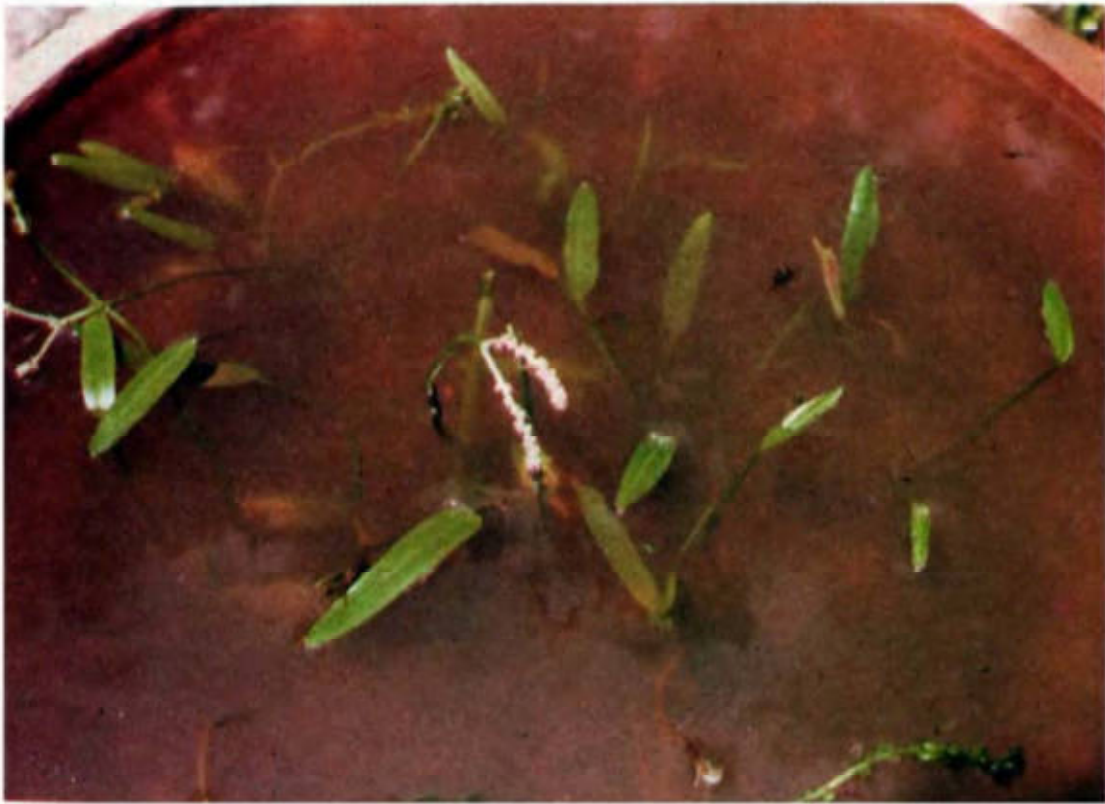


Plate 3. *Aponogeton satarensis* Sundararaghavan *et al* — grown in pot.

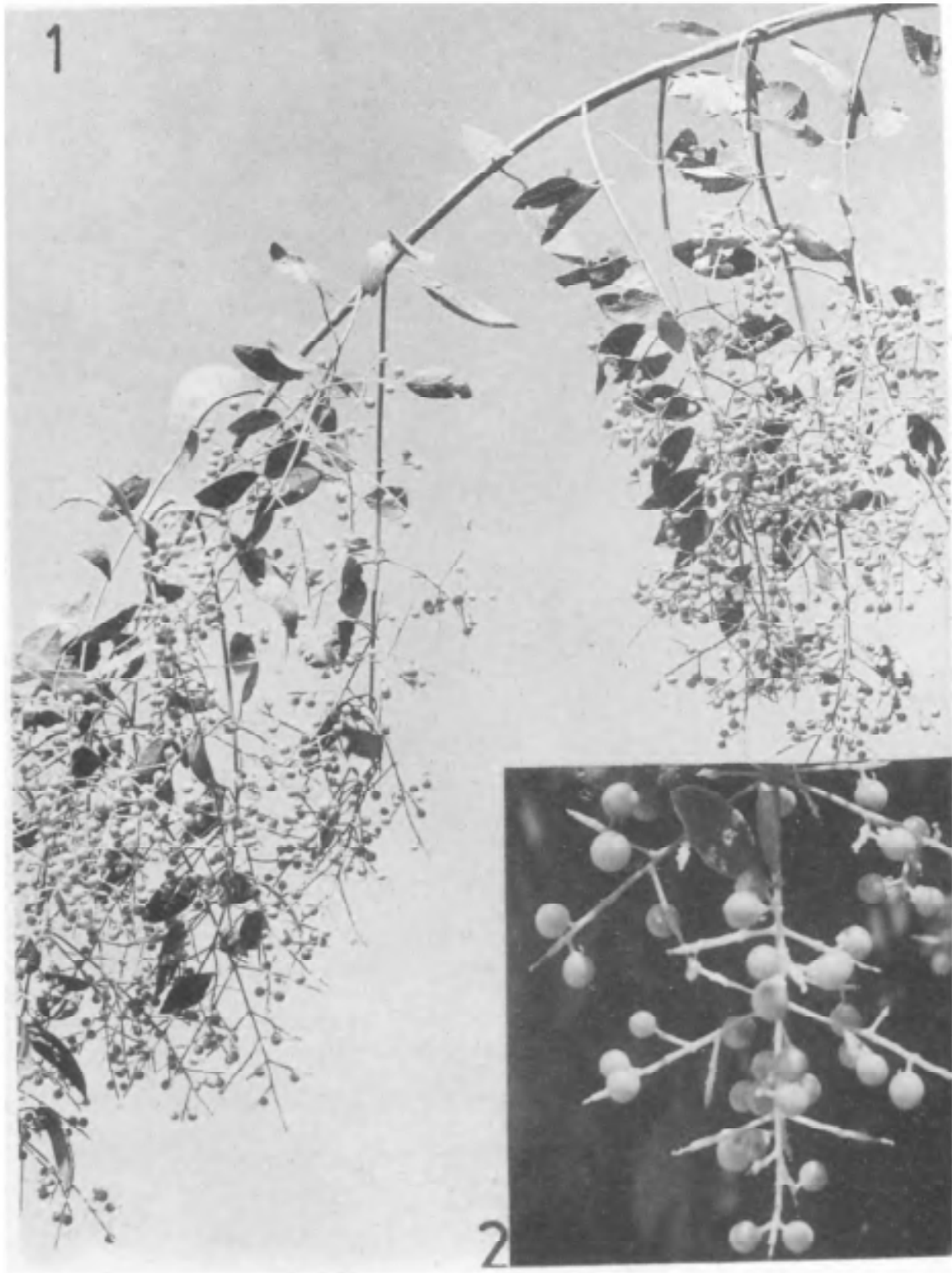
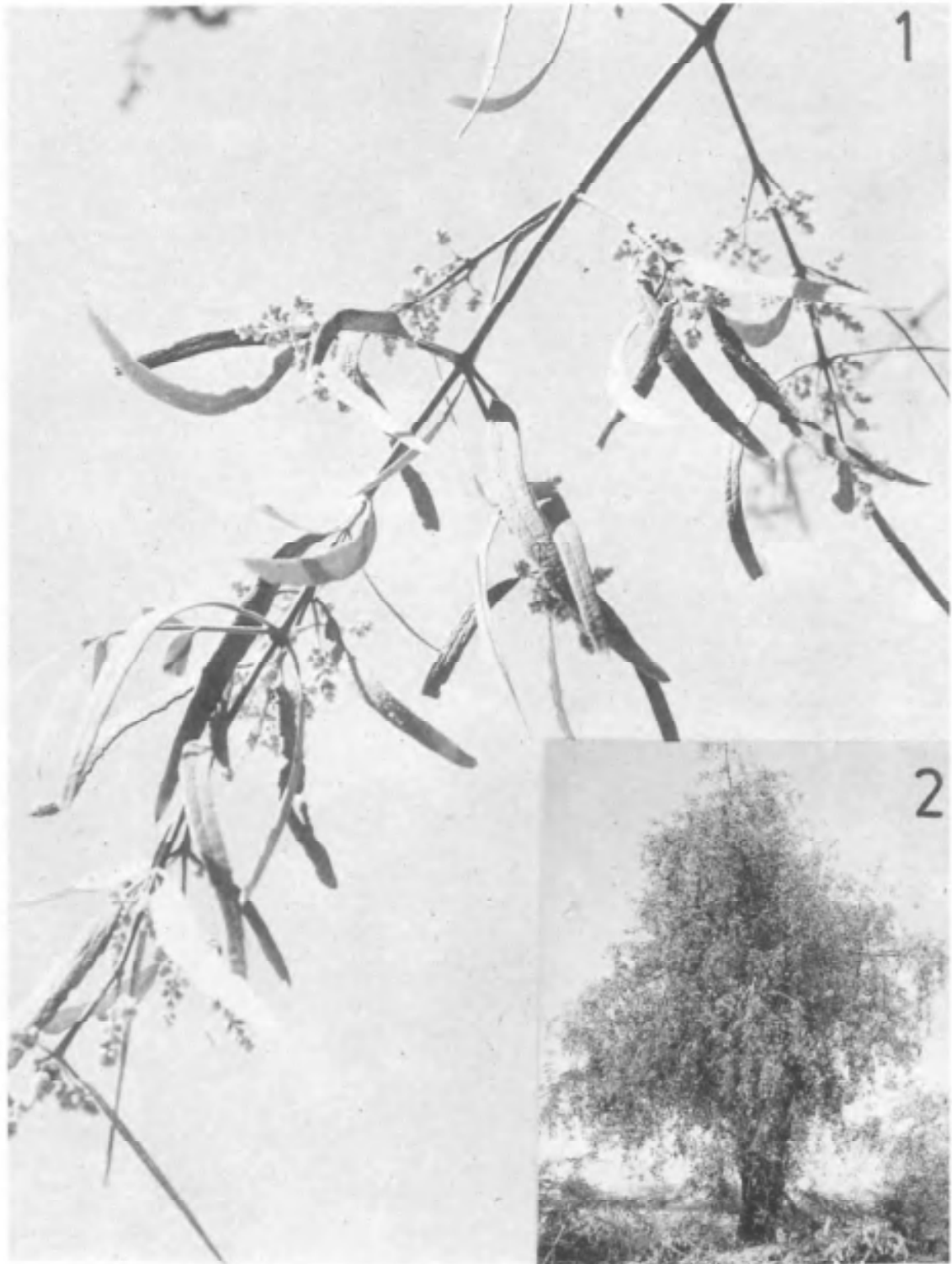


Plate 4. *Salvadora perisca* L. 1. Flowering twigs. 2. Fruiting twigs.



**Plate 5. *Salvadora oleoides* Decne 1. Pendent twig with flowers.
2. Habit.**



Plate 6. *Sonneratia caseolaris* (L.). Engler — habit.



Plate 7. *Sonneratia caseolaris* (L.) Engler — pneumatophores around the base trunk.



Plate 8. *Scaevola sericea* Forst f. ex Vahl — habit.



Plate 9. *Scaevola sericea* Forst f. ex Vahl — flowering twig.

SALVADORACEAE

Lindl., Nat. Syst. Bot. ed. 2 : 269. 1836.

T.A. Rao*

Small trees or shrubs, sometimes scrambling. Stems olive grey, unarmed or spinous ; branches spreading, drooping, slightly tumid at the articulations, nearly glabrous. Leaves simple, opposite, petiolate ; entire, coriaceous, venation conspicuous or obscure, stipules minute, caducous or persistent, sometimes absent, axillary thorns sometimes present. Flowers small, bisexual or if unisexual plants dioecious or polygamodioecious, bracteate, in dense axillary or terminal fascicles or panicles. Calyx campanulate or ovoid ; lobes 2 - 5, free, minute, often imbricate. Corolla 4 - 5, membranous, free or basally connate (in *Salvadora*), campanulate, imbricate or contorted, toothed or glandular inside. Stamens 4 - 5, hypogynous or epigynous, alternate with petals ; filaments free or basally united or adnate to corolla base ; anthers round or ovate, dithecal, dehiscing through longitudinal slits. Disc absent or present in the form of glands alternating with stamens. Ovary superior, 1 - 2 or imperfectly 4 - 10 loculed with 1 - 2 erect, anatropous ovules in each locule ; styles distinct ; stigma bifid to subentire. Fruit usually a drupe or 1 seeded berry. Seeds compressed or globose, exalbuminous ; embryo amygdaloid, with thick, fleshy, planoconvex cotyledons.

Warm Old World tropics, mainly in Asia and Africa with habitat preferences for coastal and saline areas, 3 genera and 11 Species ; 2 genera and 3 species in India, usually occur in arid and semi-arid areas. The occurrence of wild *Dobera* is doubtful in India.

KEY TO THE GENERA

- 1a. Shrubs thorny, dioecious ; flowers polypetalous ; ovary bilocular
..... *Azima* 1
b. Trees and shrubs, not thorny, monoecious ; flowers gamopetalous ; ovary
unilocular *Salvadora* 2

1. AZIMA

Lam., Encycl. 1 : 343. 1783 ; Benth. & Hook.f., Gen. Pl. 2 : 681. 1873 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 620. 1882 ; Selum. in Engl. & Prantl,

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Prantl, Pflanzenfam. 20 b : 235. 1942 ; Backer in Steenis, Fl. Males. 1. 4 : 225. 1951. *Acetegeton* Blume, Bijdr. 1144. 1827. *Monetia* subg. *Azima* Baill., Adansonia 9 : 289. 1770.

Scrambling shrubs. Stems woody at base, branches quadrangular, grooved, pubescent when young ; thorns axillary, very sharp with an indurated point. Leaves opposite, entire, venation conspicuous, subpalmate. Flowers small, in axillary clusters or umbels often passing into interrupted spikes at end of twigs ; bracts puberulous, spinescent to leaflike or sometimes absent ; bracteoles small, linear. Calyx campanulate, shortly 4-fid, in female irregularly 2 - 4 - lobed. Petals 4, rarely 5, free, lanceolate, imbricate in bud. Stamens 4, free, alternate with petals ; filaments linear ; anthers ovate. Ovary bilocular, ovules erect, basal, 1 - 2 in each locule ; stigma subsessile, large, capitate or bifid. Berries globose, endocarp membranous, 1 - 2 seeded.

Distrib. : Tropical and South Africa, Madagascar, Mascarene Islands, South Asia to Hainan, Malesia ; ca 4 species. 1 in India.

Habitat : Commonly found in scrubland or moist saline areas.

Pollen : Tricolporoidate, rarely 6-rugoroidate, subprolate, $21.5 \times 17\mu$ (Erdtman, Pollen Morph. Pl. Tax. : 392. 1952) : exine rugulate (Blasco & Caratini in Phytogeographie et Palynologie Trav. Doc. Geogr. Trop., CEGET, Talence, France, 8 : 184 - 185. 1973).

Azima tetracantha Lam., Encycl. 1 : 343. 1783 & Tab. Encycl. t. 807. (a-m) lower plate, 1799 ; Wight, Ill. Ind. Bot. 2 : t. 152. 1850 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 620. 1882 ; Prain, Beng. Pl. 1 : 663. 1903 (Repr. ed. 1 : 489. 1963) ; Cooke, Fl. Pres. Bombay 2 : 122. 1904 (Repr. ed. 2 : 184. 1958) ; Haines, Bot. Bih. Or. 531. 1922 (Repr. ed. 2 : 557. 1961) ; Gamble, Fl. Pres. Madras 800. 1923 (Repr. ed. 2 : 562. 1957). Fig. 1

Local names : *Trikanta* - juti (Beng.) ; *Kautagur* - kamai (Hindi) ; *Sukka pat* (Mar.) ; *Kudali* (Sans.) ; *Ichanka* (Tam.) ; *Tellanpi* (Tel.) ; *Kuppi gida* (Kan.).

Shrubs rigid ca 2 m high, glabrous or branchlets hairy ; thorns 1 - 2 in each axil, 1 - 3 cm long. Leaves 4 - 5.5 $\times$ 2 - 2.5 cm, elliptic, mucronate, or spinescent at apex, acute - cuneate at base, rigid, glabrous ; petioles 3 - 4 mm long. Flowers 2 - 3 mm long, greenish - white or yellowish, sessile in axillary clusters ; upper leaves often reduced or obsolete with branchlets ending in naked spikes with whorled flowers ; bracts 2, unequal, ovate, and larger linear. Male flowers in axillary fascicles, 1 - 1.5 mm long, minutely

pubescent ; calyx lobes 4, ovate, acute, valvate. Petals 4 - 5, *ca* 1 mm long, acute, ciliate, pubescent. Stamens 4 - 5, *ca* 1 mm long. Pistillodes linear, acute. Female flowers solitary or in pairs. Calyx *ca* 1 mm long, lobes ovate, apiculate, glabrous. Petals *ca* 2 mm long, linear, glabrous. Staminalodes trigonal. Ovary glabrous, *ca* 2.5 mm across, pitcher shaped, 2-loculed with 2 ovules in each ; stigmas capitate. Berries white, *ca* 8 mm across, sessile, glabrous, usually 1- or sometimes 2 - seeded. Seeds black, discoid.

Type : India Orientalis, *Sonnerat s.n.* (P. Photo. !)

Fls. : Feb. - Nov. ; *Frts.* : March - Dec.

Distrib. : INDIA : West Bengal, Orissa, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Kerala. BANGLADESH, MYANMAR, SRI LANKA, MADAGASCAR, AFRICA.

Uses : Usually grown as a good hedge plant. The juice of the leaves is reported to relieve the cough of *Phythisis* and Asthama, the decoction of bark as an expectorant. The white berries are edible.

2. SALVADORA

L., Gen. Pl. ed. 5 : 58. 1754 ; Benth. & Hook. f., Gen. Pl. 2 : 681. 1876 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 619. 1882 ; Sleumer in Engler & Prantl, Nat. Pflanzenfam. 20 : 235. 1942.

Evergreen stunted trees or shrubs. Branches pendulous. Leaves greyish green, fleshy ; stipules rudimentary. Flowers bisexual or functionally unisexual, green, sessile or pedicelled, in terminal or axillary clusters or paniced racemes or spikes ; bracts minute. Calyx campanulate ; lobes 4, free, rounded, imbricate or twisted to the right in bud. Corolla campanulate ; lobes 4, ovate, imbricate. Stamens 4, rarely 5, epipetalous, alternate with lobes ; filaments flattend. Disc glandular or absent. Ovary globose, unilocular ; ovules 1 - 2 in each locule ; styles obsolete ; stigmas broad truncate or subpeltate. Fruit a drupe, subsessile, subglobose, smooth, subtended by slightly enlarged calyx and subpersistent corolla ; endocarp crustaceous. Seeds erect, globose, exalbuminous.

Distrib. : Tropical Africa and Asia ; *ca* 5 species, 2 in India.

Habitat : Adapted to arid and semi - arid as well as to saline - alkaline areas with limited rainfall.

Pollen : Tricolporate, $16 - 23 \times 11 - 18 \mu$, exine smooth or finely reticulate, tectate (Bornefille in Adansonia 11 : 514. 1971).

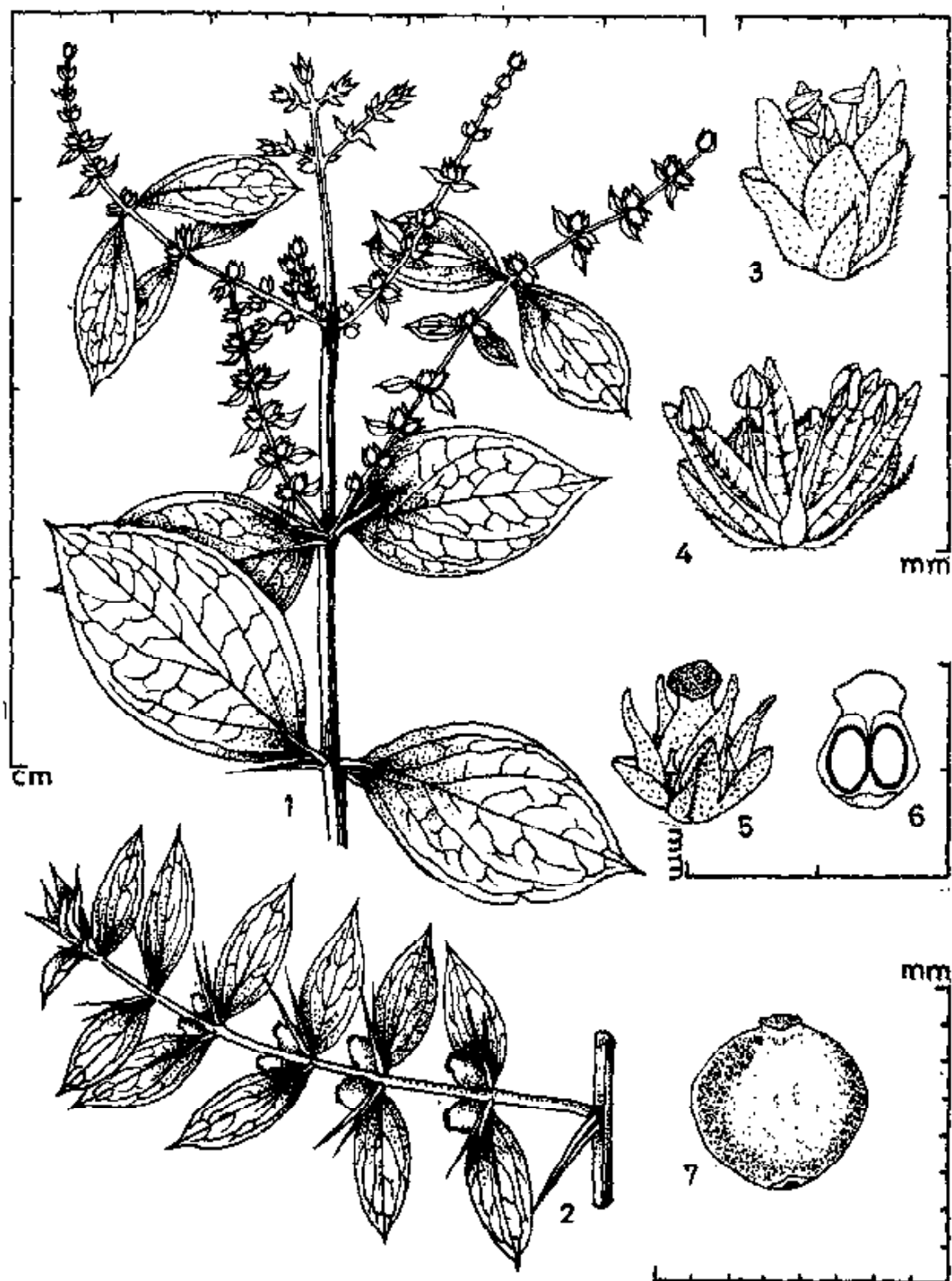


Fig. 1. *Azima tetracantha* Lam. 1. Flowering twig. 2. Fruiting twig. 3. Flower. 4 & 5. V.S. of flowers. 6 V.S. of ovary. 7. Berry.

KEY TO THE SPECIES

- 1a. Leaves linear ; flowers sessile in compact axillary panicles that are shorter than leaves ; corolla lobes erect ; ripe fruits yellow.
 *S. oleoides* 1
- b. Leaves elliptic ; flowers pedicelled in lax axillary and terminal, nodding panicles ; corolla lobes reflexed ; ripe fruits red or white.
 *S. persica* 2

1. *Salvadora oleoides* Dence, in Jacq., Voy. Bot. 140. t. 144. 1844 ; C.B. Clarke in Hook.f., Fl. Brit. India. 3 : 620. 1882 ; Cooke, Fl. Pres. Bombay 2 : 121. 1904 (repr. ed., 2 : 183. 1958) ; Duthie, Fl. Upp. Gang. Pl. 29. 1911 (Repr. ed. 1 : 481. 1960). *S. stocksii* Wight, Ill. Ind. Pl. 2 : 229. 1850 & Icon. Pl. Ind. Orient. 4 : 18, t. 1621B. 1850 ; Cooke, Fl. Pres. Bombay 2 : 122. 1904 (Repr. ed. 2 : 183. 1958).

Plate 5, Fig. 2

Local names : *Pilu* (Mar.) ; *Mithiran* (Punj.) ; *Kharojhl* (Raj.).

Evergreen shrubs or small trees, 2 - 5 m tall ; trunk short ; branches divergent ; bark grey. Leaves 5 - 10. 5 × 0.5 - 1 cm, linear - lanceolate or elliptic - lanceolate, acute or subobtuse at apex, cuneate, at base, greenish - white, coriaceous, fleshy at maturity, glabrous, lateral nerves indistinct ; petioles 3 - 15 mm long. Flowers greenish - white, 2 - 4 mm long, in erect, axillary, paniculate spikes ; bracts acute. Calyx creamy to brownish yellow, persistent, cup shaped, 4-lobed ; lobes 1 - 1.5 mm long, rounded, obtuse. Corolla lobes 1 - 2.5 mm long, obovate - oblong, obtuse. Stamens 4, 1 - 2 mm long, epipetalous, alternating with corolla lobes, inserted at base of ovary, caducous. Berries ca 5 mm across, subsessile, ovoid globose, yellow when ripe, dark brown when dry. Seed 1, erect.

Type : Panjab (Punjab), *Jaquemont* no. 60, and no. 209 (P. Photo !)

Fls. : Jan. - Aug. ; *Frts.* : Feb. - Sept.

Distrib. : INDIA : Punjab, Rajasthan, Gujarat, Delhi, Uttar Pradesh ; PAKISTAN, SAUDI ARABIA, IRAN, YEMEN.

Uses : This species is used for afforestation of arid and semi-arid tracts of India. The juice of the leaves is reported to relieve cough. Wood is used for making agricultural implements, leaves as fodder for camels, root - bark as a vesicant and dried fruits as *curries*. Fruits edible.

2. *Salvadora persica* L., Sp. Pl. 122. 1753 ; Roxb., Pl. Corom. 1 : 26, t. 26. 1795 & Fl. Ind. 1 : 384. 1820 - 3 ; Wight, Ill. Ind. Pl. 2 : 229.

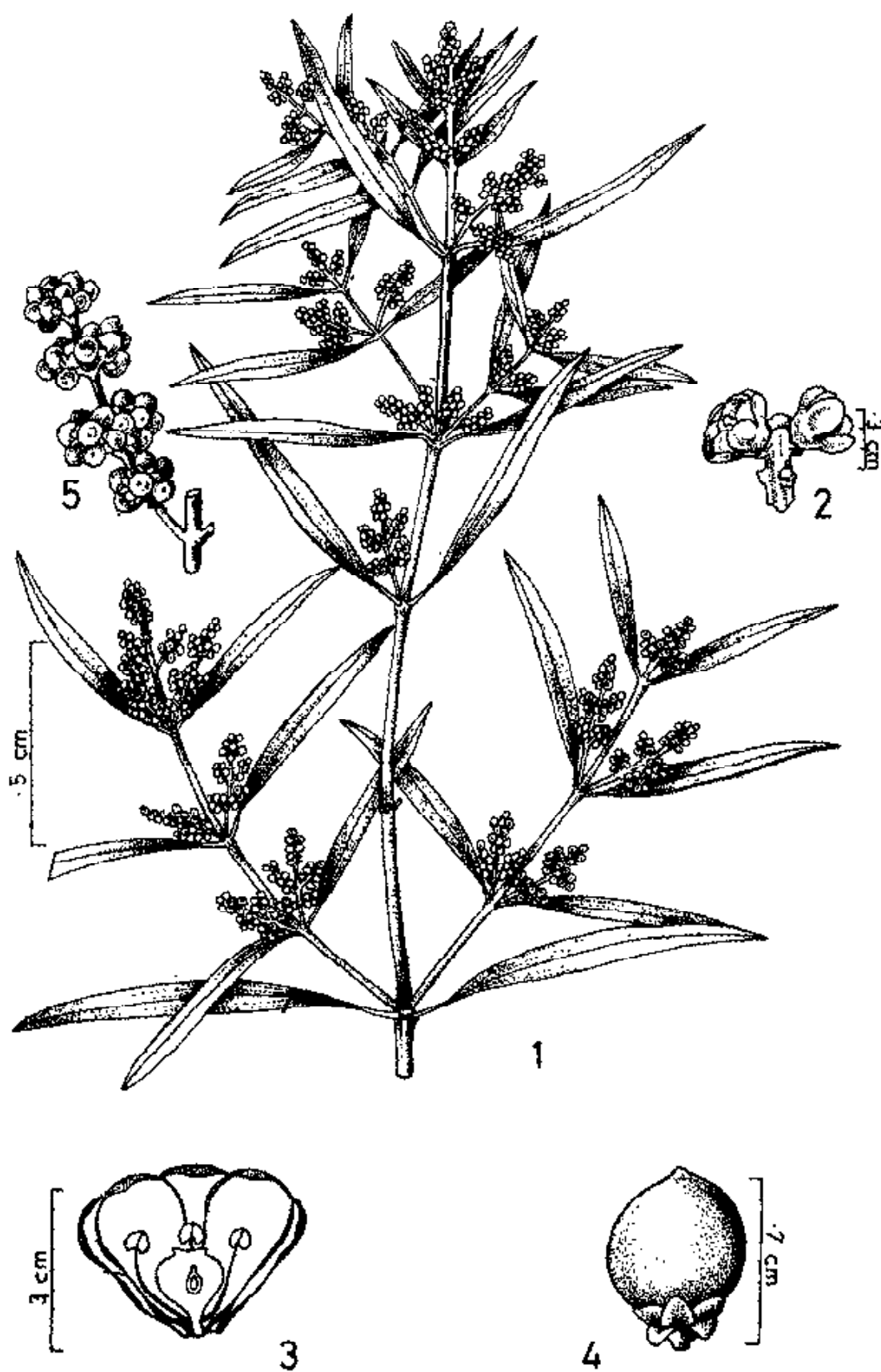


Fig. 2. *Salvadora oleoides* Decne 1. flowering twig. 2. Sessile flower.
3. V.S. of flower. 4. Fruit. 5. Cluster of fruits.

1850 & Icon. Pl. Ind. Orient. 4 : 18, t. 1621A. 1850 ; Brandis, For. Fl. 315. 1874 ; C. B. Clarke in Hook.f., Fl. Brit. India 3 : 619. 1882 ; Prain, Beng. Pl. 663. 1903 (Repr. ed. 1 : 480. 1963) ; Cooke, Fl. Pres. Bombay 2 : 121. 1904 (Repr. ed. 2 : 182. 1958) ; Duthie, Fl. Upp. Gang. Pl. 28. 1911. (Repr. ed. 1 : 481. 1960) ; Gamble, Fl. Pres. Madras 799. 1923 (Repr. ed. 2 : 562. 1957). *Galenia asiatica* Burm. f., Fl. Ind. 88, t. 31. f.1. 1768. *Salvadora indica* Wight, Ill. Ind. Bot. 2 : 229, t. 181. 1850. Plates 1 & 4, Fig. 3

Local names : *Khakhin* (Mar.) ; *Cheoni*, *Mriga*, *Palugach* (Or.) ; *Kaurijal* (Punj.) ; *Charlijol*, *Jhak*, *Jhal*, *Pilu*, *Dhalu*, *Mitha Jal* (Raj.) ; *Opa*, *Ugai* (Tam.) ; *Waragou* (Tel.).

Trees or straggling shrubs ca 6 m tall ; trunks stunted or gnarled ; bark thin, grey ; branches drooping or spreading, secundus when wind swept, terete, glabrous. Leaves opposite, decussate, 5 - 6 × 2 - 4 cm, ovate to elliptic - lanceolate, rounded to obtuse and mucronate at apex, lateral nerves 10 - 12, distinct, somewhat fleshy or coriaceous, petioles 1 - 3 cm long ; stipules minute, connected by a line, 5 - 15 cm long. Inflorescences axillary or terminal, lax compound panicles, bracts ovate, caducous. Flowers greenish - yellow, 2 - 3 mm long ; pedicels 1 - 1.5 mm long. Calyx light yellow, lobes 1 - 5 mm long, ovate to rounded, glabrous, ciliate. Corolla 5 lobed, persistent, lobes 1 - 2.5 mm long, oblong, obtuse, inflexed. Stamens 1 - 2 mm long, included ; anthers introrse. Ovary minute, stigmas peltate or subpeltate. Drupes 2 - 6.5 mm across, globose, red or white. Seeds ca 4 mm in diam., subglobose, smooth, brown.

KEY TO THE VARIETIES

- | | | | |
|-----|---|-------|-------------------------|
| 1a. | Pedicels ca 1.5 mm | ..... | 2 |
| b. | Pedicels 2 - 4 mm long | ..... | var. <i>indica</i> |
| 2a. | Leaves apices mucronate ; berries 2 - 2.5 mm across | ..... | var. <i>persica</i> |
| b. | Leaves apices rounded ; berries 3 - 4.5 mm across | ..... | var. <i>tuticornica</i> |

Var. *persica*

Fig. 3

Type : India, *Linnaeus*

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : throughout except E. & NE. India ; PAKISTAN, SRI LANKA, EGYPT, SYRIA, SAUDI ARABIA, PALESTINE, IRAN.

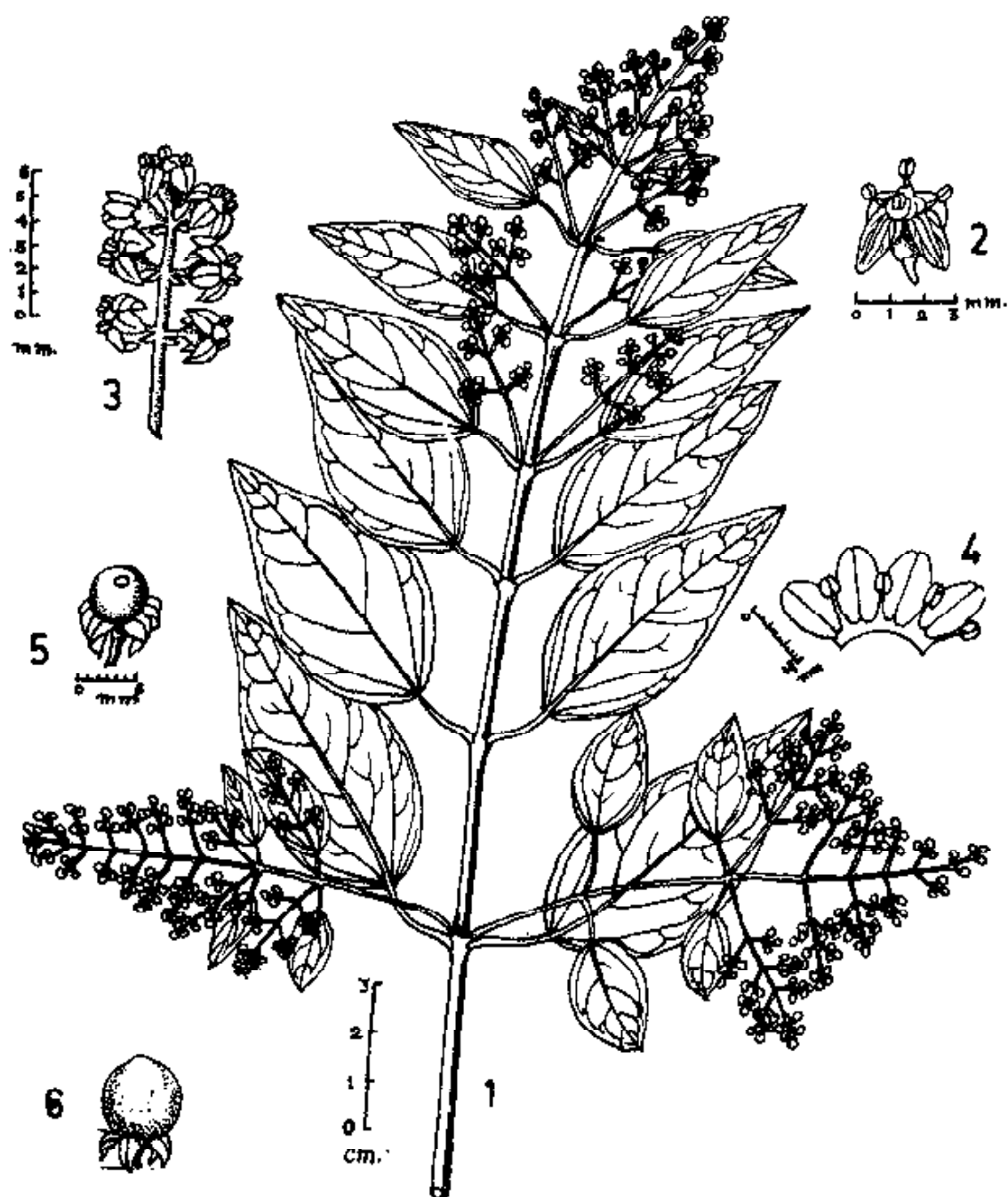


Fig. 3. *Salvadora persica* L. 1. Flowering twig. 2. Flower. 3. Inflorescence. 4. Petals with stamens. 5 & 6. Fruits.

Habitat : Arid and semi - arid regions especially on saline soils and sometimes on black cotton soil.

Uses : Twigs are used as toothbrush ; tender leaves and shoots as salad ; young branches and the leaves as fodder for camels ; fermented drink is made from the fruits ; the fresh root bark is applied as vesicant.

Chr. No. : $2n = 24$ (Kaul & Singh in Curr. Sci. 31 : 476. 1962) ; $n = 13$ (Sidhu, in Proc. 42nd Ind. Sci. Congr. Pt. III, 304. 1961).

Notes : Bhandari (Fl. Indian Des. 216. 1977) cited *Galenia asiatica* Burm. f. as a synonym of *Salvadora persica* L. An examination of Burmann's (Fl. Ind. 88. t. 31. 1768) description and figure 1 clearly shows alternate subpetiolate leaves and 5 lobed corolla.

var. tuticornica T.A Rao & S. Chakraborti, *var. nov.* *varietati persicae* affinis, sed differt foliis anguste elliptico ovatis, semi succulentis, apice rotundatis, nervis distinctis, stigmatum parum protrudenti, fructisque majoribus.

Typus : Tinnevely, Tuticoria, Sept. 1900, K. Rangachari s.n. (CAL) ; **isotypus :** B - C (MH). **Paratypus :** Shingle Island, T. A. Rao 1553 (CAL) ; Kurusadi Island, Shingle Island, A.K. Mukherjee 212 (CAL).

var. tuticornica differs from the *var. persica* in narrow elliptic - ovate leaves with rounded apex, distinct nerves, short protruded stigmas and large-sized fruits.

Distrib.: INDIA : Tamil Nadu, Tuticorin & Krusadi group of islands in the Gulf of Mannar.

Notes : Small sized, wind swept trees with more or less succulent leaves, growing on sandy strand in the vicinity of sea-shores.

var. indica (Wight) Rao & Chakraborti, *stat. nov.*

S. indica Wt., Ill. Ind. 2 : 229, t. 181. 1850. *S. persica sensu* Roxb., Fl. Ind. ed. 2. 1 : 389. 1832, *non* L. 1753 ; Bedd., Fl. Sylv. 2 : t. 247. 1872. *S. koenigii* Arn. in Proc. Phil. Soc. Glasgow 3 : 160. 1855. *S. persica* *var. wightiana* (Planch. ex Thw.) Verdc. in Kew Bull. 19 : 180. 1964. *S. wightiana* Planch. ex Thw., Enum. Pl. Zeyl. 190. 1860 ; Cooke, Fl. Pres. Bombay 2 : 121. 1904 (Repr. ed. 2 : 562. 1956) ; Bedd. Fl. Sylv. 2 : t. 247. 1872.

Leaves coriaceous. Flowering pedicels thin and rigid.

Near the sea shores of Point Calimere in Tamil Nadu.

Type : Wight, Ill. Ind. Bot. t. 181. 1850.

Fls. & Frts. : Throughout the year.

EXCLUDED TAXA

Dobera glabra (Forsk.) Poir. The only available specimen (Bombay, Geruma, Cat. *Caburne* K, Photo !) cannot be ascertained with certainty. Lack of subsequent fresh collections so far throws some doubts about the occurrence of this species in India.

SONNERATIACEAE

Engler & Gilg, Pflanzenfam. ed. 9 10. 299. 1924.

T.A. Rao*

Coastal evergreen or inland deciduous trees ; stem bases flaky giving stout, vertical, conical pneumatophores, with horizontal delicate nutrition roots on radiating, rigid cable roots (*Sonneratia*) or without them (*Duabanga*). Leaves opposite, decussate, simple, entire, coriaceous, glabrous, petiolate ; stipulate or exstipulate. Flowers large, bisexual, actinomorphic, pedicelled, solitary or 1 - 3 together in axillary or terminal cymes or corymbs. Calyx coriaceous, slightly adnate to the base of ovary, persistent, campanulate, lobes 4 - 8, valvate, acute, basally expanded or reflexed at maturity. Petals 4 - 8 or absent, broad and wrinkled or narrow and smooth. Stamens 12 - many, in several whorls on hypanthium or in clusters opposite calyx lobes, multiseriate ; filaments slender, free, inflexed in buds ; anthers reniform or versatile, medifixed, dithecous, dehiscence longitudinal, pollen sticky. Ovary superior, adnate to calyx tube at base, 4 - many loculed, septa membranous ; ovules numerous, on thick axile ascending placenta ; styles long, robust, bent in bud ; stigmas capitate or obscurely lobed and mushroom - shaped. Fruit a berry or a valvate capsule, many seeded. Seeds small, angular ; embryo straight or curved with leafy cotyledons.

2 genera and 7 species ; S.E. Asia and Malysia, Tropical Africa to the western Pacific and Australia. 2 genera and 5 species in India.

Notes : It is clear from the available literature that the 2 genera of this family have fortuitious family status in Myrtaceae (Lindly, Nat. Syst. Bot. ed. 2 : 45. 1836), Crypteroniaceae (A. DC. in Prod. 16 (2) : 677. 1868) and Lythraceae (Benth. & Hook. f., Gen. Pl. 1 : 782 - 784. 1867). The close affinity of the family with Lythraceae is evident by embryological (Venkateswaralu, Proc. Indian Acad. Sci. 5 : 206. 1937) and pollen (Erdtman, Pollen Morph. Pl. Tax. Angiosperms 413. 1952) studies. Based on wood anatomy Venkateswaralu and Rao (in Curr. Sci. 33 : 6 - 9, 1964) suggested a separate subfamily satus within Lythraceae.

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KEY TO THE GENERA

- 1a. Inland trees. Petals present, broad, crisped. Stamens biseriate. Fruits a capsules. Seeds very minute, testa tailed at ends
 *Duabanga* 1
- b. Coastal shrubs or trees. Petals absent or if present, very narrow, smooth. Stamens multiseriate. Fruit a berry. Seeds quite large, testa not tailed at ends
 *Sonneratia* 2

1. DUABANGA

Buch. - Ham. in Trans. Linn. Soc. London 17 : 177. 1835 ; Benth. & Hook.f., Gen. Pl. 1 : 783. 1867 ; C.B. Clarke in Hook.f., Fl. Brit. India. 2 : 578. 1879 ; Niedenzu in Engler & Prantl, Nat. Pflanzenfam. 3 : 16. 1892.

Large trees, glabrous, branches quadrangular, pendulous, trunks buttressed at base. Leaves opposite, distichous, oblong, acute at apex, cordate to rounded at base, short - petioled, stipulate. Flowers large, 5 - many in terminal corymbs or panicles with opposite branches. Calyx cup - shaped or turbinate, adnate to the base of ovary, lobes 4 - 7, thick, valvate, triangular or ovate, acute. Petals 4 - 7, white, obovate, shortly clawed, crisped and undulate. Stamens 12 - many, inserted in a single row round a perigynous ring ; filaments filiform - subulate, anthers recurved or replicate over one end of connative. Ovary conical, 4 - 8 - loculed with numerous ascending ovules all over inner surface of ovary walls ; styles long, bent ; stigmas capitate, 4 - 8 lobed. Capsules subglobose or woody, with thick spreading persistent calyx, 4 - 8 loculed ; dehiscence loculicidal. Seeds innumerable, minute.

Distrib. : INDO MALAYAN. INDIA, NEPAL, BHUTAN, BANGLADESH, MYANMAR, THAILAND, LAOS, CAMBODIA, CHINA AND MALAYSIA ; ca 3 species, 1 in India.

Ecol. : In evergreen or mixed evergreen forests occurring up to 1000 m, along the banks of rivers, streams and well drained slopes.

Pollen : Isopolar, subtriangular (polar view), elliptic (equatorial view) ; polar axis 25 - 30 μ ; equatorial axis 18 - 22 μ , planoperturate, triporate. Pore circular, 3 - 4 μ in diam., annulus 1 - 1.5 μ wide. Exine areolate at equatorial region ; tectate and scabrous at polar region (Thanikaimoni & Jayaweera, Trav. Sec. Sci. & Tec. 5 (3) : 1966).

Note : Probably the name is derived from 'Duyabangga' a vernacular name for the tree in Tripura (Jayaweera, J. Arn. Arb. 48 : 89. 1967).

Duabanga grandiflora (Roxb. ex DC.) Walp., Rep. 2 : 114. 1843 ; Blume, Mus. Bot. 1 : 109. 1849 ; Kurz in Pegu, Rep. App. B. 54. 1875 & For. Fl. Brit. Burma 1 : 525. 1877. *Lagerstroemia grandiflora* Roxb. ex DC. in Mem. Soc. Hist. Nat. Geneve 3 (2) : 84. 1826 & Prodr. 3 : 93. 1828 ; Roxb., Fl. Ind. 2 : 503 1832. *Duabanga sonneratioides* Buch. Ham. in Trans. Linn. Soc. London 17 : 177. 1835 ; Hook.f., Ill. Himal. Pl. : t. 11. 1855 ; C.B. Clarke in Hook.f., Fl. Brit. India 2 : 579. 1879 ; Parkinson, For. Fl. Andaman 179. 1923 ; Cowan, Trees N. Beng. 70. 1929 ; Kanjilal *et al*, Fl. Assam 2 : 312. 1938. *Leptospartion grandiflorum* (Roxb. ex DC.) Griff., Ic. Pl. Asiat. 4 : 511, t. 591. 1854 & Poth. Pap. & Itin. Notes 2 : 114. 193. 1848.

Local names : *Khukan, Kochan, Kokan, Thora* (Asm.) ; *Bondorhulla* (Beng.) ; *Jarai Jhalna* (Cachar) ; *Achung, Bondorkella, Bolchim* (Garo) ; *Dur, Durkung* (Lep.) ; *Baichua* (Sant.).

Trees ca 30 m tall ; trunk straight ; branches horizontal, branchlets drooping, obtusely quadrangular ; bark wrinkled and fissured. Leaves 17 25 × 7 9 cm, shortly acuminate to cuspidate at apex, cordate or rounded at base, glabrous, glaucous beneath, petioles ca 5 mm long ; stipules ca 5 mm long. Corymbs drooping, 5 many flowered. Flowers ca 7 cm long ; pedicels ca 1 cm long. Calyx ca 2.5 cm long, broadly campanulate, lobes 6 - 8, triangular - ovate, acute. Petals 4 - 7, ca 2.5 cm long, creamy white, caducous, ca 3 cm long, cuneate, crumpled, margins erose. Stamens many, ca 3 cm long ; filaments exserted ; anthers versatile, ribbed. Ovary ca 2.5 cm across, 9 - loculed ; styles crumpled in bud, flexuous at maturity ; stigmas mushroom shaped. Capsules ca 3 4 cm across, subglobose, glabrous, splitting with 5 7 longitudinal clefts, testa scrobiform, both ends with pointed tails, upper margin obscurely winged.

Type : India orientalis, near Chittagong (Vern. Sans. name *Indradroog*), donated by Mr. Modderth to Roxburgh in 1801, and Roxburgh s.n. (G DC., Photo !)

Fls. : Nov. June ; *Frts.* : Mar. Aug.

Habitat : Very common in Terai and lower hill forests, especially along the banks of river Teesta, from south slopes of Tropical Eastern Himalayas up to 3000 m.

Distrib : INDIA : West Bengal (Northern Parts), Arunachal Pradesh, Assam, Manipur, Meghalaya, Andaman & Nicobar Island. NEPAL, BHUTAN, BANGLADESH, MYANMAR, CHINA, THAILAND, LAOS, CAMBODIA AND MALASIA.

Uses : The wood is used for box planking, plywood of inferior quality, workshop - wood and match splints. Also used as a fodder and for planting along borders in plantations.

Chr. No. : $n = 24$ (Mehra & Bawa, Chromosomal Evolution in tropical hardwoods. Evolution 23 : 466-481, 1969).

Notes : This lofty tree with asymmetrically drawn out branches produces extremely minute seeds. The seeds require two rainy seasons to grow into a seedling. The plants could be grown easily on well drained slopes of river banks and other moisture laden stabilized landslopes. The flowers emit foul smell.

2. SONNERATIA

L.f., Sup. Pl. 38. 1781, *nom. cons.* ; Benth. & Hook.f. in Gen. Pl. 1 : 784. 1867 ; C.B. Clarke in Hook.f., Fl. Brit. India 2 : 579. 1879. *Blatti* Adans., Fam. Pl. 2 : 88. 1763 ; DC., Prodr. 3 : 231. 1828 ; Niedenzu in Engler & Prantl, Nat. Pflanzenfam 3 : 20. 1893, incl. sect. *Eublatti* & *Sciadostigma*. *Pogopate* Sonner., Voy. Nouv. Guin. 16. t. 10-11. 1776.

Coastal shrubs or trees, trunk columnar ; branches many, decumbent or recumbent, glabrous ; bark thin. Leaves opposite, entire, veins indistinct or distinct ; coriaceous, petioled, exstipulate. Flowers bisexual, large, 1 - 5 together at summit of pendulous branchlets, 4 - 8 merous, ebracteate. Calyx lobes as long as tube, valvate, ovate-oblong to lanceolate, acute. Petals absent or as many as calyx lobes, linear-oblong. Stamens in several rows on raised rim, caducous ; anther reniform. Disc saucer-shaped. Ovary nearly free or adnate at the base to the calyx tube, multilocular ; ovules numerous, ascending on axile placentae ; styles long, sinuous in bud ; stigmas subcapitate to capitate, funnel or umbrella-shaped. Fruit a berry, base closely embraced by persistent, coriaceous or woody, cup-shaped calyx with erect or reflexed lobes, crowned by persistent styles, 10 - 15-loculed. Seeds numerous, small, angular, cotyledons convolute.

Distrib. : In the mangroves of Indian and Pacific ocean. INDIA, SRI LANKA, BANGLADESH, MYANMAR, MALAYSIA, PHILIPPINES, NEW GUINEA, MICRONESIA, POLYNESIA, AUSTRALIA, MADAGASCAR, SYCHELLE, TROPICAL EAST AFRICA, ca 5 species.

Habitat : Among mangroves along the banks of tidal rivers, specially on shallow muddy banks in association with *Avicennia* or *Bruguiera*.

Fossil records : *Sonneratioxylon duderikense* (*Sonneratioxylon daksinense*) (Rao & Ramanujam in Curr. Sci. 35 : 257-258. 1966) from

the Cuddalore sandstones near Pondicherry represents the only previously known species of this genus from India. This resembles the wood of extant species of *Sonneratia* than those of *Duabanga*. Fossil pollen evidence shows that the earliest occurrence of *Sonneratia* pollen are comparable with those of extant species.

Pollen : Isopolar, subtriangular in polar view, elliptic in equatorial view. Grains colporate, subprolate, shrivelled, polar axis $52 - 73 \mu$; equatorial axis $40 - 60 \mu$; planoperturate. Pore elliptic or circular, annulus present or absent. Exine areolate to areolodate may be tectate and reticulate at the polar regions (Muller, J. in Pollen et Spores, 1969).

Notes : Fugacious petals of *Sonneratia* are very narrow and strongly resembling the filaments. They are best observed in mature buds.

Floral parts in herbarium sheets hardly remain intact. Such vegetative specimens could be identified to the species level based on distribution pattern of sclereids in the leaves (Rao & Banerjee, Curr. Sci. 44 : 648 - 649. 1975).

Chr. No. : $n = 11$ (Hou - Liu in Blumea 14 : 343. 1966) and $2n = 22$ (Cooper in Amer. J. Bot. 20 : 358 - 364. 1933).

KEY TO THE SPECIES

- | | | | |
|-----|---|-------|------------------------|
| 1a. | Petals persistent | ..... | 2 |
| b. | Petals caducous | ..... | 3 |
| 2a. | Leaves without apical knobs. Flowers white ; calyx tube angular, lobes reflexed | ..... | <i>S. alba</i> 1 |
| b. | Leaves with apical knobs. Flowers red ; calyx tube not angular, lobes erect | ..... | <i>S. caseolaris</i> 3 |
| 3a. | Leaves lanceolate elliptic. Calyx lobes 4, erect at fruit base. Fruits 2 - 3 cm across | ..... | <i>S. apetala</i> 2 |
| b. | Leaves obovate to suborbicular. Calyx lobes 7 - 8, reflexed at fruit - base. Fruits 5 - 9 cm across | ..... | <i>S. griffithii</i> 4 |
| 1. | <p><i>Sonneratia alba</i> J.Sm. in Rees, Cyclop. 33. no. 2. 1819 ; Griff., Notul. Pl. Asiat. Rar. 4 : 652. 1854 ; Kurz, For. Fl. Brit. Burma 1 : 526. 1877 ; C. B. Clarke in Hook. f., Fl. Brit. India 2 : 580. 1879 ; Engler in Engler & Prantl, Nat. Pflanzenfam. 3 (7) : 2611. 1897 ; Mooney, Suppl. Bot. Bih. Or. 251. 1950 ; Parkinson, For. Fl. Andaman 179. 1923 ; Parker in Indian For. 25 : 506. 1925 ; Backer & Steenis in Steenis, Fl. Males. 1, 4 : 285, f. 3b. 1951 ; <i>Rhizophora caseolaris</i> L. in Stickman, Herb. Amb. 13. 1754. p.p. <i>S. griffithii</i> Watson in Mal. For. Rec. 6 : 120 f. 24. 1928.</p> | | |

Local names : *Ora* (Or.) ; *Pedata, Perepat, Pidadu* (Mar.).

Trees, 5-10 (-28) m tall; branches cylindrical or gnarled on short, contorted, cracked bold, marked with prominent scars; barks dark brown. Leaves 9-10 × 5-6 cm, elliptic or obovate to oblong, obtuse at apex, cuneate at base, brittle; petioles ca 1 cm long. Flowers ca 4 cm long, 2-3 or 5-6 in dichasial cymes; bracts foliaceous, caducous. Penduncles ca 1 cm long, terete, jointed. Calyx green, tube ca 2 cm long with 6 prominent angles; lobes ca 2 cm long, narrowly lanceolate, pinkish crimson inside. Petals 5, ca 3 cm long, linear, caducous. Stamens ca 3 cm long, white; anthers brown. Ovary ca 2 cm across; styles ca 5 cm long, curved; stigmas green, dentate. Berries 4-5 cm across in enlarged ribbed calyx, ovoid to globose or obconic, yellowish when ripe, depressed at apex.

Type : Indonesia, Amboina, *Rumphius*, Herb. Amb. 3 : t. 73. 1743, *Illus. of Mangium caseolare album*.

Fls. : Feb. - Sept. ; **Frts. :** Feb. - Oct.

Distrib. : INDIA : West Bengal, Orissa, Maharashtra, Andaman & Nicobar Islands. AFRICA (EAST COAST), SRI LANKA, JAPAN, MALASIA, AUSTRALIA.

Uses : Fruits when dressed with fish used in medicine. The wood is valued for ship and house building, bridges, cheap planking and as fuel.

Habitat : Common in saline littoral forests.

Notes : Fruits get soft and break up in the sea, releasing the seeds. Seeds owe their buoyancy to the light testa.

2. *Sonneratia apetala* Buch. Ham. in Symes, Embassy Ava 3 : 313, t. 25. 1800 ; J. Sm. in Ress. Cyclop. 33 no. 1. 1816 ; Roxb., Fl. Ind. 2 : 506. 1832 ; Wight & Arn., Prodr. 327. 1834 ; Bedd., Fl. Sylv. 2 : 118. 1872 ; Kurz, For. Fl. Brit. Burma 1 : 527. 1877 ; C.B. Clarke in Hook.f., Fl. Brit. India 2 : 579. 1879 ; Cooke, Fl. Pres. Bombay 514-1903 (Repr. ed 2 : 547. 1958) ; Prain, Beng. Pl. 1 : 505. 1903 (Repr. ed. 1 : 367. 1963) ; Gamble, Fl. Pres. Madras 515. 1919 (Repr. ed. 1 : 363. 1957) ; Haines, Bot. Bih. Or. 376. 1922 (Repr. ed. 2 : 392. 1961) ; Parker in Indian For. 51 : 506. 1925.

Local names : *Kerba, Keora, Khoura* (Beng.) ; *Keora, Khirwa* (Beng. & Or.) ; *Charungi, Kandal, Undi* (Mar.) ; *Karua* (Or.) ; *Maram* (Tam.) ; *Kyalanki* (Tel.).

Trees, to 10 m tall ; 50 - 200 cm dbh ; branches drooping, pneumatophores peg-like, twice or thrice forked. Leaves 5 - 15 x 2 - 4.5 cm, elliptic, oblanceolate or narrow oblong, obtuse at apex, attenuate and oblique at base, crustaceous, nerves distinct ; petioles ca 1 cm long. Flowers 1.5 - 2 cm long, green or yellowish white, 3 flowered dichasia or 7 - flowered cymes, or solitary on ca 1.5 cm long peduncles. Calyx green or brown, tube 5 - 10 mm long ; lobes 4, 1 - 1.5 cm long, erect. Petals 0. Stamens 1 - 1.5 cm long, as long as calyx lobes, white. Ovary globose, 5 - 10 mm across ; styles 2 - 3 cm long, included or slightly exerted, stigma umbrella shaped. Capsules 2 - 3 cm across, orbicular, depressed, 8 - loculed. Seeds angular, convex.

Type : Burma, Ava, Rangoon, *Buchanan Hamilton s.n.* (BM Photo !).

Fls. : Jan. - Sept. ; *Frts* : May - Oct.

Distrib. : INDIA : West Bengal, Orissa, Maharashtra, Andhra Pradesh, Tamil Nadu ; BANGLADESH, MYANMAR, SRI LANKA, MALAYSIA.

Uses : Wood used for house building, packing boxes, planking, fuel, door-boards etc. Fruits are used as fish-bait and for tanning.

Habitat : Common in mangroves along the borders of estuaries and in intertidal zones of creeks and channels.

3. *Sonneratia caseolaris* (L.) Engler in Engler & Prantl, Nat. Pflanzenfam. 261. 1897 ; Brandis, For. Fl. 242. 1874 ; Gamble, Fl. Pres. Madras 515. 1919 (Repr. ed. 1 : 364. 1957). *Rhizophora caseolaris* L. in Stickmann, Herb. Amb. 131. 1754, *p.p.* ; Amoen. Acad. 4 : 123. 1759 ; Syst. ed. 10 : 1043. 1759 ; Sp. Pl. ed. 2, 1 : 635. 1762 ; Roxb., Fl. Ind. 2 : 506. 1832 ; Parker in Indian For. 51 : 506. 1925. *Aubletia caseolaris* Gaertn., Fruct. Sem. 1 : 379, t. 78. f. 2a-c. 1788. *S. acida* L.f., Suppl. Pl. 252. 1781 ; Roxb., Fl. Ind. 2 : 506. 1832 ; Wight & Arn., Prodr. 327. 1834 ; Griff., Notul. Pl. Asiat. Rar. 4 : 652. 1834 ; Wight, Icon. Pl. Ind. Orient. 2 : t. 340, f. 1 - 6. 1843 ; Bedd., Fl. Sylv. 2 : 118, t. 15. f. 1. 1872 ; C.B. Clarke in Hook. f., Fl. Brit. India 2 : 579. 1879 ; Cooke, Fl. Pres. Bombay 1 : 514. 1903 (Repr. ed. 347. 1958) ; Prain, Beng. Pl. 1 : 504 1903 (Repr. ed. 267. 1963) ; Haines, Bot. Bih. Or. 376. 1922 (Repr. ed. 2 : 393. 1961) ; Parkinson, For. Fl. Andaman 178. 1923. *S. acida* var. *mucronata* Miq., Fl. Ind. Bat. 1 : 496. 1856 ; Parker in Indian For. 25 : 507. 1925.

Plates 6 & 7

Local names : *Archa, Orcha, Ora* (Beng.); *Kandale* (Kan.); *Padada, Perepat, Pidadu* (Mal.); *Chipi, Tiwar* (Mar.); *Kinnai* (Tam.); *Archaka* (Beng., Hind.).

Trees, 6–15 m tall; trunk 30–70 cm dbh. Leaves 4–13 × 3–6 cm, oblong to narrowly obovate-elliptic, knobbed at apex, attenuate at base. Inflorescence articulate. Flowers 4–9 cm long, solitary at the summit of branchlets. Calyx 2.5–5 cm long, cupular, coriaceous; lobes 6. Petals 6, white or dark red, 3–8 cm long, linear-oblong, caducous. Stamens pink, 3–8 cm long, filaments filiform. Ovary 2–5 cm across, ovoid-globose, placentation axile; styles 5–10 cm long, exerted; stigmas sub-capitate, centrally concave. Capsules 4–6 cm across, globose, green, concave at tip, fleshy, indehiscent. Seeds angular, embedded in pulp; testa thick, crustaceous; cotyledons convolutedly shorter than radicle.

Type : Indonesia, Amboina, *Rumphius*, Herb. Amb. 3 : t. 74. 1743, *Illus. of Mangium caseolare rubrum*.

Rumphius (in Herb. Amb. 3 : t. 73 et 74. 1743) described two plants with illustrations, one as *Mangium caseolare album* and another as *Mangium caseolare rubrum* under the chapter *Mangium caseolare*. J.E. Smith selected the first one as the type for his new species *S. alba* and the latter for *S. acida* L.f.

Distrib. : INDIA : along West and East Coasts; West Bengal (Sundarbans), Orissa, Maharashtra, Andhra Pradesh, Tamil Nadu, Kerala; SRI LANKA, BANGLADESH, MYANMAR, THAILAND, MALASIA, N. AUSTRALIA AND PACIFIC ISLANDS.

Habitat : In mangrove swamps, prefers more situations and therefore less common in the intertidal zones.

Uses : Leaves and fruits edible, eaten raw or cooked; fruits are used in preparation of polutice for sprains and swellings; juice as substitute for vinegar, and for arresting haemorrhage and also as a condiment; tender leaves dressed with fish and to rear silkworms; wood for making models, musical instruments, boats and as fuel. Pneumatophores for making cork, soles of shoes and artificial flowers.

Notes : The foliar apical knobs are passive hydathodes of secretory function (Rao & Chakraborti in Curr. Sci. 51 : 303–305).

4. *Sonneratia griffithii* Kurz in J. Asiat. Soc. Bengal 40 : 56. 1871 & Pegu Rep. App. B. 54. 1875 & For. Fl. Brit. Burma 1 : 527. 1877;

C.B. Clarke in Hook.f., Fl. Brit. India 2 : 580. 1879 ; Parker in Indian For. 25 : 507. 1925 ; Cowan in Rec. Bot. Surv. India 11 : 213. 1928 ; Backer & Steenis, Fl. Males. 1, 4 : 286. 1951. *S. acida* var. *griffithii* King in J. Asiat. Soc. Bengal 67 : 11. 1898. *S. alba* Griff., Notul. Posth. Pap. 4 : 652. 1854, *non* Sm. .

Local names : *Lemshi*, *Tapyoo* (Beng.) ; *Oro* (Or.).

Evergreen trees, 8 - 15 m tall ; branches pale green, glabrous, drooping ; bark slightly fissured. Leaves 6 - 12 × 3 - 8 cm, obovate or oblong or suborbicular, obtuse to emarginate at apex, cuneate to narrowed at base, veins conspicuous, intramarginal, 16 pairs. Flowers greenish white, 4 - 8 cm long, solitary. Calyx tube ovoid, free from ribs, lobes 6 - 8, 2 - 4 cm long. Stamens as many as as calyx-lobes. Ovary 1 - 2 cm across ; styles 3 - 5 cm long, exserted ; stigmas capitate. Capsules 5 - 9 cm across, ovoid-globose, inflated with persistent styles at apex, many seeded.

Type : Margui or Moulmien, *Griffith* 2433 (K, Photo !)

Fls. : Jan. - July ; *Frts.* : June - July.

Distrib. : INDIA : Orissa (Mahanadi) , Andaman & Nicobar Islands ; BANGLADESH, MYANMAR, THAILAND, MALAYSIA AND INDONESIA.

Notes : This species is recorded here for the first time from Orissa tidal forest.

GOODENIACEAE

R. Br., Prodr. ed., I, 1 : 573. 1810 (Goodenoviae)

T.A. Rao*

Shrubs, herbs or even trees with simple or stellate hairs. Leaves alternate, spirally arranged, rarely opposite or whorled, simple, obovate to spatulate, exstipulate. Flowers bisexual, solitary or in axillary heads, racemes or cymes. Calyx (3-) 5 lobed, persistent, lobes valvate in bud. Corolla 5, uni- or bilabiate, zygomorphic, with a long tube splitting dorsally at maturity ; lobes 5, sub-equal, valvate. Stamens 5, alternating with corolla lobes, epistalous or filaments free ; anthers free or connate in a ring round the styles, ditheous, dehiscent with longitudinal slits. Intrastaminal discs sometimes present. Ovary superior, rarely half inferior, 1-2 loculed with 1, 2 to many erect or ascending ovules on an axile or basal placentas ; styles cylindrical, solitary or 2-3 ; stigmas cupular, ciliate. Fruits usually a capsule, drupe or nut. Seeds usually flat, sometimes winged with straight embryo, 1-many seeded, endosperm fleshy.

Predominantly Australian and a few Polynesian, 16 genera, ca 430 species ; only genus *Scaevola* L. in India.

Notes : Based on embryological studies Goodeniaceae have been treated as a separate order Goodeniales, very close to Campanulales (Vijayaraghavan & Malik in Bot. Notiser 125 : 241. 1972).

SCAEVOLA

L., Mant. Pl. 2 : 145. 1771, *nom. cons.* ; Benth. & Hook. f., Gen. Pl. 2 : 539. 1876 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 421. 1881 ; Krause in Engler, Pflanzenr. 54, 4 : 125. 1912.

Stems woody. Leaves tufted at the end of branchlets, spatulate, cuneate, entire or decurrent. Flowers in mono- or dichasial axillary cymes or solitary, pedicellate ; bracts paired, fleshy, lanceolate, hairy in axils. Calyx cupular, adnate to ovary ; lobes linear, obscure or conspicuous. Corolla oblique tubular, split longitudinally on one side, pubescent outside, puberulous or woolly inside, free lobes elliptic, crenulate. Stamens free ; filaments filiform ; anthers with or without flaps. Ovary inferior, 1-2 loculed

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with erect ovules ; styles puberulous, recurved, with funnel shaped indusiated stigmas. Fruit a drupe.

Distrib. : In tropics mostly Australian and Polynesian ; *ca* 130 species ; 2 widespread species in India viz. *S. sericea* (Indo-Pacific) and *S. plumieri* (Indo-Atlantic).

Habitat : The structure of the fruits and seeds facilitates sea dispersal, their seeds viable for long periods but germination is possible only when they are washed by rain while exposed on the top of beaches (Lesko & Walker in Ecology 50 : 730. 1969). Cross pollination is effected by stamens releasing pollen into the cup of the indusium at the bud stage while stigmas become receptive much later. (Davies in Polhill (ed.), Fl. Trop. E. Afr. p.1, Goodeniaceae, 1978).

Pollen : Grains tricolporate, rarely tetracolporate, subprolate, $42 \times 54 \times 34 \text{ } \mu$, poles rounded, not quite reached by the colpae. Ora conspicuous, *ca* $5 \times 24 \text{ } \mu$. Exine 4 - 5 μ thick, punctate, spinulate between punctae, tectum thin and translucent.

KEY TO THE SPECIES

- 1a. Leaves 4 - 5 $\times$ 2 - 3 cm, leaf axils glabrous or sparsely hairy ; flowers yellow ; drupes without calyx segments, wrinkled, purple to black
..... *S. plumieri* 1
 - b. Leaves 10 - 20 $\times$ 5 - 10 cm, leaf axils with tufts of sericeous hairs ; flowers white ; drupes with enlarged calyx segments, ribbed, white
..... *S. sericea* 2
1. ***Scaevola plumieri* (L.) Vahl**, Symb. Bot. 2 : 36. 1791 ; Lam., Ill. t. 124, f.1. 1792 ; Trimen, Handb. Fl. Ceylon 3 : 55. 1875 ; Gamble, Fl. Pres. Madras 734. 1921 (Repr. ed. 2 : 516. 1956). *Lobelia plumieri* L., Sp. Pl. 2 : 929. 1753, p.p. *S. frutescens* Mill., Gard. Dict. ed. 8. 1768, *nom. illegit.* *Scaevola lobelia* Murray in L., Syst. Veg. ed. 13 : 178. 1774, p.p., *nom. illegit.* ; Trimen, Handb. Fl. Ceylon 3 : 55. 1875, p.p. ; Cooke, Fl. Pres. Bombay 2 : 69. 1904 (Repr. ed. 2 : 128. 1961) ; Talbot, For. Fl. Bombay Pres. Sind. 2 : 141. 1911 ; Gamble, Fl. Pres. Madras. 734. 1921 (Repr. ed. 2 : 516. 1957). *Scaevola uvifera* Stocks in Wight, Icon. Pl. Ind. Orient. 4 : 16, t.1613. 1850.

Fig. 4. 1a - 1f

Shrubs, decumbent, erect or prostrate ; branches *ca* 50 cm high, arising from woody base. Leaves fleshy, alternate to subopposite, subsessile or with short winged petioles, 5 - 7 cm long, elliptic to obovate, obtuse, entire, coriaceous, glabrous, nerves inconspicuous. Flowers 5, in a series of

cymes *ca* 2.5 cm long ; pedicels 0 or 10 - 15 mm long ; bracts 2 - 3 mm long, glabrous. Calyx lobes very short, obtuse. Corolla 1 - 2 cm long, lobes 5, puberulous inside. Stamens *ca* 1 cm long ; anthers bulged with distal appendages. Ovary bilocular, 1 - ovulate ; styles *ca* 2 cm long. Drupes 1 - 1.5 cm across, indehiscent.

Type : Bahams, t. 79 in Catesby, M., Nat. Hist. Carol. Flor. Bah. 1. 1731 (US, K !)

Fls. : Sept. - Nov. ; *Frts.* : Nov. - Dec.

Distrib. : INDIA : Karnataka (Surathakal near Mangalore), Tamil Nadu (Tuticorin, Krusadi and Shingle islands) ; SRI LANKA, PAKISTAN (Karachi), AFRICA, Tropical AMERICA, WEST INDIES, BRAZIL ; COLUMBIA.

Uses : Leaves are used as wrappers for bidis and for eye treating ailments.

Notes : This species is highly variable from erect to spreading and almost prostrate. It is a coloniser of coastal sand-dunes and coral sands. The mode of pollination is of special interest because it is found that anthers shed their pollen into the cup of the style while still in bud (Kugler, *Flora*. Bd. 162, S. 381 - 391. 1923).

2. *Scaevola sericea* Forst.f. ex Vahl, *Symb. Bot.* 2 : 37. 1791 ; Leenh. in Steenis, *Fl. Males.* 1. 5 : 339. 1957 ; Davies in Polhill, *Fl. Trop. E. Africa* 1. 1978 ; Jeffrey in *Kew Bull.* 34 : 543. 1980. *Lobelia taccada* Gaertn., *Fruct. et Sem. Pl.* 1 : 119. t. 25, f. 5. 1788. *Scaevola koenigii* Vahl, *Symb. Bot.* 3 : 36. 1794 ; C.B. Clarke in Hook. f., *Fl. Brit. India* 3 : 421. 1881 ; Cooke, *Fl. Pres. Bombay* 2 : 69. 1904 (Repr. ed. 2 : 128. 1961) ; Talbot, *For. Fl. Bombay Pres. Sind.* 2 : 140. 191 ; Rama Rao, *Fl. Pl. Travancore* 230. 1917 ; Gamble, *Fl. Pres. Madras* 734. 1921 (Repr. ed. 2 : 516. 1957) ; Parkinson, *For. Fl. Andaman* 193. 1923. *S. bela-modagam* Roem. & Schult., *Syst. Veg.* 5 : 163. 1819, *nom illegit.* *S. taccada* (Gaertn.) Roxb., *Fl. Ind.* 2 : 146. 1824, *nom. illegit. non* Roxb., 1814 ; Wight, *Ill. Ind. Pl.* 2 : 114, t. 137. 1850. *S. frutescens* Krause in Engl., *Pflanzenr.* 54 : 125. 1912, *non* Mill, 1768 ; Gamble, *Pl. Pres. Madras* 73. 1921 (Repr. ed. 2 : 516 1957).

Plates 2, 8 & 9, Fig. 4. 2a - 2e

Local names : *Vella - modagam* (Mal.) ; *Bhadrak, Bhadraksh* (Mar.) ; *Vella-muttagam* (Tam.).

Evergreen shrubs or small trees, 2 - 4 m high. Branches decumbent with semilunar leaf - scars. Leaves alternate. *ca* 21 × 9 cm, spatulate to

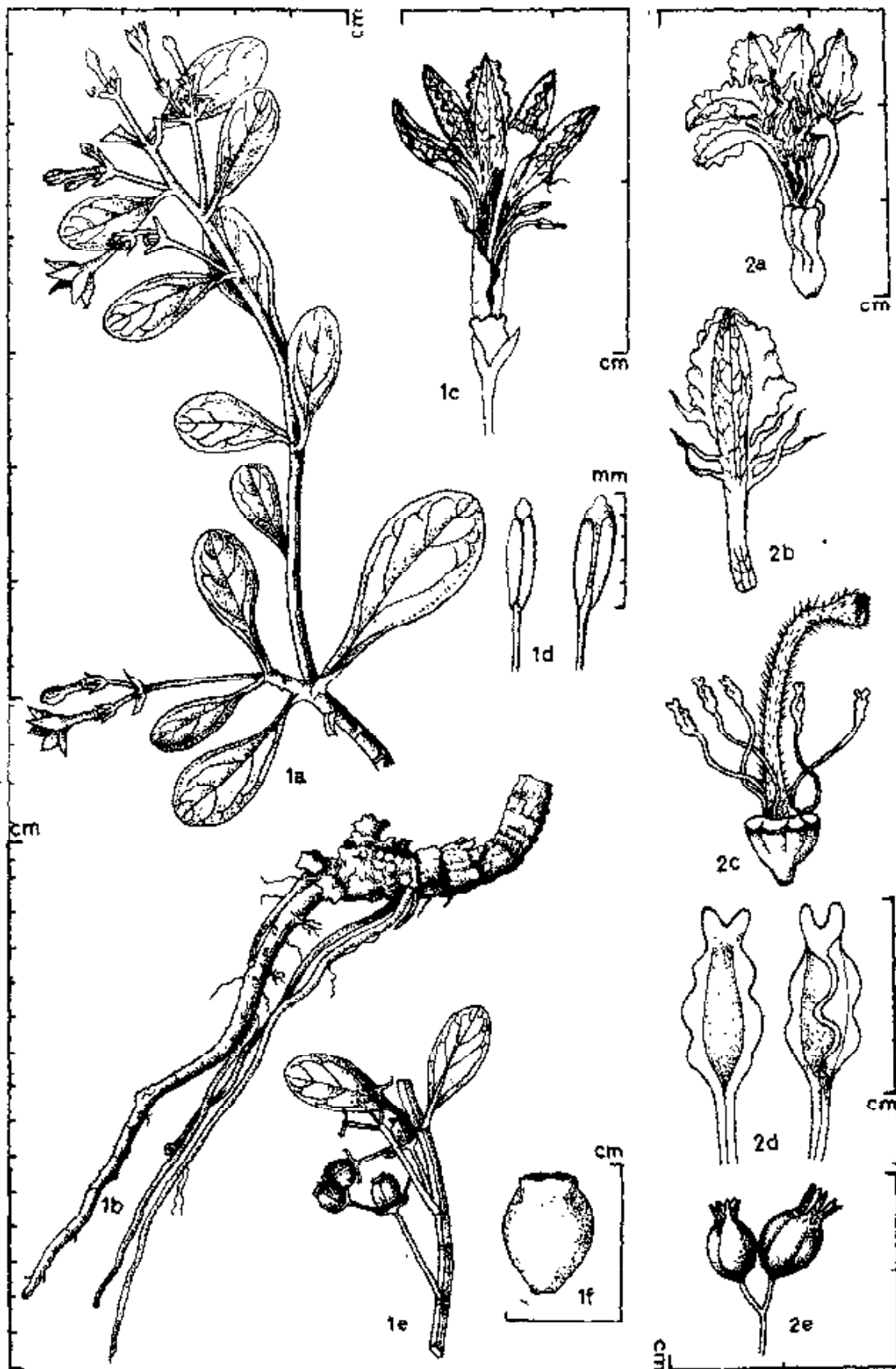


Fig. 4. 1a - 1f. *Scaevola plumeri* (L.) Vahl. a. Flowering twig. b. Basal stock with roots. c. Flower. d. Anthers with distal appendage. e. Fruiting twig. f. Drupe. 2a - 2e. *S. sericea* Forst f. ex Vahl a. Flower. b. Petal. c. Flower without sepals and petals. d. Sepals. e. Drupe.

obovate, fleshy, membranous and bluish on drying, entire or obscurely crenate, rounded or retuse at apex, sericeous or glabrescent, tufted in the axils. Flowers 1-12, cymes, 3-3.5 cm long in short, flower buds clavate, obtuse; pedicels 5-10 mm long, pubescent or glabrous; bracts 2-3 mm long, paired, pubescent. Calyx tube turbinate; lobes 5-6 $\times$ 3-6 mm long, much longer in fruits, unequal, clavate, erect to obscurely recurved. Corolla white, 2-3 cm long, woolly inside; lobes 5-6, crenulate at apex, filiform at base. Stamens 5 (-6), ca 1 cm long; filaments curled at maturity; anthers flapped, distal appendages divaricate. Ovary ca 6 mm across, bilocular; styles ca 3 cm long, thick, stigma ciliate. Drupes 1.5-2 cm across, subspherical, succulent, endocarp stony.

Type : Cooke Is., Nine (Savage I.), *G. Forster s.n.* (C : holo !)

Fls. : June-Dec. ; *Frts.* : Sept.-Dec.

Distrib. : INDIA, along West and East Coasts, Andaman & Nicobar Islands, Lakshadweep Islands ; SRI LANKA, PAKISTAN, AFRICA, CHINA, HONG KONG, MYANMAR, MALAYASIA, PACIFIC ISLANDS.

Uses : Leaves are used as vegetable, fruits in medicine. Soft pith from stout stems used to make fancy articles. It is planted as shelter fence to prevent encroachment of sea-sand to the interior.

Chr. No. : $2n = 16$ (Hsu, C.C. in *Taiwania* 14 : 11. 1968 ; Sarkar *et al* in *Taxon* 26 : 450. 1977).

Notes : This is a polymorphic in its growth structure, varying from gnarled spreading branches, almost stunted in contrast to erect, glabrous shrubs or small trees of the Andamans. A few 6-8 merous flowered dichasial or monochasial cymes were observed in some population from Rambille sea shore, Andhra Pradesh. In his next publication *S. taccada* (Gaertn.) Roxb. 1824 cited Gaertner's name and being a later homonym of heterotypic *S. taccada* 1814, it is illegitimate. Gaertner's t. 25 had been drawn from fruits and seeds sent from the conserved collection at Leiden, originally from Ceylon and now is missing. He cited several other references as synonyms along with Rheed t. 59, which according to St. John (*Taxon* 9 : 200. 1960) is lectotype for *Scaevola taccada* (Gaertn.) Roxb. Fruit or fruits used by Gaertner as his descriptive source could be taken as holotype or syntypus if those are intact. It is of priority if only neotype can be selected. But lectotypification of Rheede t. 59 is nothing but misinterpretation of the protologue and hence rejected. *S. frutescens* Krause (1912) refers to eastern whereas *Lobelia frutescens* Mill 1768 is for the western species. Hence publication date of Krause is not improper.

CAMPANULACEAE

V.K. Haridasan* and P.K. Mukherjee**

Juss., Gen. Pl. : 182. 1789, *p.p. Campanulaceae* tribe *Campanuleae* A.DC., Monogr. Camp. 1. 1830. *Campanulaceae & Sphenocleaceae* A. DC. in DC., Prodr. 7 : 414 & 548. 1889 ; Benth. & Hook. f., Gen. Pl. 2 : 541. 1876, *p.p* ; Clarke in Hook. f., Fl. Brit. India 3 : 421. 1881, *p.p* ; Moeliono & Tuyn in Fl. Males. 1, 6 : 107. 1960, *excl.* tribe *Lobelieae & Pentaphragmeae. Campanulaceae* Juss. subfam. *Campanuloideae* Schönl. in Engler & Prantl, Nat. Pflanzenfam. 4, 5 : 40. 1889.

Annual or perennial herbs, rarely shrubs to small trees, most often laticiferous. Roots slender or forming thick, simple to branched rootstocks. Leaves simple, alternate to opposite or very rarely subverticillate, sessile to petiolate, exstipulate. Flowers solitary or spicate racemose or paniculate, bisexual, actinomorphic. Calyx hypogynous to epigynous, persistent ; tube adnate to the ovary forming hypanthia or very rarely free (*Cyananthus*) ; teeth alternating with the corolla lobes, valvate or rarely imbricate. Corolla gamopetalous, rotate to campanulate, partite up to various length ; lobes valvate, rarely induplicate - valvate or imbricate. Stamens alternating with the corolla lobes, inserted along with the base of the corolla or very rarely epipetalous, rarely with alternating glands ; filaments free or rarely connivent while young, most often dilated at base ; anthers free or rarely connivent, 2 locular, introse, dehiscent longitudinally. Ovary inferior to semiinferior, rarely superior ; ovules many or rarely few on axile or very rarely on basal or apical placenta, anatropous ; style simple, cylindric, generally slightly dilated towards the apex, included or rarely exerted, rarely with a disc at the base ; stigmatic lobes as many as carpels, very rarely capitate. Fruits mostly capsular, dehiscent through apical valves or basal median or apical pores, sometimes circumscissile, rarely baccate or sac like and indehiscent. Seeds few to many, oblong or ellipsoid, rarely trigonous, albuminous or very rarely exalbuminous, with erect embryos.

Type : Campanula L.

Distrib. : ca 35 genera and ca 600 species (Kovanda in V.H. Heywood Fl. Pl. World : 254. 1978) ; mainly temperate and subtropical regions of northern hemisphere, a few genera in southern hemisphere ; *ca 10 genera and 52 species in India.*

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KEY TO THE SUB-FAMILIES

- 1a. Stamens free from corolla or attached to its bases ; capsules dehiscing by valves or pores or indehiscent *Campanuloideae* I
- b. Stamens epipetalous ; fruit dehiscing by a cap
..... *Sphenocleioideae* II
1. **Campanulaceae** subfam. **Campanuloideae** Schndl. in Engler & Prantl, Nat. Pflanzenfam. 4, 5 : 48. 1889. *Campanulaceae* A.DC. in DC., Prodr. 7 : 414. 1839 ; Wight, Ill. Ind. Pl. 2 : 111. 1850, *non* Juss. 1789. *Campanulaceae* tribe *Campanuleae* C.B. Clarke in Hook.f., Fl. Brit. India 3 : 421. 1881, *p.p.*, *non* A. DC., 1830.

Type : Campanula L.

KEY TO THE GENERA

- 1a. Fruits dehiscent 2
- b. Fruits indehiscent 8
- 2a. Capsules dehiscing through apical valves 3
- b. Capsules dehiscing through basal, median or apical pores
..... 6
- 3a. Stamens without glands at their bases 4
- b. Stamens with 5 glands at the bases *Leptocodon* 7
- 4a. Ovary semi - inferior to inferior ; calyx tube (if present) adnate to the ovary basally 5
- b. Ovary always superior ; calyx tube free from ovary
..... *Cyananthus* 6
- 5a. Herbs foetid (except *Codonopsis dicentrifolia*) ; root stock tuberous ; anthers subbasifixed ; pollen grains colpate *Codonopsis* 5
- b. Herbs inodorous with tap roots ; anthers basifixed ; pollen grains porate
..... *Wahlenbergia* 9
- 6a. Styles with tubular or cylindric discs at their bases
..... *Adenophora* 1
- b. Styles without discs at their bases 7
- 7a. Corolla split almost to the base, lobes linear or linear oblong ; carpels 2 3
..... *Asyneuma* 2

- b. Corolla split up to 1/2 or 2/3 their length, lobes ovate or elliptic ; carpels 3 5 *Campanula* 3
- 8a. Herbs rambling or twining ; fruits subglose or cylindric *Campanumoea* 4
- b. Herbs prostrate ; fruits ovoid to elliptic or rarely obovoid *Peracarpa* 8

1. ADENOPHORA

Fisch. in Mem. Soc. Not. Mosc. 4 : 165. 1823 ; A. DC., Monogr. Camp. 354. 1830 & in DC., Prodr. 7 : 491. 1839 ; Benth. in Benth. & Hook. f., Gen. Pl. 2 : 557. 1876.

Perennial, often laticiferous herbs. Roots rhizomatous. Stems erect. Leaves alternate or whorled, radical ones petiolate and cauline ones sessile or rarely all petiolate. Flowers solitary or in racemes or panicles ; pedicels or peduncles terminal or axillary, often bracteate and bracteolate. Calyx epigynous ; tubes adnate to ovary forming hypanthia ; teeth triangular oblong to linear. Corolla campanulate, tubular campanulate or infundibular, shortly 5 partite in the upper half ; lobes broadly triangular to oblong ovate. Stamens 5 ; filaments free or rarely connivent in bud, dilated towards base, finely ciliate ; anthers oblong to linear. Ovary inferior, 3- carpellary ; ovules many on axile placenta ; styles slender, slightly dilated upwards with a tubular or cylindric disc at base, as long as corolla or slightly exserted, with dense pollen collecting hairs when young and glabrescent later ; stigmatic lobes 3, erect initially, recurving later. Capsules dehiscent through 3 basal pores. Seeds ovoid, more or less flattened.

Type : *Adenophora stenanthina* (Ldb.) Kitagawa

Distrib. : ca 50 species in Eurasia, chiefly in E. Asia and C.I.S., ca 3 in India.

KEY TO THE SPECIES

- 1a. Disc cylindric ; stems simple 2
- b. Disc tubular ; stems branched *A. khasiana* 3
- 2a. Disc ca 4 x 1.5 mm, upper half pubescent ; leaves petiolate *A. alpina* 1
- b. Disc 5 - 7 x 4 - 5 mm, pubescent throughout, leaves petiolate towards the base and sessile upwards *A. himalayana* 2
- 1. *Adenophora alpina* Nannf. in Act. Hort. Gothob. 5 : 14. 1930.

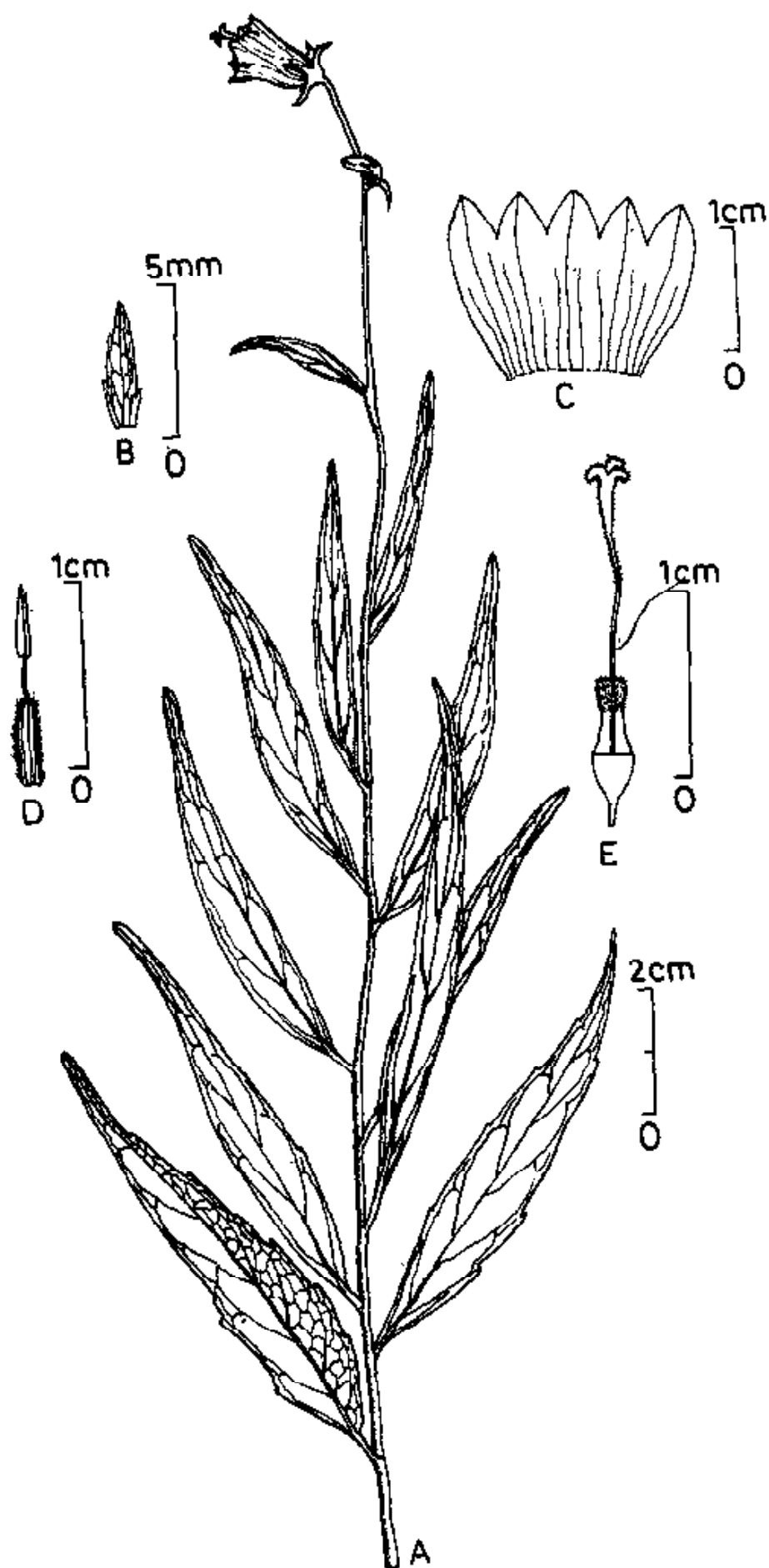


Fig. 5. *Adenophora alpina* Nannf. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil. (Boden - Powell 219 A).

Perennial herbs, ascending, simple, glabrous, 15 - 40 cm high. Root - stocks 2 - 3 mm in diam. Cauline leaves alternate, 2 - 8.5 × 0.2 - 1.5 cm, elliptic - lanceolate to linear - lanceolate, attenuate at base, subentire to remotely crenate, acuminate, glabrous, glaucous on the lower surface ; petioles up to 6 mm long, glabrous. Flowers solitary or in a few flowered racemes, pedicels glabrous, 2 - 3 mm long ; bracts short - petiolate or sessile, linear - lanceolate to linear, 3 - 9 mm long ; bracteoles linear, 1.5 - 4 mm long. Hypanthia subglobose, glabrous, ca 2.5 mm in diam. ; calyx teeth oblong - lanceolate, acuminate, entire or callose - dentate at one point on either side of the margins, ca 4.5 × 1 mm. Corolla pale blue, broadly tubular - campanulate, 5 partite up to 1/4 of the length, glabrous ; tube ca 11 × 14 mm ; lobes ovate, obtuse, ca 4 × 4 mm. Filaments densely long - ciliate, ca 7 mm long ; anthers ca 4.25 mm long, linear - oblong. Disc cylindric, pubescent in the upper half, ca 4 × 1.5 mm. Style as long as the corolla, ca 15 mm long ; stigmatic lobes narrowly oblong, ca 1 mm long. Fruits and seeds not seen.

Type : Sze - chuan bor. : Dongrergo, 4000 m, *H. Smith* 3508 (UPS)

Fls. : Aug.

Distrib. : INDIA : Himachal Pradesh ; CHINA (Zizang Ziziqu)

Exsicc. : Himachal Pradesh : Darwas, Upper Chenab, Aug. 1879, *Baden - Powell* 219a, 219b (CAL) ; Darwas, Pangi, Chamba State, *Lace* 1642 (CAL).

Habitat : In alpine meadows at elevations between 2400 and 4200 m.

2. *Adenophora himalyana* *Feer* in *Engler, Bot. Jahrb.* 14 : 618. 1890.

Fig. 6

Perennial, suberect, simple, 13 - 40 cm high, glabrous herbs. Root stocks thick. Leaves alternate ; radical, petiolate, ovate to ovate-lanceolate, rarely oblanceolate, cauline, gradually sessile, 2 - 6 × 0.2 - 1 cm, lanceolate to linear or falcate, slightly unequal and caudate at base, subentire to remotely few serrate, acute to acuminate or very rarely obtuse at apex, glabrous, petioles 3 - 8 mm long, winged, glabrous. Flowers solitary or in few flowered spreading secund racemes ; bracts 2 - 13 mm long, linear, bracteoles 2 - 2.5 mm long. Pedicels 3 - 22 mm long. Hypanthia ca 4 × 5 mm, obconic, glabrous. Calyx teeth erect, 5 - 7.5 mm long, triangular, acuminate, entire, glabrous. Corolla broadly tubular - campanulate, 5-partite

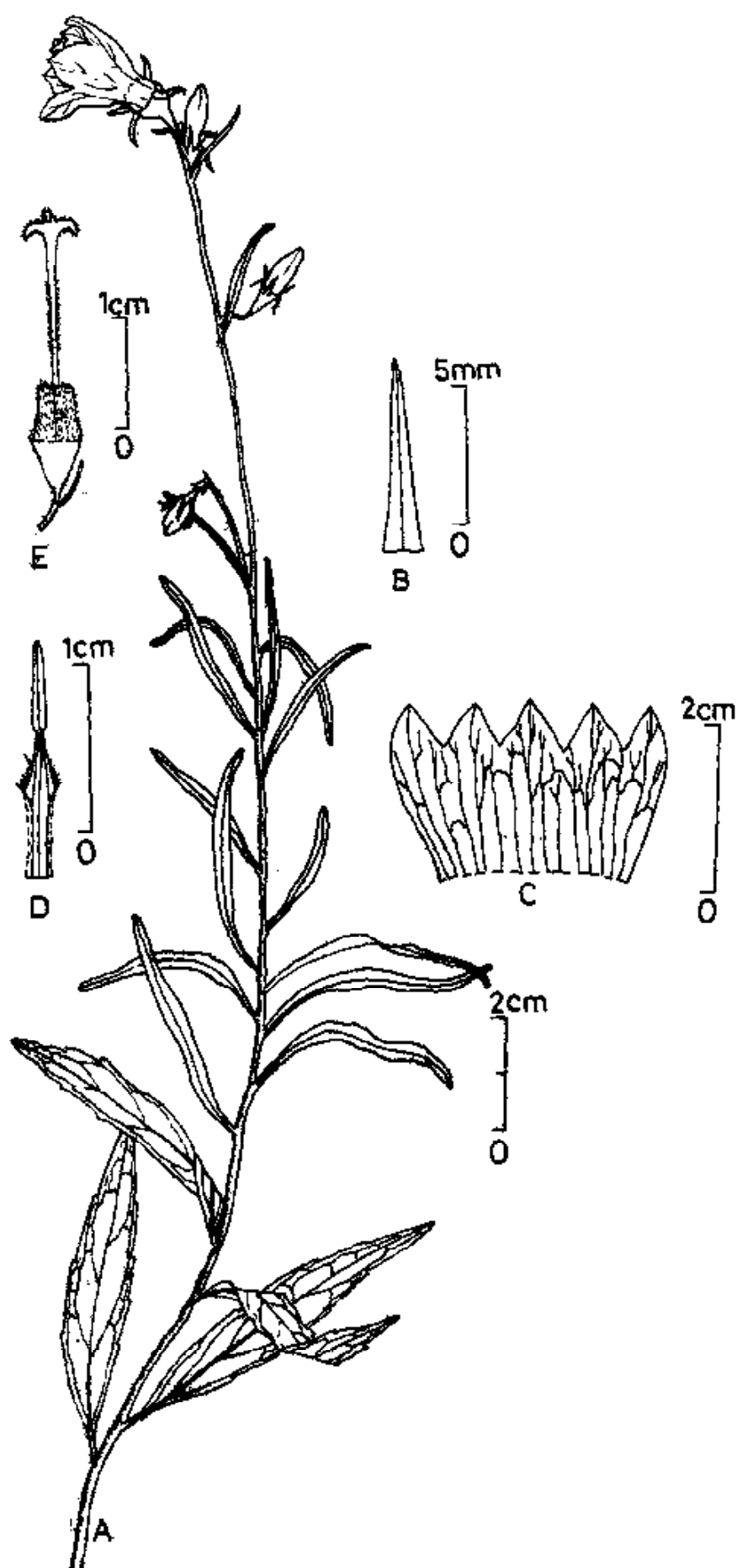


Fig. 6: *Adesophora himalayana* Feer. A. Habit. B. Calyx lobe. C. Corolla split opened. D. stamen. E. Pistil (*Duthie 5735*).

up to 1/4 the length, glabrous ; tubes 2 - 2.5 × 1.8 - 2 cm at throat ; lobes broadly triangular, acuminate, 6 - 7 × 7 - 9 mm. Filaments 9 - 11 mm long, densely long ciliate, anther 5.5 - 6 mm, linear - oblong. Disc cylindric, pubescent, 5 - 7 × 4 - 5 mm. Style as long as the corolla or slightly longer, 19 - 23 mm long ; stigmatic lobes ca 2 mm long ; oblong - ovate. Fruits and seeds not seen.

Type : INDIA : Western Himalayas, Kumaon valley above Napalcha Byans, *Duthie* 3122 (CAL, DD) ; Nepal : Kaiwa Kali valley, *Duthie* 5735 (CAL, DD).

Fls. : June - Sept.

Distrib : INDIA : Uttar Pradesh ; NEPAL, CHINA, JAPAN, C.I.S.

Exsicc. : Known by type collections only.

Habitat : Amongst rocks in alpine and subalpine zone at elevations between 2400 and 4000 m.

3. ***Adenophora khasiana*** (Hook. f. & Thoms.) Feer in Bot. Jahrb. 14 : 617. 1890 ; Kanjilal, Prelim. List Pl. Upper Assam 52. 1914. *Campanula khasiana* Hook.f. & Thoms. in J. Linn. Soc. 2 : 25. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 439. 1881 ; Rao & Balakr. in Rec. Bot. Surv. Ind. 20 : 134. 1973. Fig. 7

Herbs, erect, 0.3 - 1.75 m high, branching, glabrous to hispid. Leaves sessile or lower ones short petiolate, 1 - 9 × 0.4 - 4.2 cm, rotund - ovate to elliptic - lanceolate, caudate to attenuate at base, closely or remotely serrate, acute to acuminate, pubescent above and glaucous and hispid especially on the elevated veins beneath ; petioles leafy, winged, up to ca 4 mm long. Flowers in branched racemes ; pedicels 1.5 - 4 mm long ; bracts 6 - 24 × 1.5 - 6 mm, lanceolate to linear, sharply serrate ; bracteoles 3 - 6 mm long, linear. Hypanthium 2.5 - 3 × 1.5 - 4.5 mm, subglobose ; calyx teeth 5 - 13 mm long, narrowly linear, lanceolate, acuminate, erect, sharply and remotely few serrate. Corolla purple to blue, infundibular - campanulate, glabrous, 5-partite up to 1/3 the length ; tubes 11.5 - 16 × 15 - 19 mm at throat ; lobes 5 - 8 × 5 - 7 mm, ovate to oblong - ovate. Filaments 6 - 9 mm long, slender, much dilated towards the base, densely long ciliate ; anthers 3.5 - 5 mm long, linear. Disc ca 1 mm in diam., tubular, glabrous ; styles 14 - 25 mm long, exserted ; stigmatic lobes ca 1.2 mm long, narrowly oblong. Capsules 7.5 - 11 × 5 - 7 mm, ellipsoid. Seeds ca 1.5 mm long, narrowly ellipsoid.

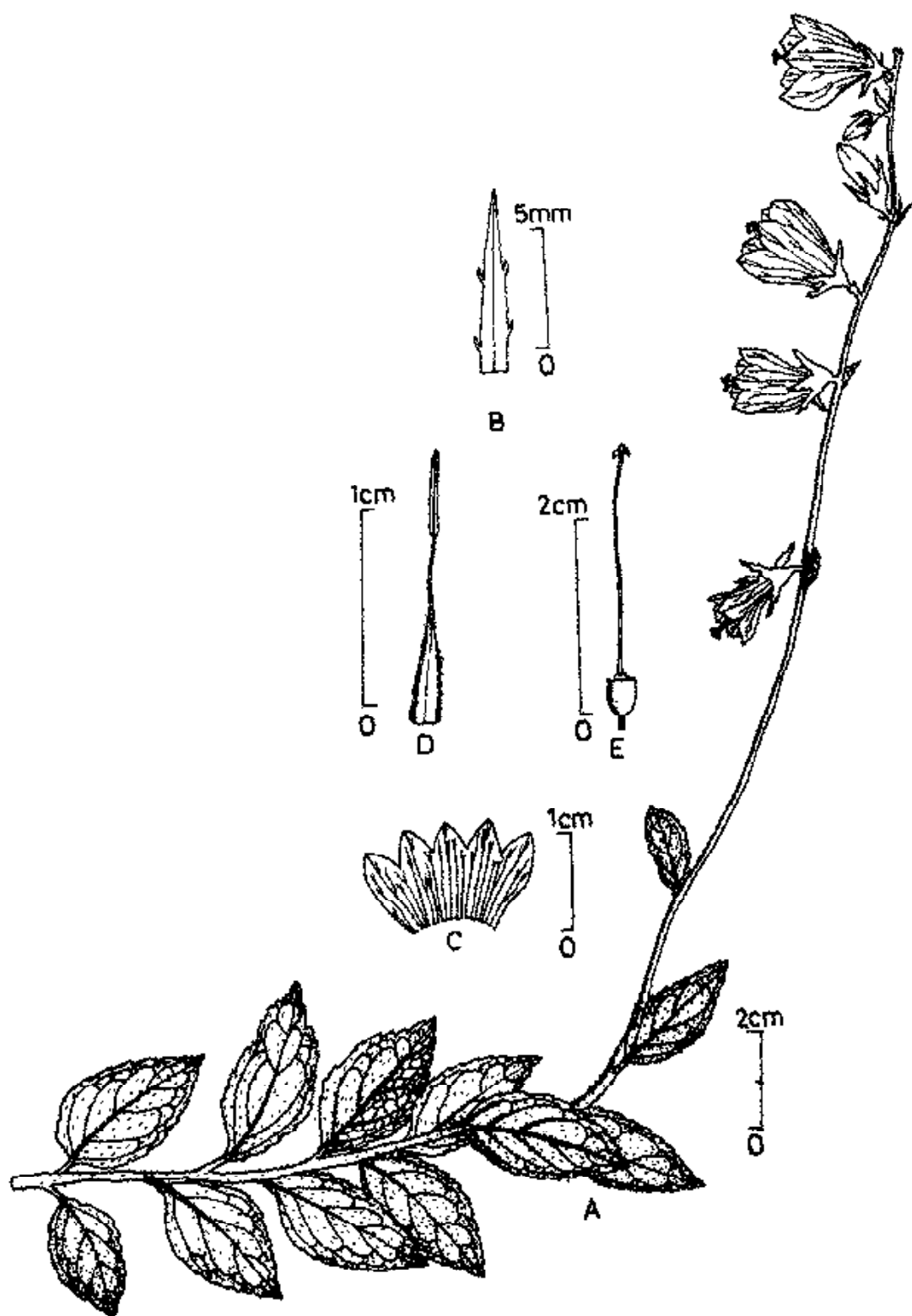


Fig. 7. *Adenophora khasiana* (Hook. f. & Thoms.). Feer. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (Clarke 6184).

Type : INDIA : Montibus Khasia, Griffith, Lobb & C.

Fls. & Frts. : Apr. Nov.

Distrib. : INDIA : Meghalaya, Arunachal Pradesh ; BHUTAN.

Exsicc. : Meghalaya, Moflong, Khasiya, C.B. Clarke 6184 (CAL) ; Arunachal Pradesh : Sehari forest, Kameng F.D., Joseph 39976 (ASSAM).

Habitat : Amidst grasses on hill - slopes, in pine forests, near waterfalls, on forest floors at elevations between 1220 and 2000 m.

2. ASYNEUMA

Griseb. & Schenk. in Arch. Naturgesch. 18 (1) : 335. 1852 ; Damboldt in Boissiera 17 : 25. 1970. *Phyteuma* sect. *Podanthum* G. Don, Gen. Hist. 3 : 334. 1834.

Annual or perennial herbs with slender rhizomes or tapering roots. Stems solitary, sometime leafy. Leaves petiolate or sessile or lower ones petiolate, becoming sessile upwards, radical leaves often closely arranged forming a rosette differing much from the cauline leaves ; ovate to lanceolate, cordate to attenuate at base, acute to obtuse. Flowers in lax or dense panicles. Pedicels slender, glabrous to hairy ; bracts petiolate or sessile, elliptic to lanceolate ; bracteoles lanceolate to linear. Calyx epigynous ; tubes adnate to the ovary, teeth 5, subulate to linear, acute to acuminate. Corolla 5-partite for the entire length or up to 4/5 the length, lobes lanceolate or linear - oblong, glabrous. Stamens 5 ; filaments short, ovate, rotund to triangular, much dilated at base, ciliate ; anthers linear - oblong to linear. Ovary inferior, 2 - 3 carpellary ; ovules many on axile placenta ; styles cylindric, dilated towards apex ; stigmatic lobes 2 - 3, erect, later recurved. Capsules ovoid to obconoid, dehiscing through basal, median or apical pores. Seeds oblong to ellipsoid, dark brown to brown, shiny.

Type : *Asyneuma canescens* (Waldst. & Kit.) Griseb. & Schenk.

Distrib. : ca 22 species (Damboldt. l.c.) in the Northern hemisphere of the Old World, chiefly in the Mediterranean region, Caucasus, Iran and Turkey. 2 species in India.

KEY TO THE SPECIES

- 1a. Stigmatic - lobes 3 ; panicles lax towards base and dense upwards ; seeds ca 0.8 mm long *A. fulgens* 1
- b. Stigmatic - lobes 2 ; panicles lax throughout ; seeds ca 1.5 mm long *A. thomsonii* 2

1. *Asyneuma fulgens* (Wall.) Briquet in Candollea 4 : 334. 1931 ; Damboldt in Boissiera 17 : 63. 1970 ; Hara in Fl. E. Himal. Rep. 3 : 109. 1975. *Campanula fulgens* Wall. in Roxb., Fl. Ind. 2 : 99. 1824 ; A. DC. in DC., Prodr. 7 : 477. 1839 ; Wight, Ic. Pl. Ind. Orient. 4 : t. 1179. 1848 & Ill. Ind. Bot. 2 : t. 136. 1850 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 442. 1881 ; Gamble, Fl. Pres. Madras 740. 1921 ; Balakr., Fl. Jowai 1 : 278. 1981.

Local names : *Mendo* Ghumbu, *Tsergon Mendo* (Bhut.) ; *Userv Soab* (Nep.).

Annual erect herbs, simple or branching at base, scabrid - pilose, 12 - 75 cm high. Leaves often sessile towards the apex, 1. 4 - 6. 5 × 0. 5 - 2 cm, elliptic to lanceolate, rarely oblanceolate, caudate or rarely attenuate at base, irregularly crenate - serrate to cuspidate - serrate, acute to acuminate, lower at time obtuse, glabrous or sparsely to densely scabrid pilose on both surfaces, petioles up to 2.5 cm long, slender, winged, glabrous or scabrid - pilose. Panicles lax towards the base and dense upwards. Pedicels slender, 1 - 4 mm long ; bracts sessile, 2. 4 - 4 × 0.3 - 0. 6 mm, elliptic to lanceolate ; bracteoles 4 - 15 mm long, linear. Hypanthium 2 - 2. 5 × 1.5 - 2 mm, clavate. Calyx teeth 5 - 8 mm long, linear, acute. Corolla blue, 5-partite almost up to the base ; lobes 8 - 10 × 1.5 - 2 mm near the base, lanceolate or linear, acuminate ; filaments 3 - 4 mm long, much dilated at base, ciliate ; anthers 3. 5 - 4 . 5 mm long, linear ; ovary 3- carpellary ; style 7 - 8. 5 mm long, cylindric, slightly dilated upwards ; stigmatic lobes 3, ca 1.5 mm long, 5 - 7 × 4 - 5. 5 mm, ellipsoid to ovoid, dehiscing through 3 median pores. Seeds minute, brown, ellipsoid, shiny.

Type : NEPAL : Chitlong valley, *Wallich* ; Chandaghery (Candagiri) *Wallich* Cat. No. 1283 (K. Microfiche !) ; Road to Gosain Than, *Wallich*.

Fls. & Frts. : July - Jan. (reported to be throughout the year by Wight., l.c.).

Distrib. : INDIA : West Bengal, Sikkim, Meghalaya, Manipur, Tamil Nadu and Karnataka ; NEPAL, BHUTAN, TIBET, S.W. CHINA AND SRI LANKA.

Exsicc. : Sikkim : Lachung valley, *Gammie* 342 (CAL). Meghalaya : Kalapani, Khasiya, *Clarke* 6255 (CAL). Arunachal Pradesh : By way of Sadiya, up to Lohit valley, *Kingdon - Ward* 20137 (ASSAM). Tamil Nadu : Dodabetta, *Fischer* 1305 (CAL) ; Kodaikanal, *Sauliers* 961 (CAL). Karnataka : Kulhutti, Bababoodan hills, *Meebold* 9550 (CAL).

Habitat : On grassy hills, banks of streams, etc. at elevations between 900 and 2100 m.

Notes : In specimens of Nilgiri the calyes have been found to be considerably shorter than the corolla (ca about half as long as the corolla) but agree well in all other characters with the North East Indian plants as pointed out by Wight (*l.c.*). The disjunct distribution is notable.

2. *Asyneuma thomsonii* (Hook.f. & Thoms.) Bomm. in Beih. Bot. Centralbl. 38 : 350. 1921 ; Damboldt in Boissiera 17 : 106. 1970. *Campanula thomsonii* Hook.f. & Thoms. in J. Linn. Soc. 2 : 25. 1858. *Phyteuma thomsonii* (Hook.f. & Thoms.) C.B. Clarke in Hook. f., Fl. Brit. India 3 : 438. 1881 ; Blatt., Beaut. Fl. Kashmir 2 : 10, t. 36, f. 3. 1928.

Perennial erect, herbs, 12 - 46 cm high, branching, glabrous, at times basally puberulous. Rootstocks 3 - 5 mm thick. Leaves 2.2 - 7 × 1 - 3.7 cm, ovate to ovate - lanceolate, lower suborbicular, slightly unequal and attenuate at base, obscurely - serrate to cuspidate - serrate, acute to attenuate, glabrous to densely pubescent above and sparsely to densely strigose beneath especially on the veins ; petioles slender, winged, 0.4 - 2 cm long. Pedicels slender ; bracts 1.7 - 5 × 0.4 - 1.5 cm, ovate lanceolate to lanceolate ; bracteoles sessile, 2 - 12 mm long, linear. Hypanthium 1.5 - 2.5 mm long, subglobose to obconic. Calyx teeth 4 - 5.5 mm long, subulate, acuminate. Corolla blue, 5-partite for slightly more than 4/5 of the length ; tubes 1 - 1.5 mm long ; lobes 6 - 10 × 1.25 - 2.5 mm, linear - oblong, acute. Filaments much dilated towards the base, ciliate, anther 3 - 5 mm long, linear - oblong, at first forming a cylinder around the style and later becoming free. Ovary 2-carpellary ; styles 5 - 5.5 mm long, cylindric, clavate upwards ; stigmatic lobes 2, ca 2 mm long. Capsules 4.5 - 5 × 4 - 4.5 mm, ovoid, dehiscing through 2 median pores. Seeds dark brown, shiny ellipsoid, ca 1.5 mm long, mature ones not seen.

Type : INDIA : Western Himalayas : Jammu, Thomson s.n.

Fls. & Frts. : April - Oct.

Distrib. : INDIA : Jammu & Kashmir ; PAKISTAN, AFGANISTAN, C.I.S.

Exsicc. : Jammu & Kashmir : Himal. Bor. Occ., Thomson s.n. (CAL - Acc. Nos. 262816, 262818, 26819) ; near Gulmarg, Baramulla Dist., Duthie s.n. (CAL) ; Lumbar nullah, Duthie 11029 (DD).

Habitat : In shady places in damp forests, under hedges, at elevations between 1200 and 3000 m.

Note : Damboldt (*l.c.*) has described the capsules as "in der Milte mit drei poren offnend." However, the capsules of Indian plants have been found

to possess two pores only, though very few could be examined. 2 - carpellary ovaries with 2 - lobed stigmas have been recorded for the Kashmir plants by Blatter (*l.c.*) and these characters have been noted as constant for the Indian plants.

3. CAMPANULA

L., Sp. Pl. 163. 1753 & Gen. Pl. 3 : 77. 1754 ; A. DC., Monogr. Campan. : 213. 1830 & DC., Prodr. 7 : 457. 1839 ; Benth. in Benth. & Hook. f., Gen. Pl. 2 : 561. 1876 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 438. 1881.

Perennial or annual or monocarpic herbs, erect to decumbent, simple or branched, glabrous or hairy. Leaves alternate or rarely radical in rosettes, petiolate to sessile, ovate to linear, cuneate at base, entire to serrate, obtuse to acute, glabrous or hairy. Flowers solitary or in panicles or spikes, normal or dimorphic (flower completes with all the 4 floral whorls and incompletes without stamens and corolla), pedicellate or subsessile ; erect or curved. Calyx epigynous ; tube adnate to the ovary forming a hypanthium ; hypanthia subglobose to obconic, glabrous or hairy ; calyx teeth 5, with or without appendices at sinuses. Corolla infundibular to campanulate, lobes 5, almost equal to or slightly shorter than tube. Stamens 5, free ; filaments dilated at base, densely ciliate or rarely glabrous ; anther narrowly oblong to linear, apiculate. Ovary inferior, usually 3 (as in Indian taxa) or rarely 4 - 5 carpellary, ovules many on axile placenta ; styles included or rarely exserted, cylindric, dilated upwards, with dense pollen collecting hairs ; stigmas usually 3 (as in Indian taxa), rarely 4 - 5 lobed. Capsules erect or pendulous, obovoid to subglobose, dehiscent through small pores at base or near apex, glabrous to hairy. Seeds oblong - ellipsoid to ellipsoid, rarely marginate.

Type : Campanula latifolia L.

Distrib. : ca 300 species in temperate regions of the Northern hemisphere, especially in the Mediterranean, and tropical mountains. ca 12 species in India with 2 endemic ones.

KEY TO THE SPECIES

- | | | | |
|-----|--|-------|-----------------------|
| 1a. | Capsules dehiscent through basal pores | ..... | 2 |
| b. | Capsules dehiscent through apical pores | ..... | 11 |
| 2a. | Erect to procumbent herbs, slender, rarely subrobust, short (very rarely over 50 cm) ; flowers dimorphic or rarely all normal ; seeds minute, less than 1 mm long, not marginate or rarely obscurely marginate | ..... | 3 |
| b. | Erect herbs, robust, 60 - 180 cm long ; Flowers normal ; seeds 1.5 mm long, marginate | ..... | <i>C. latifolia</i> 8 |

- 3a. Styles included ; corolla varyingly campanulate, 5 partite to less half the length 4
- b. Styles exerted ; corolla subrotate, 5 partite to more than half their length *C. wattiana* 12
- 4a. Leaves ovate to lanceolate or very rarely oblanceolate, entire to serrate ; filaments mostly as long as or longer (shorter in *C. cana*) the anthers, ciliate 5
- b. Leaves linear, entire ; filaments much shorter than the anthers, glabrous *C. sylvatica* 11
- 5a. Plants erect to ascending, glabrous to villous or rarely hirsute 6
- b. Plants procumbent, densely and patently silvery hairy *C. argyrotricha* 3
- 6a. Stems straight ; leaves pilose to hirsute on one or both surfaces, or rarely white tomentose beneath 7
- b. Stems much zig zagged ; leaves hoary villous or tomentose on both surfaces *C. cashmeriana* 7
- 7a. Leaves pilose to hirsute beneath 8
- b. Leaves white tomentose beneath 10
- 8a. Plants erect ; stems sparingly branched 9
- b. Plants flexuous ; stems profusely branched *C. pallida* 10
- 9a. Most of the leaves oblong-ovate ; stems flexuous, pubescent ; corolla white with red veins *C. alsinoides* 2
- b. Most of the leaves oblanceolate ; stems subrobust, hirsute ; corolla blue *C. benthamii* 5
- 10a. Stems pilose ; leaves elliptic to oblanceolate ; calyx teeth broadly ovate ; filaments much longer than the anthers *C. alphonssi* 1
- b. Stems patently white hirsute ; leaves oblong to oblong - elliptic ; calyx teeth ovate lanceolate ; filaments much shorter than the anthers *C. cana* 6
- 11a. Capsules subcylindric to elongate - obconoid ; calyx teeth as long as corolla *C. aristata* 4
- b. Capsules obovoid ; calyx teeth much shorter than corolla *C. modesta* 9

1. ***Campanula alphonsii*** Wall. ex A. DC., Monogr. Camp. 294. 1830 & in DC., Prodr. 7 : 473. 1839 ; Wight, Icon. Pl. Ind. Orient. 4 : t. 1177. 1848 & Spic. Nilgh. 2 : 22, t. 125. 1851 ; Fyson, Fl. Nilgiri & Pulney Hilltops 3 : 75, t. 406. 1920 ; Gamble, Fl. Pres. Madras 2 : 740. 1921.

Perennial, decumbent, simple or a few branched, branches glabrous towards base, pilose upwards, 6 - 18.5 cm long, many arising from root stock. Rootstocks tapering, simple or branched, 2 - 4 mm in diam. Leaves sessile, 3 - 14 × 1 - 4.5 mm, elliptic to oblanceolate, cuneate at base, repand - dentate, acute at apex, pilose above, white tomentose and often pilose on the nerves beneath. Flowers solitary, terminal ; pedicels 2 - 8 mm long, pilose. Hypanthia obconic or subglobose, hirsute. Calyx teeth 1.5 - 2 × 1.5 - 2 mm, orbicular to broadly ovate, subentire to distantly few dentate, acute, hirsute outside. Corolla blue, broadly campanulate, 5-partite for about 1/2 of the length, puberulous outside ; tube 4.5 - 5.5 × 8 - 10 mm at the throat ; lobes 4.5 - 5.5 × 3.6 - 4.5 mm, ovate to ovate-oblong, acute. Filaments 1.5 - 2 mm long, dilated towards base, ciliate ; anthers narrowly 1 - 1.5 mm long, oblong. Styles 3.5 - 4.5 mm long ; stigmatic lobes ca 1 mm long. Capsules ca 3 × 4 mm, broadly subglobose. Seeds minute, brown, shiny, ca 0.5 mm long, oblong-ellipsoid.

Type : INDIA : TAMIL NADU : Nilgherry (Nilgiri), Wallich Cat. No. 1296 (K, Microfiche !).

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : Tamil Nadu and Kerala. Endemic.

Exsicc. : Tamil Nadu : ('Nilgherry'), Dodabetta, Nilgiri dist., Lawson s.n. (MH, Acc. No. 29119) ; Levinge cliff, Kodaikanal, Pulneys, Bourne 283 (MH). Kerala : Anamudy peak, Kottayam dist., Shetty 26529 (MH).

Habitat : On rocky slopes of hills at elevations between 2000 and 2700 m.

2. ***Campanula alsinoides*** Hook.f. & Thoms. in J. Linn. Soc. 2 : 24. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India : 3 : 441. 1881 ; Blatt., Beut. Fl. Kashmir 2 : 12, t. 36. f. 7. 1928 ; Chowdh. & Wadhwa, Fl. Himachal Pradesh 2 : 429. 1984.

Perennial herbs, slender, erect, 8 - 20 cm high ; stems many from a rootstock, erect to ascending, pubescent. Rootstocks woody, ca 1 mm in diam. Leaves 2 - 17.5 × 1 - 8.5 mm, oblong-ovate or rarely obovate, attenuate at base, obscurely dentate, acute or rarely obtuse at apex, membranous, pilose

on both surfaces ; petioles winged, pilose, 0.5 - 4 mm long. Flowers solitary, terminal or axillary ; pedicels 6 - 25 mm long, erect to curved, slender, pubescent. Calyx teeth 1.5 - 3 mm long, narrowly lanceolate, entire or irregularly dentate, about 2/3 as long as the corolla in fruits. Corolla white with reddish purple lines, campanulate, 5 - partite for ca 1/2 the length ; lobes obtuse. Stamens not seen. Stigmatic lobes 3. Capsules ca 3 × 3 mm, subglobose, rounded at base, pubescent. Seeds minute, brown, shiny, ellipsoid.

Types : INDIA : Jammu & Kashmir, Kanawur, T. Thomson s.n. (K, Photo!) Kishtwar, T. Thomson s.n. ; TIBET, Thomson s.n.

Frts. : Sept.

Distrib. : INDIA : Jammu & Kashmir ; CHINA (Zizang ziziqe).

Exsicc. : Himal. Bor. Occ., Thomson s.n. (CAL Acc. No. 263120).

Notes : A single specimen and a photograph of a type specimen could be examined. Flowers character adapted from Blatter (*l.c.*) and Bailey, (The garden of Bell flowers in North America 36. 1953).

3. *Campanula argyrotricha* Wall. ex A. DC. in DC., Prodr. 7 : 473. 1839 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 24. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 441. 1881 ; Blatt., Beaut. Fl. Kashmir 2 : 12, t. 36, f. 6. 1928 ; Hara, Fl. E. Himal. Rep. 2 : 129. 1971 ; Chowdhery & Wadhwa, Fl. Himachal Pradesh 2 : 430. 1984.

Perennial procumbent herbs, delicate, simple or branched, silvery hairy, 6.5 - 20 cm long. Rootstocks 2 - 8 mm in diam. Leaves : lower ones petiolate, upper at times subsessile, 5 - 27 × 3 - 18 mm, ovate to elliptic lanceolate, uppermost elliptic-lanceolate, much reduced and bracteiform, thin, caudate to attenuate at base, dentate to crenate, densely silvery hairy on both surfaces, petioles ca 9 mm long, winged, silvery hairy. Flowers solitary, dimorphic, axillary or terminal ; pedicels 4 - 25 mm long, slender, erect, later pendulous, sparsely to densely silvery hairy. Hypanthium 1 - 2 × 1.5 - 2 mm, broadly subglobose, densely silvery hairy. Calyx teeth 3 - 5 × 0.7 - 1.5 mm, triangular to lanceolate, acuminate, entire to few dentate, densely silvery hairy, ca 1/3 as long as the corolla tubes. Corolla purplish blue or blue, broadly campanulate, pilose outside ; tube 7 - 9 mm long and as broad at throat ; lobes 4 - 5 × 2.5 - 3 mm, oblong - ovate, acute. Filaments 2 - 3 mm long ; anthers 2 - 3 mm long, narrowly oblong. Styles 8 - 10 mm long ; stigmatic lobes 5 - 2 mm long, linear. Capsules 2 - 2.5 × 2 - 3.5 mm, broadly subglobose. Seeds minute, ellipsoid, brown, shiny.

Type : INDIA : Uttar Pradesh : Kamnaon (Kumaon), *Blinkworth* in Wall. Cat. No. 7138 (Syntype : G, Photo !); N.W. Himalaya, *Royle* 100/7 (Syntype : G, Photo !).

Fls. & Frts. : May Oct.

Distrib. : INDIA : Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh ; NEPAL.

Exsicc. : Himachal Pradesh : Kangra, *Burkill* 15551 (CAL). NEPAL : Near Seng Khola, *Stainton, Sykes & Williams* 4693 (CAL) ; above Dogadi Khola, *Stainton, Sykes & Williams* 4633 (CAL).

Habitat : On dry stony slopes, rocky cliffs at altitudes between 1800 and 4000 m.

4. *Campanula aristata* Wall. in Roxb., Fl. Ind. 2 : 98. 1824 ; A. DC., Monogr. Camp. : 285. 1830 & in DC., Prodr. 7 : 483. 1839 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 24. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 441. 1881 ; Blatt., Beaut. Fl. Kashmir 2 : 11, t. 36, f. 5. 1928 ; Biswas, Pl. Darjeeling Sikkim Himal. 1 : 495. 1966.

Local names : *Mendo chungchung, Lamjhung Mendo* (Bhut.) ; *Khu* (Tib.).

Perennial erect herbs, slender, simple or branched ; arising from root stocks. Stems many, terete at base and striate upwards, glabrous, 4 - 40 (- 60) cm tall. Rootstocks fusiform, simple or branched, 2 - 5 mm in diam. Leaves more or less crowded towards base, 7.5 - 75 × 1 - 10 mm, elliptic to lanceolate, upper ones sessile, remotely arranged, oblong linear to linear, caudate to cuneate at base, obtuse to acuminate, entire to distally gland dentate, glabrous or very rarely pilose on upper surface ; petioles up to 60 mm long. Flowers solitary, terminal ; pedicels 0.4 - 4.5 cm long, glabrous. Hypanthia 6 - 10.5 × 1 - 1.25 mm, subcylindric, tapering into pedicels, glabrous. Calyx 6 - 12.5 mm long, teeth somewhat unequal, linear - subulate, entire or few gland - dentate, acute, as long as or slightly longer than the corolla. Corolla blue, tube 4 - 7 mm long, 7 - 10.5 mm broad at throat, infundibular - campanulate, glabrous, 5 - partite for ca 1/3 of the length ; lobes 2 - 4 × 1.5 - 3.5 mm. Filaments 1.5 - 2 mm long, dilated towards base, glabrous or few ciliate ; anthers 1.5 - 2 mm long, linear - oblong. Styles 4 - 7 mm long ; stigmatic lobes linear, 1.5 - 2.5 mm long. Capsules 11.5 - 31 × 2.5 - 5.5 mm, subcylindric to elongate - obconoid, contracted near the apex. Seeds ca 1 mm long, ellipsoid to oblong ellipsoid.

Type : INDIA : Jammu & Kashmir : Ludak (Ladakh), *Moorcroft* in Wallich Cat. No. 1291 (K, Microfiche!, CAL).

Fls. & Frts. : Jan. Oct.

Distrib. : INDIA : Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim ; NEPAL, BHUTAN, CHINA.

Exsicc. : Jammu & Kashmir : Tragbol, *Clarke* 29259B (CAL). Himachal Pradesh : Sharram glacier valley, *Watt* 13492 (BSIS, CAL). Uttar Pradesh : Rhoduhara, Tihgri, *Duthie* 601a (CAL, DD). Sikkim : Momay, Lachung valley, *Gammie* 902 (CAL).

Habitat : In damp places, on limestones and micaceous rocks, on open hills slopes etc. between 2400 and 4500 m.

Notes : The corolla was stated as "lobed half - way down" by Clarke (*l.c.*). However, in all the specimens examined lobation up to 1/3 of the length has been observed.

5. *Campanula benthamii* Wall. ex Kitam., Fl. Afghanistan : 377. 1960. *C. benthamii* Wall. ex A. DC. Monogr. Camp. 292. 1830 *pro syn.* *C. canescens* Wall ex A. DC., Monogr. Camp. 292. 1830 & in DC., Prodr. 7 : 473. 1839, *non* Roth 1827 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 23. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 439. 1881 ; Prain, Beng. Pl. 1 : 636. 1903 ; Duthie, Fl. Upp. Gang. Pl. 1 : 499. 1905 ; Gamble, Fl. Pres. Madras 2 : 740. 1921 ; Haines, Bot. Bih. Or. 2 : 503. 1922 ; Santapau, Fl. Purandhar 74. 1957. *C. colorata* Collett, Fl. Simlensis 291. 1902, *p.p.* *C. wallichii* Babu in J. Bombay Nat. Hist. Soc. 65 : 808. 1969 & Fl. Dehradun 294. 1977, *nom. superfl.*

Fig. 8.

Subrobust to slender erect herbs, 7 - 85 cm high, striate, stems simple or branched, pilose to hirsute. Leaves sessile, lower at times petiolate, 0.8 - 5.5 × 0.4 - 1.5 cm, mostly oblanceolate, rarely narrowly oblong, caudate at base, obtuse to acute at apex, subentire to serrate, ciliate, pilose to hirsute ; petioles winged, up to 18 mm long. Flowers dimorphic ; few to many, clustered in panicles ; pedicels 0.5 - 5 mm long, slender, pilose to hispid. Hypanthia 1.5 - 3.5 × 1.5 - 5 mm, broadly subglobose, densely hirsute especially on the nerves. Calyx teeth 1.5 - 5.5 mm long, linear - lanceolate to linear, acuminate, entire, hirsute, in complete flowers as long as corolla tubes. Corolla greyish purple, campanulate, pilose outside ; tubes 4 - 5.5 mm long, ca 4.5 mm broad at throat ; lobes 3 - 4 × 1.5 - 2.5 mm, oblong - ovate to ovate, obtuse. Filaments 1.5 - 2 mm long ; dilated towards the base, ciliate ; anthers 2.5 - 3 mm long, oblong. Styles 3 - 3.5 mm long ; stigmatic lobes ca 1 mm long. Capsules 1.5 - 5 mm in diam, globose to subglobose, hirsute. Seeds minute, brown, shiny, ellipsoid.

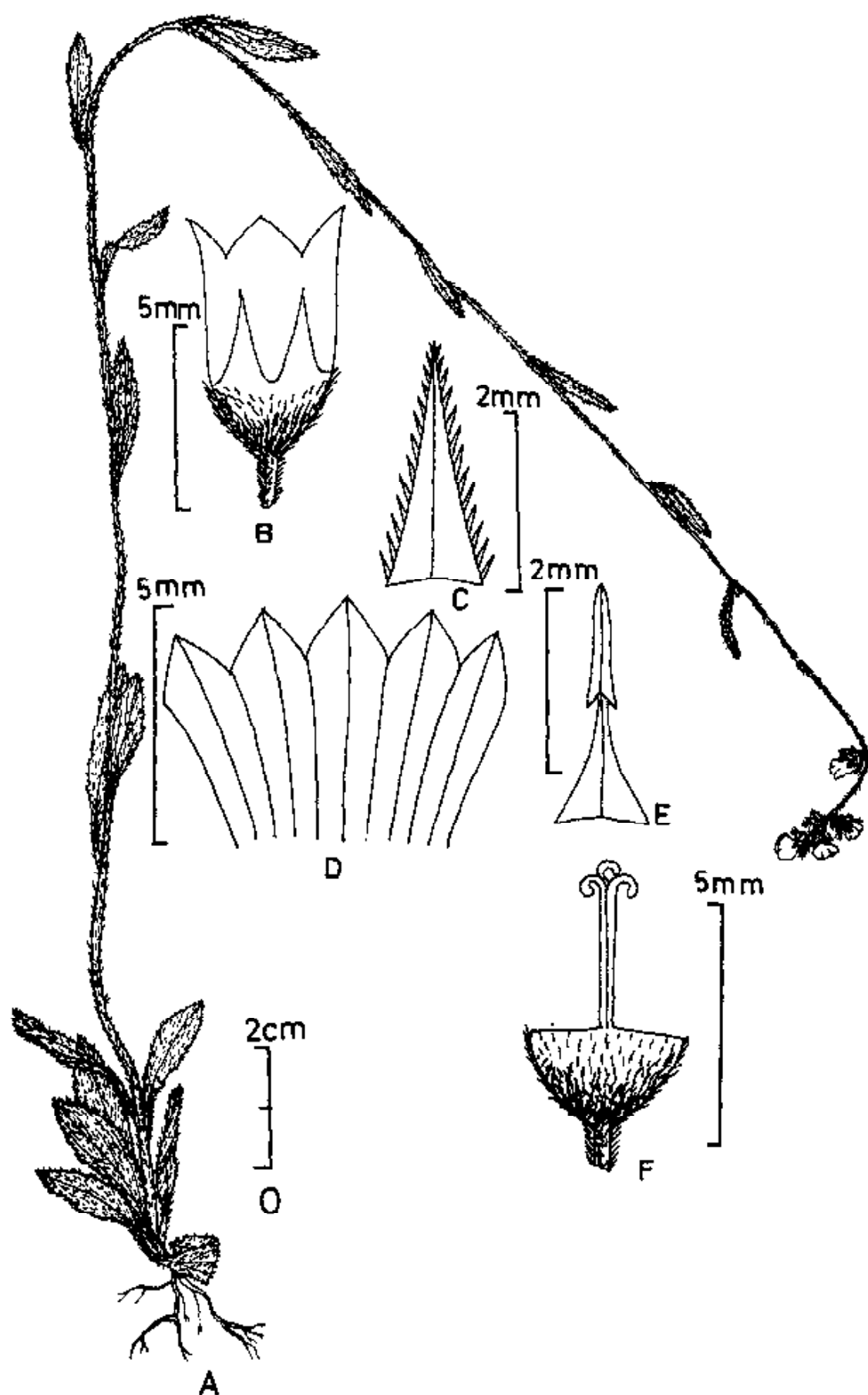


Fig. 8. *Campanula benthamii* Wall. ex Kitamura. A. Habit. B. Flower. C. Calyx lobe. D. Corolla split opened. E. Stamen. F. Pistil (Collector uncertain 644 CAL).

Type : INDIA : Rampore, *Wallich* Cat. No. 1289 (K, Microfiche !); Uttar Pradesh : Kumaon (Kumaon), *Blinkworth* in Wall. Cat. No. 1290 (K, photo !).

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : Throughout ; PAKISTAN, AFGHANISTAN, MYANMAR, SRI LANKA.

Exsicc. : Himachal Pradesh : Chamba, *Lace* 1909 (BSIS). Uttar Pradesh : Pithoragarh, *Bhattacharyya* 21081 (BSD). West Bengal : Rangeet, *Clarke* 27275F (CAL). Bihar : Parasnath, *Clarke* 14027 (CAL). Madhya Pradesh : Jabalpur, *Clarke* 31961 ; Karnataka, Santaveri, *Meebold* 9521. Kerala Periyar, *Vivekananthan* 46747 (MH). Tamil Nadu : Kalkad to Sengalteri, *Hooper & Ramaswamy* 39239.

Habitat : A weed in cultivated fields, gardens, embankments of canals, streams, on forest edges along with mosses and near bamboo clumps, shaded rocky slopes, sandy soils, swampy places etc. at elevations between 350 and 2000 m.

6. *Campanula cana* Wall. in Roxb., Fl. Ind. 2 : 101. 1824 ; A. DC., Monogr. Camp. : 292. 1830 & in DC., Prodr. 7 : 472. 1839 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 22 : 1858, p.p. ; Clarke in Hook.f. Fl. Brit. India 3 : 440. 1881 ; Chowdhery & Wadhwa, Fl. Himachal Pradesh 2 : 430. 1984. Fig. 9

Decumbent to ascending herbs, 11. 5 - 25 cm high ; glabrous towards base, densely hirsute upwards. Leaves sessile, closely arranged, upper much reduced and bracteiform, 5 - 16 × 2 - 8 mm, oblong to oblong elliptic, cuneate at base, acute at apex, crenate to irregularly crenate, pilose above and white tomentose beneath. Flowers solitary, terminal ; pedicels 1.5 - 4 mm long, densely hirsute. Hypanthia 2 - 4 × 3 - 4.5 mm, obconic, densely tomentose. Calyx ca teeth 2 - 3.5 × 1 mm, ovate lanceolate, few dentate, acute, tomentose. Corolla deep violet or blue, broadly campanulate, 5 - partite for ca 1/3 the length ; lobes 4 - 5 × 5 - 6 mm, broadly lanceolate, acute. Filaments 1 - 1.5 mm long, much dilated at base, ciliate ; anthers 2 - 2.5 mm long, narrowly oblong. Styles 3.5 - 4.5 mm long ; stigmatic lobes 3, 2 - 2.5 mm long. Capsules 4.5 - 5.5 × 4 - 6 mm, obconoid to obovoid. Seeds minute, brown, shiny.

Type : NEPAL : Gossain than, *Wallich* Cat. No. 1284 (K, Microfiche !).

Fls. & Frts. : Sept. - Dec.

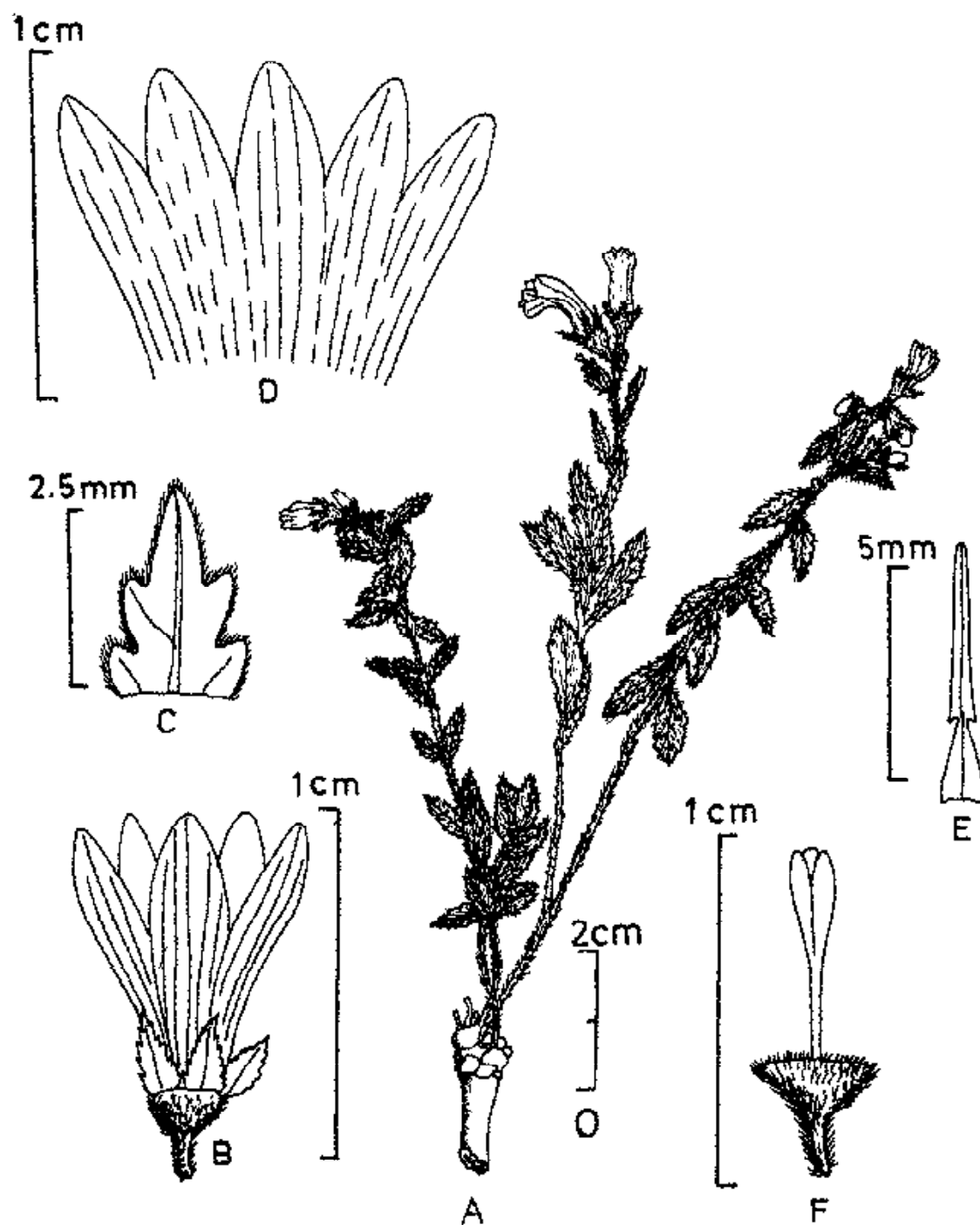


Fig. 9. *Campanula cana* Wall. A. Habit. B. Flower. C. Calyx lobe. D. Corolla split opened. E. Stamen. F. Pistil (Meebold 570).

Distrib. : INDIA : Himachal Pradesh, Uttar Pradesh and Arunachal Pradesh ; NEPAL, BHUTAN, BANGALADESH.

Exsicc. : Uttar Pradesh : Nainital, *Meebold* 540 (CAL).

Habitat : On hill tops, rocky soils at elevations between 1800 and 2500 m.

Notes : This species resembles *C. alphonsii* of South Indian Hills especially in habit, mode of branching, arrangement and indumentum of leaves but is distinguishable by its broadly lanceolate calyx teeth, filaments being longer than anthers, patently hirsute stems.

Two collections from Eastern Himalayas (Mishmi hills according to Clarke *l.c.*) Griffith (Kew Distrib. No. 3431 (CAL) and East Bengal (Bangladesh) (Griffith Kew Distrib. No. 3432) are densely tomentose stems than being hirsute, but agree otherwise to the North-Western Himalayan specimens. No specimens from Himachal Pradesh could be examined, though it has been reported from there by Chowdhery and Wadhwa (*l.c.*).

7. ***Campanula cashmeriana*** Royle, Ill. Pl 1 : 254, f.l. 1836 ; A. DC. in DC., Prodr. 7 : 473. 1839 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 24. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 441. 1881 ; Blatt., Beaut. Fl. Kashmir 2 : 13, t. 36. f. 8. 1928 ; Nair, Fl. Bashahr Himal. 170. 1977. *C. evolvulacea* Royle ex A. DC. in DC., Prodr. 7 : 473. 1839. *C. cashmeriana* var. *evolvulacea* (Royle ex A. DC.) C.B. Clarke in Hook.f., Fl. Brit. India 3 : 441. 1881.

Perennial herbs, 8.5 - 28 cm high, stems zig - zagged, terete, villous or rarely glabrous at base, many arising from a rootstock ; branches slender, wiry to subrobust, pendulous to ascending. Root stock *ca* 7 mm in diam. Leaves petiolate to subsessile, uppermost elliptic to lanceolate, highly reduced and bracteiform, caudate to cuneate at base, acute at apex, entire to distantly dentate, villous on both surfaces, 4 - 35 × 1.5 - 13 mm, petioles up to 2.5 mm long, winged, villous. Flowers solitary, terminal ; pedicels 1 - 11 mm long, villous. Hypanthia 1.5 - 2 × 1.5 - 4 mm, broadly sub - globose, villous. Calyx teeth 4 - 5 × 1.5 - 3 mm, ovate to lanceolate, sometimes much broadened and overlapping at base, subentire to distantly few dentate, acute, *ca* 1/2 as long as the corolla tube. Corolla blue, broadly campanulate, villous or rarely pilose outside, tube 8.5 - 13.5 mm long, 6.5 - 20 mm broad at throat ; lobes 3.5 - 7 × 2.5 - 5.5 mm, ovate to ovate - lanceolate, acute. Filaments 3 - 4.5 mm long, dilated at base, densely ciliate ; anthers 2.5 - 3.5 mm long, narrowly oblong. Ovary 3 - loculed ; styles 8 - 15 mm long ; stigmatic lobes 1 - 1.5 mm long. Capsules 2 - 3.5 × 2 - 5 mm, subglobose, villous or glabrescent. Seeds minute, brown, shiny, ellipsoid.

Type : INDIA : Jammu & Kashmir : without precise locality, Royle s.n. (LIV, photo !).

Fls. & Frts. : July Dec.

Distrib. : INDIA : Jammu & Kashmir and Himachal Pradesh ; CHINA, PAKISTAN, AFGHANISTAN.

Exsicc. : Jammu & Kashmir : Kanaor, Royle s.n. (G, Photo !); Sonamarg, Clarke 30884C (CAL). Himachal Pradesh : Pangie, Stoliczka s.n. (CAL. ACC. No. 263159) ; Labrang, Bashahr, Lace 536 (CAL).

Habitat : On rocky areas in forests at elevations between 1300 and 4800 m.

Notes : The var. *evolvulacea* was described based on weak stems, smaller leaves and flowers, lanceolate calyx teeth, by Clarke (*l.c.*). All these characters intergrade with *C. cashmeriana* ; therefore the var. *evolvulacea* is merged with the typical one as done by Rechinger and Schiman Czeika (in Rechinger, *Flora Iranica* 13 : 24. 1965).

Chr. No. : $2n = 28$ (Gadella, in *Wentia* 11 : 1 104. 1964).

8. *Campanula latifolia* L., Sp. Pl. : 165. 1763 ; A. DC., Monogr. Camp. : 254. 1830 & in DC., Prodr. 7 : 469. 1839 ; Hook f. & Thoms. in J. Linn. Soc. 2 : 22. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 439. 1881 ; Blatt., Beaut. Fl. Kashmir 2 : 11, t. 36. f. 4. 1928 ; Nair, Fl. Bashahr Himal. 170. 1977.

Local names : Branz - hakh, Minhjara (Kashm.)

Perennial erect herbs, 60 - 180 cm high ; stems robust, glabrous to pilose, simple or very rarely branched, ridged. Leaves petiolate towards base and gradually sessile towards apex, highly reduced and bracteiform, 4.5 - 13.5 x 1.5 - 6.5 cm ; ovate to broadly lanceolate, truncate to cuneate at base, crenate to irregularly serrate, rarely ciliate, acute to acuminate at apex, glabrous or pubescent above and sparsely to densely hirsute especially on the veins beneath, very rarely glabrous on both the surfaces ; petioles up to 4.5 cm long, winged. Flowers solitary or aggregated, axillary or terminal ; pedicels 0.2 - 3.5 cm long, erect to ascending, recurved finally, pubescent or glabrous. Hypanthia 3 - 5.5 x 3 - 5 mm, broadly obconic to campanulate, glabrous. Calyx teeth 11 - 13.5 x 2.5 - 4.5 mm, lanceolate, rarely oblong lanceolate, acute, subentire to gland - tipped denticulate, ciliate, more or less half as long as the corolla. Corolla purple to purple blue, campanulate,

glabrous, 5 - partite up to 1/2 of the length ; tube 16 - 19 mm long, 12 - 16 mm broad at throat ; lobes ovate to oblong ovate, acute, long ciliate along margins, 13 - 17 × 9 - 10 mm. Filaments 4 - 6 mm long, dilated towards base, long ciliate, much shorter than the anthers ; anthers 8 - 11 mm long, narrowly linear. Styles 18 . 5 - 26 . 5 mm long, stigmatic - lobes 2 - 4.5 mm long. Capsules 3 - locular, pendulous, 7 - 9 × 7.5 - 9.5 mm, ovoid to subglobose. Seeds pale yellow, ca 1.5 mm long, ovoid to elliptic ovoid, marginate.

Type : Angliae Swriae montosis, s.l. s.n. (LINN, Microfiche !).

Fls. & Frts. : May - Oct.

Distrib. : Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh ; NEPAL, C.I.S., IRAN, EUROPE.

Exsicc. : Jammu & Kashmir : Hirpur - Fir Panjab, Gammie s.n. (CAL, DD). Himachal Pradesh : Sissu, Lahul, Bor 11911 (DD). Uttar Pradesh : Min Deoban, Keshavanand 119 (BSIS).

Habitat : In open patches of forests, fir forests, *Caltha* marshes, in alpine meadow. On river banks, wet grounds, at elevations between 2400 and 3600 m.

Uses : It has recorded (on Keshavanand 2305 DD) that young shoots and leaves are cooked and eaten as a vegetable.

Chr. No. : 2n = 34 (Zhukova in N.A. Avoorin Plantarum in Zonarum Polarem Transportatio II : 139 - 149. 1967).

9. *Campanula modesta* Hook.f. & Thoms. in J. Linn. Soc. 2 : 24. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 442. 1881 ; Biswas, Pl. Darjeeling Sikkim Himal. 1 : 498. 1966. Fig. 10

Perennial herbs, 4.5 - 22.5 cm high, stems many arising from rootstock, ascending or rarely suberect, glabrous. Rootstocks simple or branched, up to 3 mm diam. Leaves petiolate at base, gradually sessile upwards, rounded ovate or narrowly elliptic, 4.5 - 22 × 1 - 20 mm, linear, linear - oblong or oblanceolate, much reduced and bracteiform upwards, truncate to cuneate at base, obtuse or acute at apex, glabrous ; petioles up to 50 mm long, slender. Flowers solitary ; pedicels 1 - 16.5 mm long, glabrous. Hypanthia 1.5 - 3.5 mm in diam., obovate or elliptic - obovate, glabrous. Calyx teeth 2.5 - 6 mm long, subulate, with 2 distant serrations, acute. Corolla blue, infundibular, 5 partite for ca 1/3 of the length, glabrous ; tube 2.5 - 3.5 mm long and as much

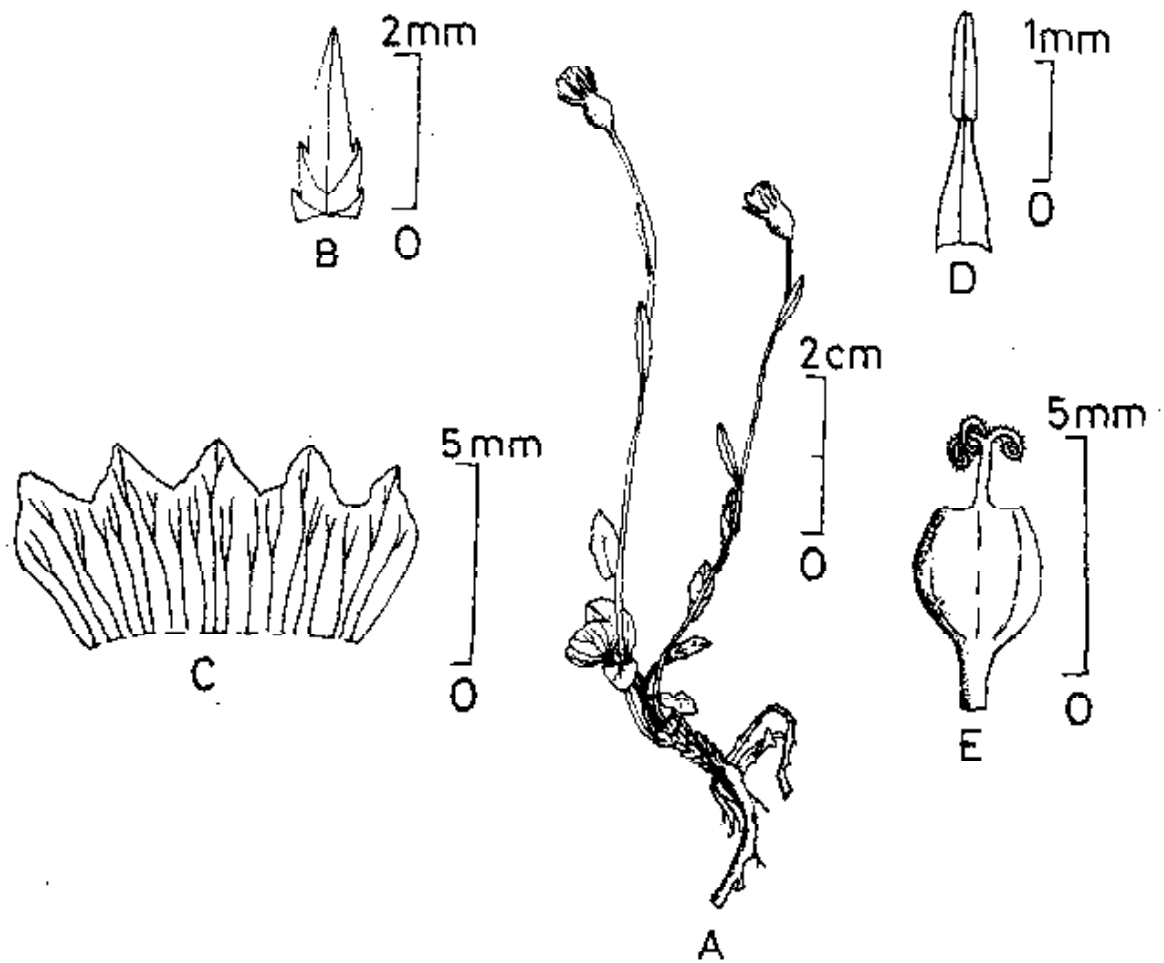


Fig. 10. *Campanula modesta* Hook. f. & Thoms. A Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (*Duthie 602*).

broad at throat ; lobes 1.5 - 2 mm long, triangular - ovate. Filaments *ca* 1 mm long, glabrous ; anthers *ca* 1 mm long, narrowly oblong. Ovary 3 - loculed ; styles 1.5 - 2.5 mm long ; stigmatic lobes *ca* 1.5 mm long. Capsules 4 - 6 mm in diam., obovoid, contracted near the apex, narrowed into the pedicels at base. Seeds brown, shiny, ellipsoid.

Type : INDIA : Sikkim, *J.D. Hooker s.n.* (K, photo !).

Fls. & Frts. : July - Oct.

Distrib. : INDIA : Uttar Pradesh and Sikkim ; NEPAL.

Exsicc. : Uttar Pradesh : INDIA. Dudu glacier, under Srikanta, *Duthie* 602 (CAL, DD). Sikkim : without precise locality, *J.D. Hooker s.n.* (CAL ACC. No. 263214) ; Zemu valley, *Smith & Cave* 1579 (CAL).

Habitat : Among stones at edges of streams at elevations between 4200 and 5100 m.

Notes : *Sengupta* 773 (CAL) from Paro, Bhutan, is an incomplete specimen and does not belong to Campanulaceae. No other specimen could be examined to support its distribution in Bhutan.

10. *Campanula pallida* Wall. in *Asiat. Res.* 13 : 375. 1820 & in Roxb., *Fl. Ind.* 2 : 100. 1824 ; D. Don, *Prodr. Fl. Nepal.* : 156. 1825 ; A. DC., *Monogr. Camp.* : 293. 1880 & in DC., *Prodr.* 7 : 473. 1839 ; Hara in *J. Jap. Bot.* 50 : 270. 1975. *C. colorata* Wall. in Roxb., *Fl. Ind.* 2 : 101. 1824 ; A. DC., *Monogr. Camp.* : 293. 1830 & in DC., *Prodr.* 7 : 473. 1839 ; Hook.f. & Thoms. in *J. Linn. Soc.* 2 : 23. 1858, *p.p.* ; C.B. Clarke in Hook.f., *Fl. Brit. India* 3 : 440. 1881 ; Hara, *Fl. E. Himal.* 1 : 326. 1966 ; Babu, *Herb. Fl. Dehradun* 294. 1977 ; Chowdhery & Wadhwa, *Fl. Himachal Pradesh* 2 : 431. 1984. *C. ramulosa* Wall. in Roxb., *Fl. Ind.* 2 : 100. 1824 ; A. DC., *Monogr.* : 294. 1830 & in DC., *Prodr.* 7 : 473. 1839 ; Gamble, *Fl. Pres. Madras* 2 : 520. 1921 ; Nair, *Fl. Bashahr Himal.* 170. 1977. *C. odorata* var. *ramulosa* (Wall.) Hook.f. & Thoms. in *J. Linn. Soc.* 2 : 23. 1858. *C. himalayensis* Klotz., *Bot. Reise Prodr. Waldem.* 73, t. 78, f. 2. 1862. *C. heffmeisteri* Klotz., *Bot. Reise Prodr. Wadem* 74, t. 77. 1862.

Annual herbs, 11 - 60 cm high ; stems flexuous, branched, pilose to hirsute. Leaves sessile towards base and petiolate towards tips, 0.4 - 5.2 x 0.1 - 2 cm, elliptic to lanceolate, uppermost much reduced and bracteiform, caudate to attenuate at base, acute or very rarely obtuse, crenate to serrate, sparsely to densely pilose above, sparsely to densely hirsute beneath especially on the veins ; petioles up to 4 mm long, winged. Flowers solitary

or in few - many - flowered panicles, terminal or axillary, 2.5 - 5 cm, often dimorphic ; pedicels 2 - 11 mm long, pilose to hirsute. Hypanthia 2.5 - 5 × 2.5 - 5 mm, subglobose to broadly obconic, pilose to hirsute. Calyx teeth 4.5 - 9 × 1.5 - 4 mm, triangular to lanceolate, acute to acuminate, pilose to hirsute. Corolla purple to blue, campanulate, pilose without, rarely sparsely pilose within, 5-partite for 1/3 to 1/2 the length ; tube 5- 8.5 mm long, 5 - 9.5 mm broad at throat ; lobes 4 - 7.5 × 2.5 - 4 mm, oblong-ovate to lanceolate, acute. Filaments dilated towards the base, ciliate, 1.5 - 2.5 mm long ; anthers narrowly oblong, 1.5 - 2.5 mm long. Ovary 3 - loculed ; styles 4 - 6 mm long ; stigmatic lobes 1.5 - 2 mm long. Capsules 4 - 5.5 × 3.5 - 6 mm, subglobose to obconoid, pilose to hirsute, rarely glabrescent. Seeds brown, shiny, ellipsoid.

KEY TO THE VARIETIES

- 1a. Calyx teeth triangular-lanceolate to lanceolate, not overlapping at base var. *pallida*
 b. Calyx teeth broadly triangular, overlapping at base var. *tibetica*

Var. *pallida*

Type : Nepal *n.v.*

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, West Bengal, Sikkim, Meghalaya, Arunachal Pradesh, Nagaland and Tamil Nadu ; NEPAL, S.W. CHINA, PAKISTAN, AFGHANISTAN.

Exsicc. : Jammu & Kashmir : Sind valley, *Clarke* 31027A. Himachal Pradesh : Simla, *Watt* s.n. (CAL ACC. NO. 263087). Punjab : Kothi, *Singh* 23053. Uttar Pradesh : Kumaon (Kumaon). *Blinkworth* in Wall. Cat. No. 1286 (K, photograph !); Deoban range, *Duthie* 1172. West Bengal : Tonglu ridge, *Burkill* 25158. Sikkim : Rungbee, *Clarke* 8567. Meghalaya : Laillyngkot, *Kapoor & pty.* 75611 (LWG). Arunachal Pradesh : Lohit valley, *Ward* 19190 (ASSAM). Nagaland : Konoma, *Pruin* s.n. (BSIS ACC. NO. 17866). Tamil Nadu : Segarghat, Nilgiri dist., *Lawson* s.n. (MH ACC. NO. 29106).

Chr. No. : $2n = 28$, *C. colorata* (Gadella in Wentia : 1 - 104. 1964).

Habitat : In rock crevices, slopes, mossy boulders, grasslands, sidewalls, among Oak-Rhododendron forests at elevations between 1000 and 4000 m.

Notes : This species is very widely distributed from S.W. China to Afganistan through the Himalaya and Khasi and Naga hills. It is also found in isolation in the Nilgiri Hills (Peninsular India). It exhibits a high degree of variation especially in the relative dimentions of the calyx teeth and corolla, shape of the calyx teeth and leaves, indumentum, and hence was known under various names.

Var. tibetica (Hook.f. & Thoms.) Hara in J. Jap. Bot. 50 : 1975. *C. colorata* var. *tibetica* Hook.f. & Thoms. in J. Linn. Soc. 2 : 23. 1853 ; C.B. Clarke in Hook.f., Fl. Brit. India. 3 : 440. 1881.

Slender, flexuous, scabrid pilose, shorter (8 - 23 m high) herbs. Leaves elliptic - ovate, obscurely dentate. Calyx teeth broadly triangular, overlapping at base, scabrid pilose.

Type : Jammu & Kashmir : Ladakh and Zaskar, Thomson (K, Photo !).

Fls. & Frts. : June - July.

Distrib. : INDIA : Jammu & Kashmir and Himachal Pradesh ; CHINA (Zizang Zigian), PAKISTAN.

Exsicc. : Jammu & Kashmir : Upshi to Lei (Leh), Indus valley, *Stoliczka s.n.* (CAL ACC. NO. 263148A).

Habitat : On alluvial sand, sand stones at elevations between 2650 - 3660 m.

11. *Campanula sylvatica* Wall. in Roxb., Fl. Ind. 2 : 97. 1824 & Cat. No. 1293. 1829 ; A. DC., Monogr. Camp. : 285. 1830 & in DC., Prodr. 7 : 471. 1839 ; Hook.f. & Thoms in J. Linn. Soc. 2 : 22. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India. 3 : 439. 1881 ; Hara, Fl. E. Himal. 2 : 129. 1971. *C. stricta* Wall. in Asiat. Res. 13 : 374. 1820, *non* L. 1753. *C. integerrima* D. Don, Prodr. Fl. Nepal : 155. 1825. *C. caperonioides* Klotz., Reis. Pr. Waldem. Bot. : 73, t. 78. f. 1. 1862.

Local name : Nausa Soah (Nep.)

Perennial erect herbs, 10 - 30 cm high ; stems slender, simple or a few branched, pilose to densely hirsute. Leaves sessile, more or less crowded towards the middle of the stem, 1.5 - 6.5 x 0.1 - 0.3 cm, linear, tapering at base, acute at apex, entire to distantly and minutely denticulate, ciliate, scabrid - pilose to hirsute on both surfaces especially on midrib beneath. Flowers solitary or a few in lax panicles ; bracts and bracteoles much reduced,

subulate to linear ; pedicels slender, 2 - 14 mm long. Hypanthia 2.5 - 3.5 × 1.5 - 3 mm, obconic, scabrid pilose to hirsute or glabrescent. Calyx teeth 3.5 - 6 mm long, lanceolate to linear - lanceolate, entire, ciliate, acuminate, densely hirsute. Corolla blue, campanulate, pilose without, 5-partite for 1/5 to 1/4 the length ; tube 6.5 - 7.5 mm long, 4 - 5.5 mm broad at throat ; lobes 2 - 2.5 × 1.5 - 2 mm, ovate, acute. Filaments 2 - 2.5 mm long, dilated at base, glabrous ; anthers 3.5 - 4.5 mm long, narrowly oblong. Ovary 3-loculed ; styles 6.5 - 7.5 mm long ; stigmatic - lobes ca 1.5 mm long, linear-oblong. Capsules 5 - 6 × 4 - 5 mm, obconoid.

Type : Nipal (Nepal), without precise locality, *Wallich* in Cat. No. 1293 (K, Microfiche !).

Fls. & Frts. : March - July.

Distrib. : INDIA : Uttar Pradesh and Arunachal Pradesh ; NEPAL, BHUTAN, PAKISTAN.

Exsicc. : Uttar Pradesh : Kumaon (Kumaon) *Blinkworth* in Wall. Cat. No. 1293 (CAL ACC. NOs. 262919, 262920) ; near Pithoragarh, *Duthie* 5740. Arunachal Pradesh : Rupa to Bomdila, *R.S. Rao* 7277 (ASSAM, CAL).

Habitat : On dry rocky soils, open moist forest grounds at elevations between 900 and 2800 m.

12. *Campanula wattiana* Nayar & Babu in Ind. Bot. Soc. 49 : 183. 1970 ; Nair, Fl. Bashahr Himal. 170. 1977.

Perennial subrobust suberect to ascending herbs, 13 - 40 cm high ; stems simple or profusely branched, pilose to woolly hairy. Leaves crowded towards the tips of the stems, subsessile to sessile, upper ones much reduced and bracteiform, 6 - 21 × 1 - 10 mm, ovate - elliptic to lanceolate, attenuate to cuneate at base, acute at apex, subentire to irregularly dentate, densely pubescent, rarely woolly hairy above and white woolly hairy beneath. Flowers solitary, terminal ; pedicels 3 - 15 mm long, pilose to densely woolly. Hypanthia, 2 - 3 × 3 - 4 mm, broadly obconic, densely pubescent to woolly. Calyx teeth 3.5 - 6 × 3 - 4 mm, broadly ovate to ovate - lanceolate, subentire to few dentate, acute, densely pubescent to woolly tomentose. Corolla subrotate, 5-partite for 1/2 or slightly more the length, pilose outside ; tube 3 - 5 mm long and 8 - 12 mm broad at throat ; lobes 4 - 8 × 4 - 6 mm, oblong - ovate to ovate. Filaments 2 - 3.5 mm long ; dilated at base, long ciliate ; anthers 2 - 3.5 mm long. Styles 9 - 15 mm long ; stigmatic - lobes 1 - 1.5 mm long. Capsules 4 - 5 mm long and as much broad, obvoid.

Type : : INDIA : Himachal Pradesh : Bagi, Watt 8609 (Holo, CAL : Iso, CAL !).

Fls. & Frts. : Sept. Oct.

Distrib. : INDIA : Himachal Pradesh and Uttar Pradesh ; Endemic.

Exsicc. : Himachal Pradesh : Bunsun, Patunala tract, Collett 363. Uttar Pradesh : Deoban range, Duthie 1199. Karsawa, Jaunsar, Gamble 15101.

Habitat : On rocks, above nallah tracts, at 2200 to 3900 m.

Notes : The occurrence of the species in Jammu & Kashmir, as reported by Nayar & Babu (l.c.) is doubtful as 'Bagi', the type locality is situated in Himachal Pradesh in Simla Hills.

IMPERFECTLY KNOWN TAXA

1. *Campanula nakaol* Kitam. in Act. Phytotax. Geobot. 15 : 108. 1954 & in Kihara, Fauna Fl. Nep. Himal. 1 : 239, f. 67. 1955.

Local names : Chasun Mendo (Bhut.) ; Chali Mendo (Tib.).

Slender herbs, 15 - 27 cm high ; stems dark purplish, angular, sparsely or densely white pilose, ca 1 mm in diam., procumbent to ascending, simple or sparsely branched ; rhizomes creeping, 1 - 2 mm in diam. Leaves petiolate to sessile, 14 - 22 × 5 - 8 mm ; ovate - oblong or oblong, cuneate or narrowed into the petioles at base, obtuse at apex, crenate, minutely strigose near the margins above, white strigose beneath especially on the veins. Flowers solitary, 2.5 - 3 cm long, pedicellate. Hypanthia ca 4 mm long and as much broad, obconic, densely hirsute. Calyx teeth 6 - 7 × 1.5 - 2 mm, lanceolate, mucronulate, distantly mucronate serrate. Corolla blue, 11 - 14 × 18 - 22 mm, campanulate, glabrous. Anthers ca 5 mm long. Styles ca 10 mm long ; stigmatic lobes ca 2.5 mm long.

Types : Near Tsumje, Khar in winter wheat field, 3200 m, July 1953 ; Tsumje, 3400 m, June 18, 1953 ; Chbokang, 3150 m, July 4, 1953.

Notes : No specimen of this species could be studied other than a photograph of the holotype and the above description is adopted from Kitamura (l.c.). It's allied taxa have not been mentioned by Kitamura. From the description and study of the photograph, it appears to be closer to *C. pallida* Wall., but the corolla seems to be more deeply partite.

2. *Campanula tenuissima* Dunn in Kew Bull. 1924 : 385. 1924 ; Blatt., Beaut. Fl. Kashmir 2 : 13. 1928.

Flexuous, slender, strigose, herbs *ca* 20 cm high, stems arising from a rootstock. Cauline leaves few, sessile 1 - 1.5 cm long, linear - lanceolate, narrowed at base and apex, repand - dentate, sparsely pilose. Flowers 8 - 10 mm long in terminal, lax, panicles ; bracteate. Hypanthia *ca* 5 mm long, obconic. Calyx teeth linear, as long as the hypanthia. Corolla white, campanulate, 5-partite for *ca* 1/2 of the length ; lobes linear. Ovary 3 - carpellary ; stigmatic lobes 3. Capsules trigonous, narrowed at base, dehiscing by 3 basal pores.

Type : Kashmir ; Jhelum valley Road, at about 800 m, 28 Aug. 1919, R.R. Stewart 5104 (K, photo !).

Notes : The above description is adopted from Dunn (*l.c.*) and no specimen could be studied other than a photograph of the type specimen. Dunn (*l.c.*) considered it as allied to *C. argyrotricha* Wall. ex A. DC. but differs from it leaves being lanceolate and capsules narrowed at base. However, the shape of the leaves, nature of calyx teeth indicate close affinity with *C. pallida* Wall. than with *C. argyrotricha* Wall.

3. *Campanula wightii* Gamble, Fl. Pres. Madras 2 : 740. 1921. *C. ramulosa* Wight, Icon. Pl. Ind. Orient. 4 : t. 1178. 1848, *non* Wall. 1824.

Slender, tufted herbs, softly villous, *ca* 20 cm tall. Rootstock thick. Leaves ovate, dentate to serrate, lower up to 12.5 mm long. Flowers 5 - 7.5 mm long, short pedicellate, usually without corolla or stamens. Calyx teeth *ca* 2.5 mm long, triangular, dentate. Corolla purple.

Type : Wight, Icon. Pl. Ind. Orient. t. 1178. 1848.

Notes : No specimen with the above characteristics could be located in any of the Indian herbaria. The above description adopted from Gamble (*l.c.*). The illustration in Wight's Icon matches well with the typical *C. pallida* except in the leaf shape and size of flowers. However, the specimen Wight 1255 (K) (whose photograph could be studied) identified as *C. wightii* by Gamble, is a mixture of *C. wightii* and a species of *Campanula* yet to be identified.

4. CAMPANUMOEIA

Blume, Bijdr. : 726. 1826 ; A. DC., Monogr. Camp. 118. 1830 & in DC., Prodr. 7 : 423. 1839 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 9. 1858 ; Benth. in Benth. & Hook.f., Gen. Pl. 2 : 558. 1876 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 435. 1881 ; Prain, Bengal Pl. 1 : 634. 1903 ; Das in Kanjilal *et al*, Fl. Assam

3 : 129. 1939. *Cyclocodon* Griff., Not. Pl. Asiat. 4 : 277. 1854 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 17. 1858. *Codonopsis* Moeliono in Steenis, Fl. Males. 1, 6 : 118. 1960, p.p. non Wall., 1824.

Annual or perennial, twining or rambling, foetid or inodorous herbs. Stems branched ; branches axillary or leaf opposed, often di or trichotomous ; rootstocks large, tuberous. Leaves opposite, alternate or subverticillate, petiolate. Flowers solitary or in cymes, pentamerous (tetramerous in *C. parviflora*), pedicels axillary, supra - axillary, leaf - opposed, or terminal, at times curved near the apex, glabrous. Hypanthium subglobose. Calyx hypoperi or epigynous forming a tube at base or rarely completely free below the ovaries ; tube adnate to the ovary to various lengths ; teeth ovate to lanceolate - linear, often foliaceous. Corolla epigynous inserted at the rim of the disc, broadly campanulate or funnel shaped. Stamens free, inserted at the base of corolla ; filaments slender, dilated towards the base, glabrous ; anthers nearly basifixed, narrowly oblong. Ovary inferior, semi inferior or rarely superior to calyx and inferior to corolla, subglobose, with a depressed disc at the top, 4 - 6 loculed (3 - 5 in Indian species), ovules many, multiseriate on axile placenta ; style short, cylindric, slightly dilated towards both ends, stigmatic lobes 3 - 5, oblong to ovate, erect, later recurved, densely pilose when young. Berries subglobose or cylindric, rounded at ends, at times reticulate.

Type : *C. javanica* Blume.

Distrib. : 6 species, Indo - Malesian ; 4 species in India with 1 endemic.

KEY TO THE SPECIES

- | | | | |
|-----|--|-------|------------------------|
| 1a. | Herbs twining, foetid | ..... | 2 |
| b. | Herbs erect, inodorous | ..... | 3 |
| 2a. | Calyx adnate to the base of ovary for a short length (up to 2 mm) ; filaments much longer than anthers | ..... | <i>C. javanica</i> 2 |
| b. | Calyx adnate to the ovary for the entire length ; filaments as long as anthers | ..... | <i>C. inflata</i> 1 |
| 3a. | Calyx adnate to ovary for a short length and to fruits up to the middle | ..... | <i>C. lancifolia</i> 3 |
| b. | Calyx entirely free from ovary, situated often on the pedicels | ..... | <i>C. parviflora</i> 4 |

Notes : The species of *Campanumoea* were treated under various genera by different workers. Griffith (*l.c.*) treated them under 3 genera *Campanumoea*, *Codonopsis* and *Cyclocodon*. Strangely Griffith treated the

true *Campanumoea javanica*, under his *Codonopsis* species 2, though the fruits were of "pseudobaccate" type. J.D. Hooker & Thomson (l.c.) also placed their *Codonopsis inflata* with baccate fruits having apparently obliterated valves under the genus *Codonopsis*. Despite the fruits of *Codonopsis* dehisc by three horny valves within the base of the corolla. The species with fleshy berries were retained by them under *Campanumoea* and *Cyclocodon*. However, it was Clarke (l.c.) who brought all the species with berried fruits under a single genus *Campanumoea*. He retained species with capsular fruits under genus *Codonopsis* and those with baccate fruits under *Campanumoea*. He also considered the tall erect forms of *Campanumoea* with spreading branches under his section 'Cyclocodon' of *Campanumoea*. Clarke's treatment was accepted by Komarov (Act. Hort. Petrop. 29 : 98 124. 1908), Chipp (J. Linn. Soc. 374 - 391. 1908), the later Diels (Bot. Jahrb. 29 : 606. 1901) while in his revision of *Codonopsis* proposed to merge *Campanumoea* with *Codonopsis* which was following J.D. Hooker & Thomson (l.c.). Nannfeldt (Notes R.B. G. Edinb. 16 : 149 160. 1931) also considered the merger of those 2 genera as logical and stated that "but in order to avoid nomenclatural changes, it is perhaps more practical to maintain *Campanumoea* as a distinct genus on account of its baccate fruits". It was Moeliono (l.c.) who united the two and retained *Codonopsis* as the correct name. The "berry vs. capsule" difference was not considered by Moeliono as of much taxonomic importance in *Campanulaceae* as is evidenced in the case of merger of *Pratia* with *Lobelia* by Moeliono. He also cited the similarities between the 2 genera in foliage, habit as in the case of *Campanumoea lancifolia* and *Codonopsis purpurea* and also *Campanumoea javanica* and *Codonopsis viridis*. The occurrence of 4 distinct floral types as proposed by Chipp (l.c.) for the genus *Codonopsis* s. str. of which 2 types are met within *Campanumoea* also were cited by Moeliono as an evidence for his merger.

However, the "berry vs. capsule" difference has been found as a constant character, with no intergrading forms, in the two genera during the course of the present study of Indian and extra Indian specimens. Moreover, the ovary in *Campanumoea* is truncate and slightly depressed at apex, while those in *Codonopsis* are conical apically, which open later as valves.

The Pollen grains *Campanumoea* are colpate while those of *Codonopsis* are colpate. This also point to the distinct nature of the two genera (Erdtman, Pollen Morpho. Tax. 1 (Angiosperms) : 90 94. 1952 ; Dunbar, Bot. Notis. 128 : 73 - 118. 1975 ; Huang, Pollen flora of Taiwan : 73 73. 1972).

Thus the 2 genera are considred as separate in the present work and the Indian species with baccate fruits are treated under *Campanumoea*.

The type was not designated by Blume (*l.c.*) at the time of publication of the genus nor any lectotypification was attempted by later workers. Hence *C. javanica* Blume is proposed here as the lectotype.

1. *Campanumoea inflata* (Hook.f. & Thoms.) C.B. Clarke in Hook.f., Fl. Brit. India 3 : 436. 1881. *Codonopsis inflata* Hook.f. & Thoms. in Hook.f. & Cath., Ill. Himal. Pl. : t. 16c. 1855 & in J. Linn. Soc. 2 : 13. 1858 ; Hara, Fl. E. Himal. Rep. 1 : 326. 1966.

Herbs, branched, glabrous or very rarely puberulous. Leaves alternate or opposite 3 - 12.8 × 1.5 - 8 cm, ovate - cordate to triangular - ovate, deeply cordate at base, acuminate or acute, entire to crenate - dentate, glabrous or sparsely puberulous above, glaucous beneath ; petioles 0.7 - 7.7 cm long, slender, glabrous. Flowers solitary ; pedicels 1.4 - 4 cm long, leaf - opposed or supra - axillary. Hypanthia obconic. Calyx epigynous ; teeth 8 - 12 × 4.5 - 9 mm, patent, foliaceous, ovate to ovate - lanceolate, distantly and obscurely denticulate, often recurved, acute, finely veined, glabrous. Corolla lurid yellow with purple veins, broadly campanulate ; tubes 1.5 - 3 cm long, lobes 6 - 10.5 × 7 - 12 mm, ovate, acute. Filaments 6 - 8 mm long ; anthers as long as the filaments or slightly shorter. Ovary inferior, 3 - 5 loculed ; style 8 - 11.5 mm long ; stigmatic lobes 3 - 5, 3 - 4 mm long, oblong to ovate. Berries dark purple, subglobose or cylindric. Seeds ca 1 mm long, 6 - 10 mm in diam., prominently reticulated.

Type : INDIA : Sikkim, *J.D. Hooker s.n.* (K, photo !)

Fls. & Frts. : July - Jan.

Distrib. : INDIA : West Bengal and Sikkim ; endemic.

Exsicc. : West Bengal ; Kurseong, *Gamble 2379A & 2379 B* ; Jorpokhri, Darjeeling dist., *Burkill s.n.* Sikkim : Phodonchen, *Smith 4453* ; Bijan, *King's coll. s.n.* (CAL 262435).

Habitat : In Eastern Himalayas at elevations between 1200 and 3200 m.

Notes : In the photograph of the type obtained from K, the collection locality is not mentioned and the altitude is cited as "5 - 7000 ped.". But in the original description the altitude is mentioned as "5 - 6000 ped.". However, the photograph of the specimen matches well with the description.

2. *Campanumoea javanica* Blume, Bijdr. 727. 1826 ; A.DC., Monogr. Camp. : 119. 1830 & in DC., Prodr. 7 : 423. 1839 ; Hook. f. & Thoms. in J. Linn. Soc. 2 : 9. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 :

435. 1881 ; Das in Kanjilal *et al.* Fl. Assam 3 : 129. 1939 ; Biswas, Pl. Darjeeling Sikkim Himal. 1 : 493. 1966. *Codonopsis javanica* (Blume) Hook.f. & Thoms. in Hook.f. & Cath., Ill. Himal. Pl. : 116. 1855 ; Hara in Ohashi, Fl. E. Himal. Rep. 3 : 109. 1975. *Codonopsis* sp. 2 Griff., Not. Pl. Asiat. 4 : 280. 1854.

Herbs, branched, glabrous. Leaves opposite or alternate, 1.5 - 8 × 1 - 6.5 cm, broadly to narrowly cordate - ovate, rarely oblong, deeply cordate to reniform at base, obtuse or acute at apex, crenate to serrate, rarely entire, glabrous, glaucous beneath ; petioles 0.7 - 4 cm long, glabrous. Flowers solitary, axillary or leaf opposed, glabrous ; pedicels 5 - 25 mm long. Hypathia absent or if present up to 2 mm long. Calyx perigynous or hypogynous, glabrous, teeth green with purple veins, 9.5 - 17.5 × 3 - 7 mm, oblong lanceolate to ovate lanceolate, entire, crenate or serrulate, acute. Corolla greenish white to lurid yellow with purple veins, campanulate, 5 lobed for 1/2 or slightly more of their length ; tubes 9 - 13 mm long ; lobes 13 - 18 × 8 - 10 mm, oblong - ovate to ovate, acute. Filaments 8 - 9 mm long ; anthers 3.5 - 4 mm long. Ovary semi inferior to inferior, 3 - 5 loculed ; style 8 - 9 mm long ; stigmatic - lobes 3 - 5, ca 1.5 mm long, oblong ovate to ovate. Berries dark purple, 10 - 25 mm in diam., broadly subglobose to globose. Seeds ca 1 mm long, prominently reticulated.

Type : "Montrum Salak, Gede, etc." (Gede, Blume s.n. (L. Photo !).

Fls. & Frts. : July - Dec.

Distrib. : West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh and Nagaland ; BHUTAN, BANGLADESH, CHINA, MYANMAR, THAILAND, INDONESIA.

Exsicc. West Bengal : Darjeeling, Clarke 27398c (DD). Sikkim : Teesta valley, Gammie s.n. (CAL - 26242) ; Assam : Kalke, Burkill 37574. Meghalaya : Nungklao, Khasia, Clarke 40127 A. Arunachal Pradesh : Zero mile post downwards, Bomdila surroundings, Kameng F.D., Joseph 40340 (ASSAM). Nagaland : Kohima, Bor 16165 (ASSAM).

Habitat : As an undergrowth in forests among bushes, secondary forests, at elevations between 1100 and 2200 m.

3. *Campanumoea lancifolia* (Roxb.) Merr., Enum. Philipp. Fl. Pl. 3 : 587. 1923. *Campanula lancifolia* Roxb., Fl. Ind. 2 : 96. 1824. *Campanumoea celebica* Blume, Bijdr. 727. 1826 ; A.DC., Monogr. Camp. 120. 1830 & in DC., Prodr. 7 : 423. 1838 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 436. 1881 ; Prain, Bengal Pl. 1 : 634. 1903.

Cyclocodon adnatus Griff., Not. Pl. Asiat. 4 : 278. 1854. *Codonopsis lancifolia* (Roxb.) Moeliono in Steenis, Fl. Males. 1, 6 : 120. 1960.

Herbs, 30–120 cm high ; branches pinkish - green, drooping, often falling on the grounds, glabrous, rarely sparsely pilose upwards. Leaves opposite to subopposite, remotely arranged, 1–11.2 × 0.4–4.5 cm, elliptic - ovate to lanceolate, truncate to caudate at base, acute to acuminate at apex, dentate, serrate or cuspidate serrate, glabrous above and glabrous to pubescent beneath ; petioles 1.5–11 mm long, glabrous to hirsute. Flowers solitary or in dichotomous cymes ; pedicels 3–22 mm long, glabrous. Hypanthia 1.5–2.5 mm long, in fruits up to 4 mm long. Calyx perigynous, glabrous ; teeth 3.5–6.5 mm long, lanceolate to linear - lanceolate, remotely few serrate, acuminate. Corolla white, turning pale yellow, infundibular ; tubes 2–3.5 mm long ; lobes 1.5–3 × ca 2.5 mm, broadly triangular - ovate, acute. Ovary semiinferior, sub - globose to globose, 5–6 loculed, 3–6 mm in diam. ; style 2–3.5 mm long ; stigmatic lobes 5–6, 1.5–2 mm long, narrowly oblong. Berries 6–10 mm in diam., globose. Seeds minute.

Type : Bangladesh : Massat, Roxburgh 217 (BM, photo !).

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh and Mizoram ; BANGLADESH, MYANMAR, THAILAND, INDONESIA, PHILIPPINES, NEW GUINEA.

Exsicc. : West Bengal : Lebong, Darjeeling, Gamble 9784 (CAL, DD). Sikkim : Reang ka sir, Smith 556. Assam : without precise locality, Parry s.n. (CAL ACC. NO. 262473). Meghalaya : East of the T.B. of Jowai, Khasi to Jaintia Hills dist., Panigrahi 4163 (ASSAM & CAL). Arunachal Pradesh : Paya to Shoeliang, Lohit F.D., R.S. Rao 10860 (ASSAM). Mizoram : Between Lungleh Ridge camp, South Lushai hills, Gage 202 (BSIS & CAL).

Habitat : In open forests in wet places, near streams, hill slopes at elevations between 900 and 1600 m.

4. *Campanumoea parviflora* (Wall. ex A. DC.) Benth. in Benth. & Hook.f., Gen. Pl. 2 : 558. 1876 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 436. 1881 ; Das in Kanjilal *et al*, Fl. Assam 3 : 129. 1939. *Codonopsis parviflora* Wall. ex A. DC., Monogr. Camp. 123. 1830 ; Balakr., Fl. Jowai 1 : 279. 1981. *Cyclocodon distans* Griff., Not. Pl. Asiat. 4 : 277. 1854 & Icon. Pl. Asiat. 4 : t. 481. f. 1. 1854. *C. parviflorum* (Wall. ex A.DC.) Hook.f. & Thoms. in J. Linn. Soc. 2 : 18. 1858 *excl. syn.* *Campanumoea celebica* & *C. lancifolium* Kurz in J. Asiat Soc. Bengal 46 : 210 1877, p.p.

Local names : Ju tyn dong (Kh.)

Annual herbs, 30–90 cm high ; branches pale yellowish, opposite, straight, fulvous at nodes. Leaves opposite, remotely arranged, 1.2–11.7 × 0.1–3.6 cm, elliptic-lanceolate to broadly lanceolate, rounded to cuneate at base, acuminate at apex, distantly and irregularly serrate to sharply serrate, glabrous, glaucous beneath ; petioles 1–8 mm long, glabrous. Flowers solitary or in 3-flowered dichotomous cymes ; pedicels 0.8–3.8 cm long, reddish, terminal, often curved near the apex. Calyx hypogynous, glabrous ; tubes absent ; teeth 4.5–6.5 mm long, linear-lanceolate, distantly few serrate, acuminate, inserted just below the ovary, up to 1 mm long, up to 2.5 mm long in fruits below the ovary. Corolla white, infundibular, 5-partite for 1/3–1/2 the length ; tubes 1.5–3.5 mm long ; lobes 2.5–3 × 5–7 mm, broadly triangular-ovate, acute. Filaments 1.5–2.5 mm long ; anther 1–2 mm long. Ovary 2.5–5 mm in diam., subglobose to globose, 4-loculed ; style 1.5–5 mm long ; stigmatic-lobes 4, 1–2 mm long. Berries 5–12 mm in diam., globose. Seeds minute.

Types : Bangladesh : Pundua, *De Silva* in Wall. Cat. No. 1300 (K, Microfiche !) ; Mt. Sillet (Sylhet), *De Silva* in Wall. Cat. No. 1300.

Uses : 'Leaves eaten cooked' (U.N. Kanjilal 6204 CAL, DD).

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur and Mizoram ; BANGLADESH, MYANMAR.

Exsicc. : West Bengal : Junction of Reang with Tista, *Burkill* 34093 (BSIS & CAL). Sikkim : Labdah, *Smith* 640. Assam : Rotung, *Burkill* 37608. Meghalaya : Chitimang, Garo hills, *Parry* 1000. Arunachal Pradesh : Krishna, 8 kms to Sessa, 36 kms from Bhalukpong, Kameng F.D., *Joseph* 39709. Nagaland : Neechoogard, Naga hills, *Clarke* 40876 F. Manipur : Makru, *Meebold* 5568. Mizoram : Lushai hills, *Parry* 22.

Ecol. : On shady stream banks, marshy places, hillslopes, hill cuttings of forest borders at elevations between 200 and 1800 m.

Notes : The morphology of the calyx teeth of *C. parviflora* has evoked considerable interest and controversies among botanists. The anomaly of a hypogynous calyx with epigynous corolla is illustrated to the highest degree in this species, where the calyx teeth are placed on the peduncle of the flower far removed from the base of the corolla and ovary. *De Candolle (l.c.)*

described this as involucre and the calyx as without lobes. Griffith (*l.c.*) followed De Candolle's views less expressed doubt that "the involucre is most likely the calyx, ...". The placement of the calyx on the peduncle some distance away from the base of the ovary in this species can be linked to those species where the calyx is hypogynous. Further its mode of development and valvate aestivation confirm its true nature of calyx. The Indian plants examined are 4 - merous and the 6 - merous condition reported by Bentham (*l.c.*) has never been observed in the Indian plants.

5. CODONOPSIS

Wall. in Roxb., Fl. Ind. 2 : 103. 1824 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 11. 1858 ; Benth. in Benth. & Hook.f., Gen. Pl. 2 : 557. 1876 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 430. 1881 ; Komarov, in Act. Hort. Petrop. 29 : 102. 1908 ; Chipp in J. Linn. Soc. 38 : 378. 1908 ; Anth. in Notes R.B.G. Edinb. 15 : 173. 1926 ; Nannf. in Notes R.B.G. Edinb. 16 : 149. 1931 ; Fedorov in Shishikin & Bobrov, Fl. URSS. 24 : 433. 1957 ; Moeliono in Steenis. Fl. Males. 1, 6 : 118. 1960, *p.p. Glosocomia*, D. Don, Prodr. Fl. Nepal. : 158. 1825.

Perennial erect herbs, ascending or twining, most often foetid, glabrous to hairy with milky or watery sap ; rootstocks tuberous ; stems a few branched, fistular, slender or stout. Leaves alternate to opposite, petiolate (as in Indian species) or rarely sessile, orbicular to lanceolate, rounded to acute at apex, cordate to cuneate at base, glabrous to densely hairy. Flowers solitary ; pedicels terminal, axillary or supra axillary, at times leaf opposite, ebracteate. Hypanthia subglobose or obconical, glabrous or hairy, usually broader than long. Calyx hypo, peri - or epigynous ; tube adnate to the ovary ; teeth 5, broadly ovate to linear, entire or remotely denticulate or crenate serrate, at times ciliate, glabrous or hairy. Corolla peri or epigynous, campanulate and shortly 5 partite in the upper half or rotate, glabrous or hairy ; lobes broadly triangular to ovate, broader than long or rarely as broad as long. Stamens 5, free ; filaments slightly dilated at base, glabrous to pubescent or ciliate ; anthers basifixed, erect, linear to linear - oblong or rarely carinate, glabrous or very rarely setose dorsally. Ovary semi inferior or rarely inferior, 3 - 5 loculed ; ovules many on axile placentas ; style cylindric, dilated towards the apex, hairy when young ; stigma 3 - 5 lobed, erect, later recurved, hairy when young. Capsules subglobose, obconoid or elongate obconoid, 3 - 5 locular, dehiscent through 3 - 5 apical valves. Seeds ellipsoid or oblong ellipsoid.

Type : Codonopsis viridis Wall.

Distrib. : Mostly in Eastern and Central Asia (Fedorov l.c.). Extending from China to USSR through the Himalayas ; 40 species ; 13 in India with 2 endemic.

KEY TO THE SPECIES

- 1a. Anthers glabrous dorsally ; corolla not constricted in the middle 2
- b. Anthers setose dorsally ; corolla constricted in the middle 11
- 2a. Herbs erect to ascending or rambling 3
- b. Herbs twining 8
- 3a. Calyx perigynous ; stems not fulvous at nodes 4
- b. Calyx epigynous ; stems fulvous at nodes *C. purpurea* 8
- 4a. Calyx teeth oblong to ovate - lanceolate, with narrow sinuses ; plants foetid 5
- b. Calyx teeth linear with broad sinuses ; plants inodorous *C. dicentrifolia* 4
- 5a. Calyx teeth more or less as long as the corolla tubes 6
- b. Calyx teeth about half as long as corolla tubes 7
- 6a. Corolla epigynous ; calyx teeth oblong ; filaments about as long as anthers *C. clematidea* 3
- b. Corolla perigynous ; calyx teeth ovate to ovate - lanceolate ; filaments much longer than the anthers *C. subsimplex* 10
- 7a. Corolla globose - campanulate ; leaves alternate towards the base and opposite upwards ; seeds ca 2 mm long *C. foetens* 5
- b. Corolla infundibular - campanulate ; leaves opposite althrough ; seeds ca 1 mm long *C. ovata* 7
- 8a. Calyx perigynous ; corolla peri - or epigynous 9
- b. Calyx and corolla epigynous *C. affinis* 1
- 9a. Calyx teeth linear, with broad sinuses ; corolla perigynous 10
- b. Calyx teeth elliptic or elliptic - ovate with narrow sinuses ; corolla epigynous 9. *C. rotundifolia*
- 10a. Corolla 5 - partite for ca 1/4 of the length ; capsules 8 - 9 x 13 - 17 mm *C. griffithii* 6
- b. Corolla 5 - partite for ca 1/3 of the length ; capsules 11 12 x 16.5 - 20.5 mm *C. viridis* 12
- 11a. Calyx teeth broadly ovate, with very narrow sinuses ; filaments ciliate *C. benthamii* 2
- b. Calyx teeth oblong with broad sinuses ; filaments glabrous *C. thalictrifolia* 11

- 1 *Codonopsis affinis* Hook.f. & Thoms. in J. Linn. Soc. 2 : 12. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 431. 1881, *excl. var.* ; Komarov in Act. Hort. Petrop. 29 : 107. 1908 ; Chipp in J. Linn. Soc. 38 : 389. 1908 ; Hara, Fl. E. Himal. Rep. 1 : 326. 1966. *excl. var.* Fig. 11

Twining herbs, branched, glabrous to puberulous. Leaves alternate or opposite, 1.2 - 7.6 × 0.5 - 4.6 cm, ovate to ovate-lanceolate, acute or obtuse at apex, cordate at base, subentire to dentate, sparsely to densely pubescent above, villous beneath ; petioles 0.3 - 3.6 cm long, sparsely pilose to densely villous. Flowers solitary ; pedicels 6 - 33 mm long, leaf-opposed or terminal, subtended by 2 bracteiform leaves, densely pubescent. Hypanthia 4 - 5 × 6 - 7 mm, broadly subglobose, densely pubescent. Calyx epigynous ; teeth 6 - 7.5 × 3 - 4 mm, oblong-elliptic or lanceolate, weakly sinuate, at times recurved, acute, pubescent. Corolla green with purple or red marks, epigynous, broadly cylindric-campanulate, pubescent without ; tubes 5 - 6.5 mm long and 10 - 15 mm broad at throat ; lobes 4 - 5 × 4 - 5.5 mm, triangular-lanceolate. Filaments glabrous, *ca* 1/2 as long as the anthers ; anthers 1.5 - 2 mm long, linear-oblong. Ovary inferior ; styles *ca* 1.5 mm long. Capsules 8.5 - 11.5 × 9 - 12 mm, subglobose, sparsely to densely pubescent, valves 2 - 3 mm long. Seeds dark brown, minute, oblong-ellipsoid.

Type : INDIA : Sikkim : Lachen & Lachung valleys., J.D. Hooker s.n. (K, photo !)

Fls. & Frts. : Aug. - Oct.

Distrib. : INDIA : Sikkim - Endemic.

Exsicc. : Sikkim : without precise locality, J.D. Hooker s.n. ; Lachen, Ribu & Rhomoo 3066 ; Rothangoong, Ribu 118 ; Sikkim, Bijan, Dr. King's coll. s.n.

Habitat : In valleys at elevations between 1800 and 3500 m.

Notes : This species has smallest flowers among the Indian species of *Codonopsis*.

2. *Codonopsis benthamii* Hook. f. & Thoms. in J. Linn. Soc. 2 : 14. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 432. 1881 ; Komarov in Act. Hort. Petrop. 29 : 113. 1908 ; Chipp in J. Linn. Soc. 38 : 382. 1908 ; Anth. in Notes R.B. G. Edinb. 15 : 184. 1926. Fig. 12

Herbs 16 - 40 cm high, much branched, glabrous to adpressed hairy ; rootstocks 1 - 2.3 cm in diam., branches 2 - 30 cm long. Leaves opposite to

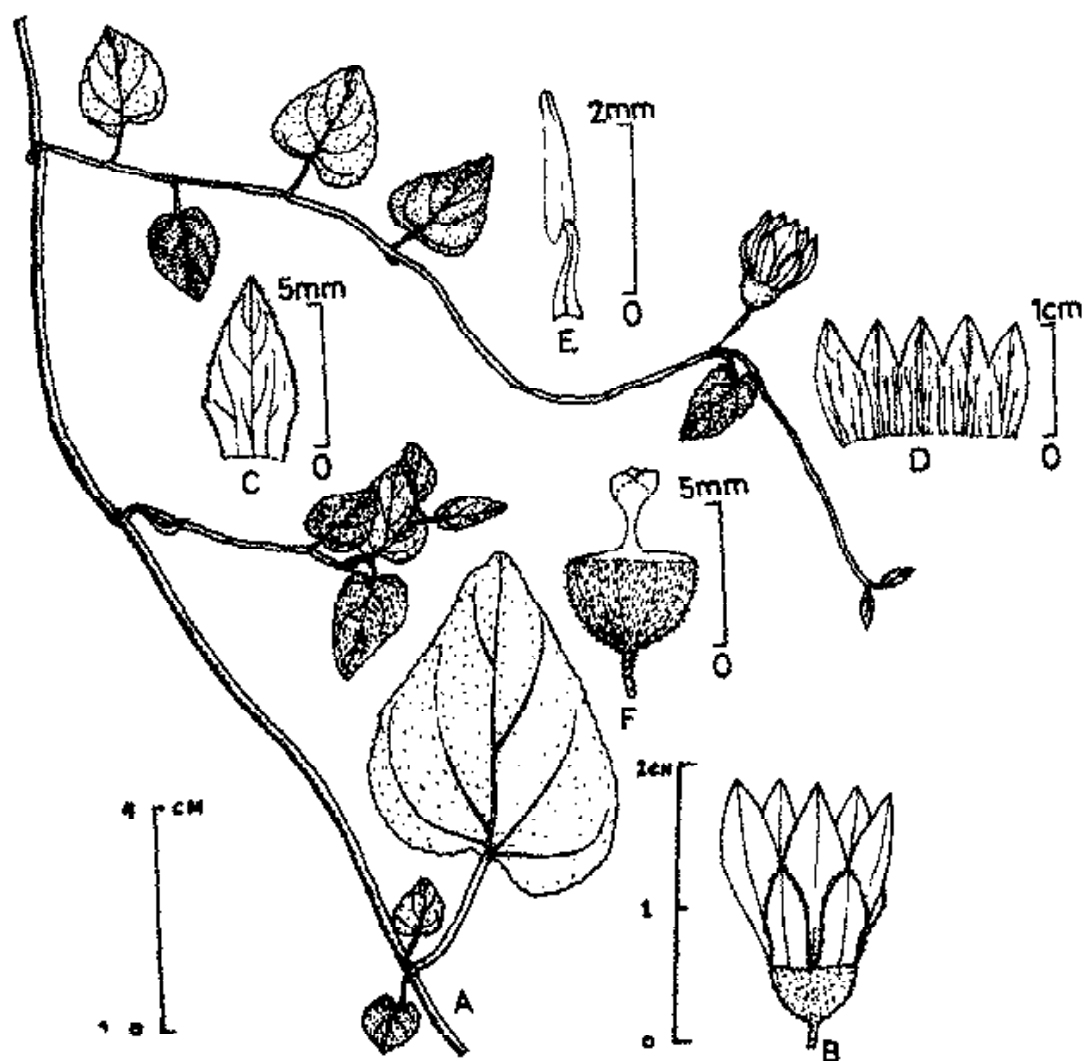


Fig. 11. *Codonopsis affinis* Hook.f. & Thoms. A. Habit. B. Flower. C. Calyx lobe. D. Corolla split opened. E. Stamen. F. Pistil (*King's coll. s.n.*).

alternate, 0.9 - 12.3 × 0.7 - 8.2 cm, ovate to elliptic - lanceolate, acute to acuminate or rarely obtuse at apex, truncate to caudate at base, sinuate or crenate - serrate, pilose to densely hirsute on both surfaces ; petioles 0.3 - 4 cm long, pilose to hirsute. Flowers solitary, terminal, 1.5 - 8.7 cm long, pilose to hirsute, rarely glabrescent. Hypanthia broadly obconic, glabrous, 2 - 2.6 × 7 - 9 mm. Calyx perigynous ; teeth 8 - 11 × 6 - 11 mm, broad at base, broadly ovate, with narrow sinuses, crenate - serrate and ciliate at margins. Corolla purple - yellow, epigynous, tubular - campanulate ; tubes 19 - 23 mm long and 12.5 - 13.5 mm broad at throat ; lobes 4.5 - 5 × 5 - 6 mm, triangular, acute. Filaments 8.5 - 9 mm long ; densely ciliate ; anthers 3 - 3.5 mm long, carinate, setose dorsally. Ovary semi inferior ; styles 10 - 12.5 mm long ; stigmatic lobes ca 2.5 mm long, ovate - lanceolate. Capsules 6 - 12 × 9 - 15 mm, subglobose, valves 4 - 7 mm long. Seeds ca 1 mm long, oblong - ellipsoid.

Type : Sikkim : Lachen and Lachung valleys, *J.D. Hooker s.n.*

Fls. & Frts. : July - Oct.

Distrib. : INDIA : Sikkim - Endemic.

Exsicc. : Sikkim : without precise locality, *J.D. Hooker s.n.* ; Top of Gangtok, *King's coll.* 4439 ; Yakla, *Clarke* 10224C.

Habitat : In temperate Himalaya at elevations between 2400 and 4200 m.

Notes : Hooker & Thomson (*l.c.*) reported this plant as having "a heavy, almost rank, hircine smell".

3. *Codonopsis clematidea* (Schrenk) C.B. Clarke in Hook.f., *Fl. Brit. India* 3 : 433. 1881 ; Komarov in *Act. Hort. Petrop.* 29 : 115. 1908 ; Anth. in *Notes R.B.G. Edinb.* 15 : 187. 1926 ; Nannf. in *Notes R.B.G. Edinb.* 16 : 156. 1931 ; Fedorov in Shishkin & Bobrov, *Fl. URSS.* 24 : 437. 1957, *p.p. Wahlenbergia clematidea* Schrenk in Fischer & Mey, *Enum. Pl. Nov. Schrenk lect.* : 38. 1841. *Glosocomia clematidea* (Schrenk) Fischer in *Regel Garten Fl.* : 266, t. 167, f. 2. 1856. *Codonopsis ovata* var. *cuspidata* Chipp in *J. Linn. Soc.* 38 : 385. 1908.

Erect to ascending herbs, 30 - 85 cm high, sparsely foliate on stems, glabrous or sparsely pilose, profusely branched in the lower half ; rootstocks up to 12 mm in diam. ; branches slender, densely foliate, 5.5 - 35 cm long. Leaves alternate to opposite, 15 - 35 × 3.5 - 23 mm, ovate - elliptic, ovate - lanceolate or lanceolate, acute at apex, truncate, attenuate or caudate at base,

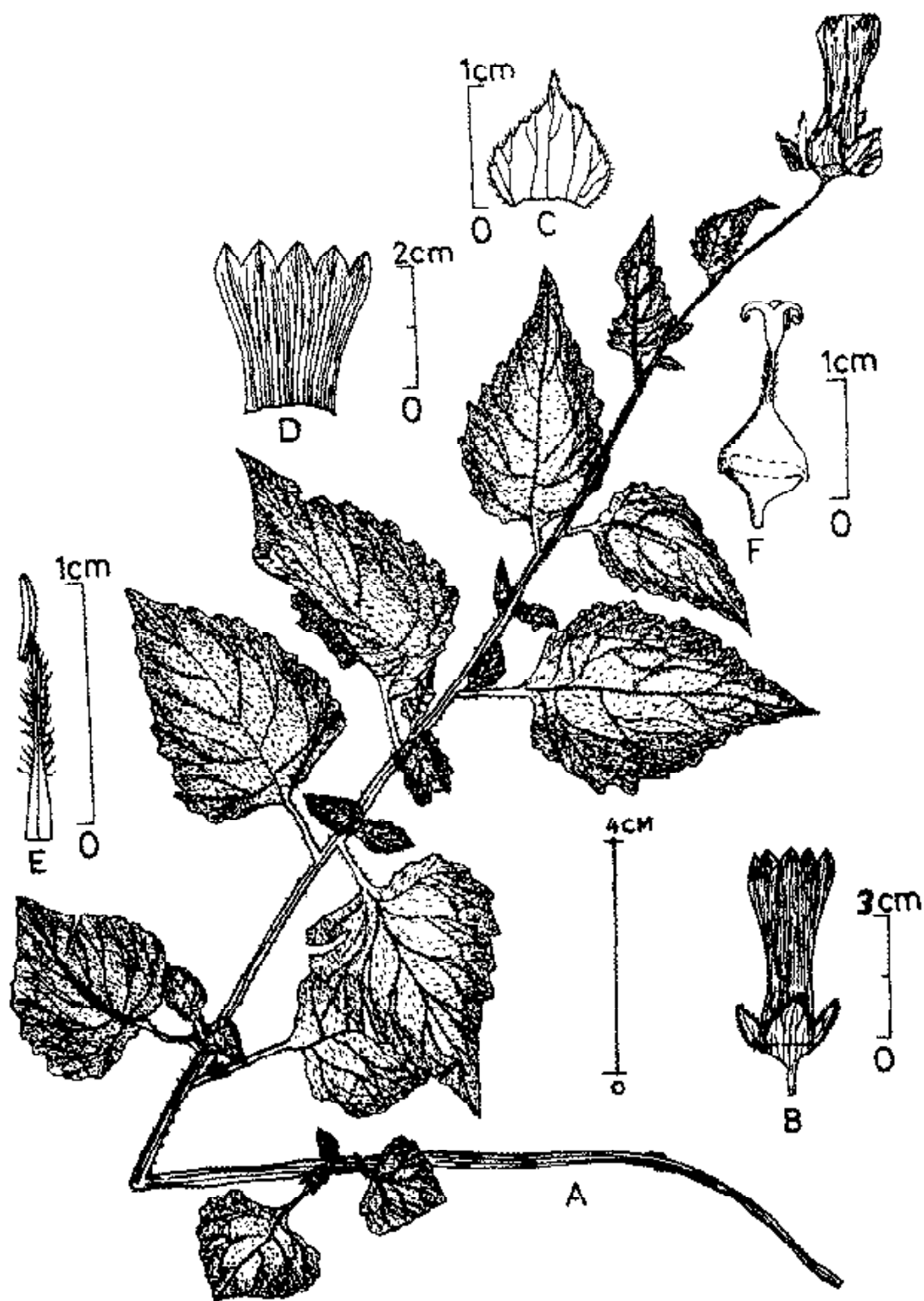


Fig. 12. *Codonopsis benthamii* Hook.f. & Thoms. A. Habit. B. Flower. C. Calyx lobe. D. Corolla split opened. E. Stamen. F. Pistil (King's coll. 4439).

subentire to weakly sinuate, often ciliate, densely pubescent or pilose on both surfaces; petioles 2 - 14 mm long, slender, sparsely to densely pilose. Flowers solitary, terminal; pedicels 2 - 18.5 cm long, glabrous or sparsely pilose. Hypanthia 3 - 3.5 × 7 - 9 mm, broadly subglobose, glabrous or sparsely pilose. Calyx perigynous; teeth 13 - 19 mm long and 5 - 10 mm broad at base, oblong, approximate at base, acute to obtuse at apex, entire, recurved, rarely ciliate towards the apex. Corolla blue, epigynous, broadly campanulate, lobed for 1/4 - 1/3 of the length; tubes 13 - 20 cm long, 2.3 - 2.6 cm broad at throat; lobes 6 - 7 × 9 - 11 mm, broadly triangular, acute. Filaments 4.5 - 5.5 mm long, glabrous; anthers 4.5 - 5.5 mm long, linear-lanceolate, glabrous. Ovary semiinferior; style 8 - 10 mm long; stigmatic lobes 2 - 2.5 mm long, oblong-ovate. Capsules and seeds not seen but they are described in literature as capsules broadly subglobose or ovoid. Seeds narrowly ellipsoid.

Type : Montibus Alatau et Dschillkaragai, *Schrenk* (Holotype LE, Photo!).

Fls. & Frts. : June - Aug.

Distrib. : INDIA : Jammu Kashmir and Himachal Pradesh; PAKISTAN, AFGHANISTAN, C.I.S., CHINA (including Xizang Zizhiqu).

Exsicc. : Jammu & Kashmir : Sonamarg, *Koebel* 80; Dras valley, *Duthie* 12563; Himachal Pradesh : Labul, *Jaeschke s.n.*; Donai to Bindraban, Pangi, *Lace* 1620.

Chr. No. : 2n=16 (*Rosen, Act. Hort. Gothob.* 7 : 31 - 42. 1931).

Habitat : At elevations between 2100 and 4200 m.

Notes : *Fedorov* (1957) has included *C. ovata* var. *obtusa* Chipp as a synonym of this taxon. As we have not seen any specimen of Chipp's taxon it is excluded presently.

4. **Codonopsis dicentrifolia** (C.B. Clarke) W.W. Smith in *Rec. Bot. Surv. India* 4 : 388. 1913; *Anth. in Notes R.B.G. Edinb.* 15 : 187. 1926; *Hara in Ohashi, Fl. E. Himal. Rep.* 3 : 109. 1975. *Wahlenbergia dicentrifolia* C.B. Clarke in *Hook.f., Fl. Brit. India* 3 : 430. 1881.

Fig. 13

Local name : Shignha (Bhut.).

Suberect herbs, 30 - 42 cm high; rootstocks 5 - 15 cm in diam.; stems branching, glabrous, branches 8.5 - 15 cm long, spreading. Leaves alternate

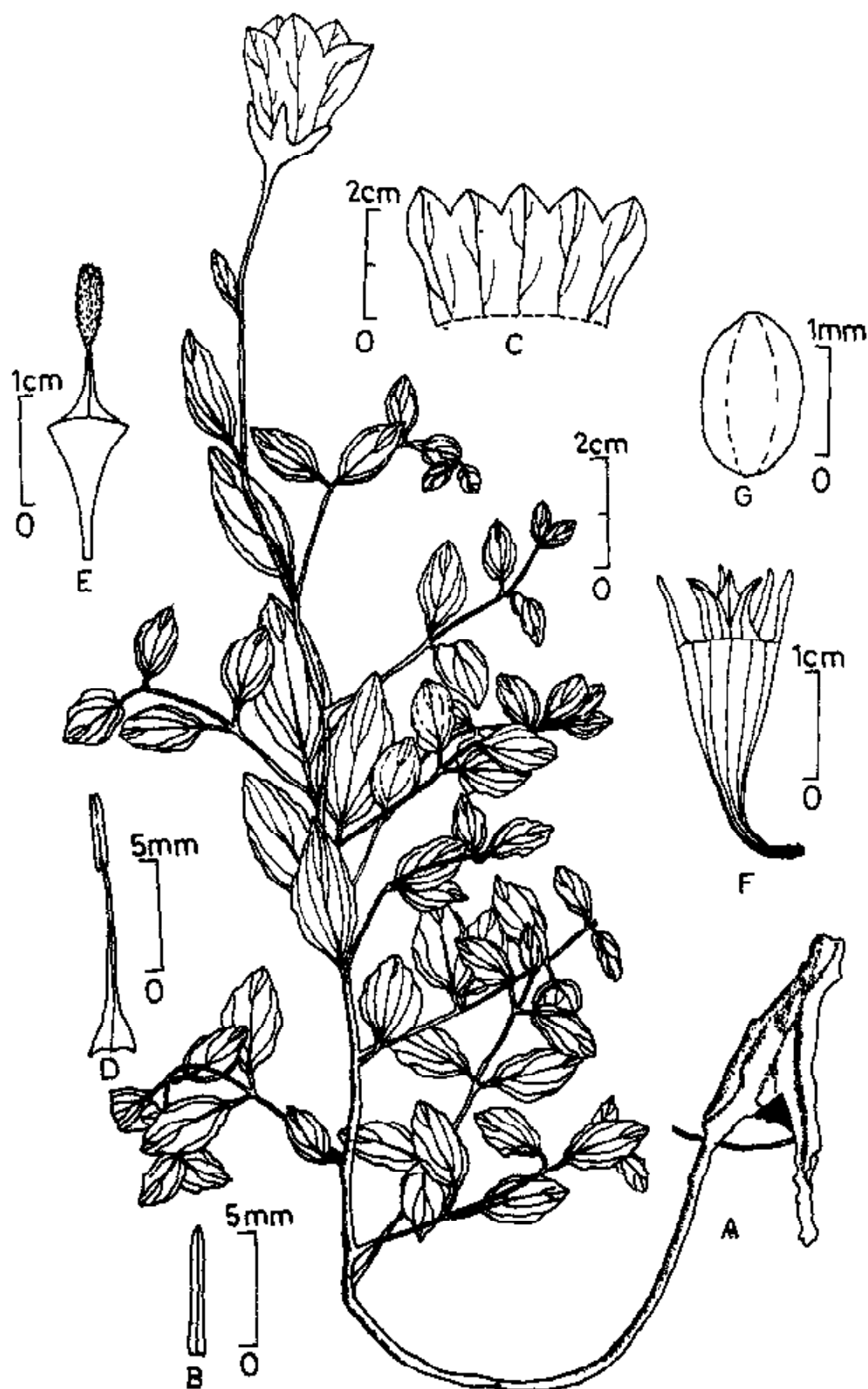


Fig. 13. *Codonopsis dicentrifolia* (Clarke) Smith. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil. F. Fruit. G. Seed (Smith 4381).

to opposite, 1 - 4.2 × 0.4 - 1.8 cm, ovate to elliptic lanceolate, rounded to cuneate at base, obtuse or very rarely acute at apex, subentire, glabrous and glaucous beneath; petioles 2 - 6 mm long, slender, glabrous. Flowers solitary, terminal; pedicels 1.8 - 4.8 cm long, glabrous. Hypanthia 7 - 9 × 8 - 10 mm, obconic to elongate - obconic. Calyx epigynous, glabrous; teeth 6 - 10 × 0.5 - 1 mm, linear oblong, with broad sinuses, entire, acute. Corolla blue, epigynous, campanulate, glabrous; tubes ca 1.9 cm long and ca 2.3 cm broad at throat; lobes ca 6 × 9 mm, broadly triangular, obtuse. Filaments ca 8 mm long, glabrous; anthers ca 4.5 mm long, linear oblong, glabrous. Ovary inferior; style ca 12 mm long, stigmatic lobes ca 2 mm long, oblong. Capsules 12 - 15 × 8.0 - 8.5 mm, elongate obconoid, glabrous, valves 5 - 7 mm long. Seeds ca 1.5 mm long, oblong - ellipsoid.

Type : INDIA : West Bengal : Phulloom (Phalloot), Clarke 25722A (K, photo !)

Fls. & Frts. : Aug. - Oct.

Distrib. : INDIA : West Bengal and Sikkim ; NEPAL.

Exsicc. : West Bengal : Sandakpu (Sandakphu), Cave s.n. (CAL ACC. NO. 262113). Sikkim : Gnatong, Ribu & Rhomoo 4616; Gnatong Chus, Smith 4381.

Habitat : On the wet precipices in mountain valleys at elevations between 3200 and 4000 m.

Notes : Smith (l.c.) has recorded the plant as "free from the objectionable odour"

5. *Codonopsis foetens* Hook. f. & Thoms. in J. Linn. Soc. 2 : 16. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 433. 1881 ; Komarov in Act. Hort. Petrop. 29 : 114. 1908 ; Chipp in J. Linn. Soc. 38 : 383. 1908 ; Anth. in Notes R.B.G. Edinb. 15 : 185. 1926 ; Nannf. in Notes R.B.G. Edinb. 16 : 157. 1931. Fig. 14

Ascending herbs, 12 - 35 cm high, sparsely and remotely foliate, sparsely pilose or glabrous, profusely branched near the base; branches 2 - 17 cm long, slender. Leaves alternate or opposite, broadly ovate to elliptic - ovate, caudate to cordate at base, obtuse at apex, entire or subentire, densely white pilose on both surfaces; 3 - 11 × 3 - 10 mm; petioles 1 - 3 mm long, pilose; pedicels 4.2 - 25 mm long, terminal, glabrous or sparsely pilose. Hypanthia 3 - 4 × 7.5 - 9 mm, broadly subglobose, glabrous or sparsely pilose. Calyx perigynous, teeth 8 - 11 × 3 - 4.5 mm, oblong - elliptic or oblong,

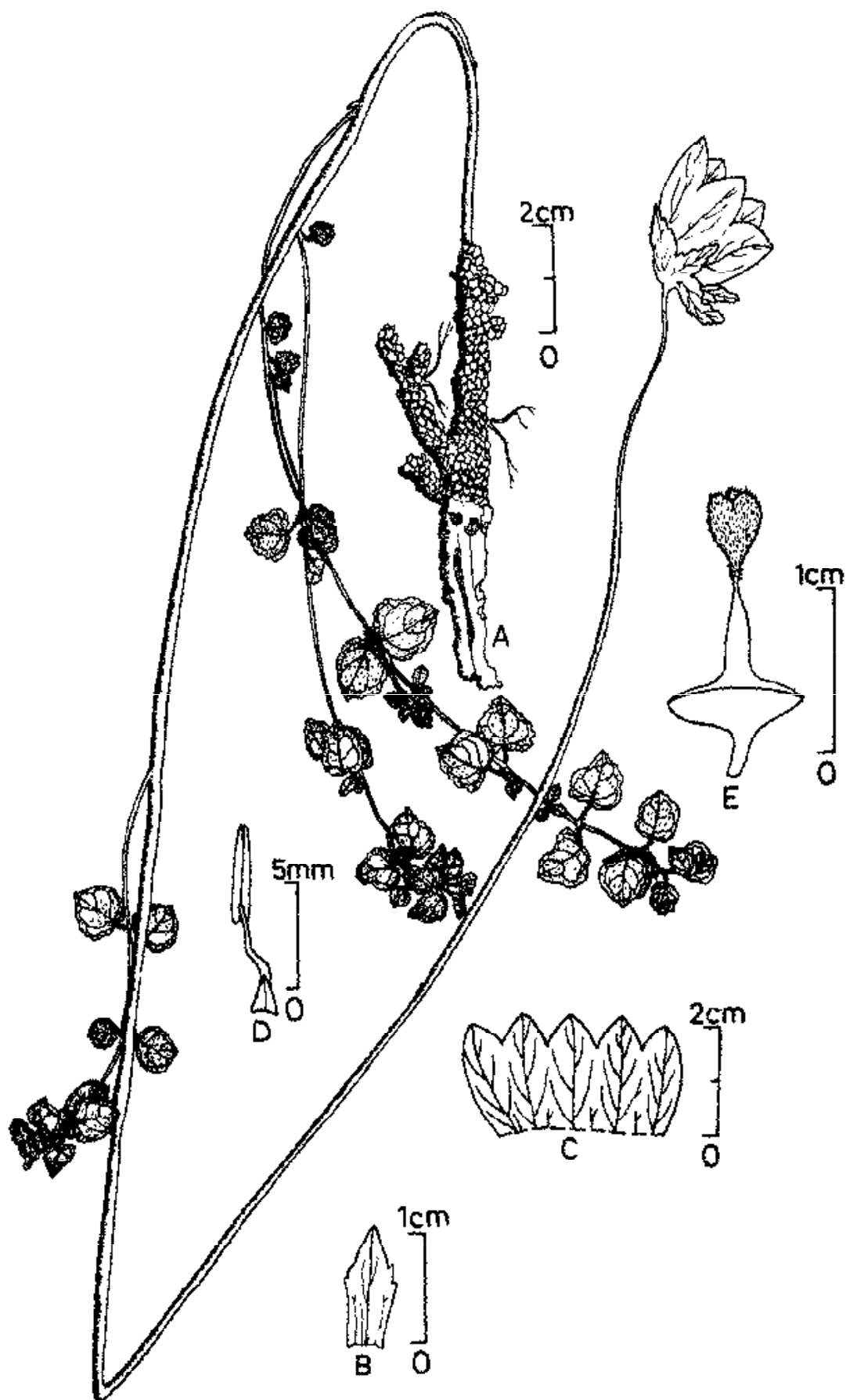


Fig. 14. *Codonopsis foetens* Hook.f. & Thoms. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (Smith 3811).

subentire or remotely few serrate, acute or obtuse, densely pilose outside, sparsely inside. Corolla epigynous, blue or white tinged purple, globose campanulate; tubes 16 - 20 mm long and 18 - 35 mm broad at throat, glabrous, lobes 6 - 8 × 9 - 16 mm, broadly triangular, acute, with a few stiff hairs outside at the apex. Filaments curved above the middle towards the stigma, about as long as the anthers or slightly longer; anthers 3 - 5 mm long, linear - oblong. Ovary semi inferior; style 9 - 10 mm long; stigmatic - lobes 2 - 3 mm long, oblong. Capsules 4 - 6 × 9 - 13 mm, obovoid, sparsely pilose, valves 6 - 8.5 mm long. Seeds *ca* 1 mm long, oblong ellipsoid.

Type : INDIA : Sikkim, *J.D. Hooker s.n.*

Fls. & Frts. : July - Oct.

Distrib. : INDIA : Sikkim ; BHUTAN, CHINA (including Xizang Zizhiqie).

Exsicc. : Sikkim : Tankra, *Gammie* 406 ; Potang la, *King's coll.* 4387 ; Dzongri ('Jongri') to Alokiong, *Anderson* 760 ; Tahshisphu, *Gazulu s.n.* (CAL ACC. NO. 261975) ; Chamnago, *W.W. Smith* 3811.

Habitat : Alpine Himalayas at altitudes between 3500 and 4500 m.

6. *Codonopsis griffithii* C.B. Clarke in Hook.f., Fl. Brit. India 3 : 431. 1881 ; Komarov in Act. Hort. Petrop. 29 : 107. 1908 ; Das in Kanjilal *et al*, Fl. Assam 3 : 121. 1939 ; Rao & Balakr. in Rec. Bot. Surv. India 2 : 134. 1973 ; *Codonopsis* sp. 3 : Griff., Itiner. Notes 2 : 56. n. 866. 1848 & Not. Pl. Asiat. 4 : 281. 1854 & Icon. Pl. Asiat. 4 : t. 482. 1854. *C. viridis* Hook.f. & Thoms. in J. Linn. Soc. 2 : 12. 1858, *p.p.* *C. viridis* var. *hirsuta* Chipp in J. Linn. Soc. Bot. 38 : 386. 1908 ; Anth. in Notes R.G.B. Edinb. 15 : 180. 1926.

Twining herbs, 8 - 36 cm long ; stems shiny, branched, glabrous ; branches hirsute when young. Leaves alternate to opposite, 16 - 22 × 6.5 - 36 mm, ovate to elliptic - lanceolate, rounded to rhomboid at base, acute or rarely obtuse at apex, remotely and minutely denticulate, sparsely to densely hirsute above, densely hirsute beneath ; petioles 5 - 22 mm long, densely hirsute. Flowers solitary ; pedicels 11 - 44 mm long, terminal or leaf - opposed, drooping, sparsely hirsute towards the apex. Hypanthia 8 - 8.5 × 13 - 15 mm, obconic to subglobose, sparsely hirsute ; calyx perigynous, teeth distant, separated by interstices of 5 - 7 mm, 9.5 - 11 × 1.5 - 2 mm, oblong - linear, few and remotely denticulate, recurved, densely hirsute outside. Corolla green, perigynous, tubular - campanulate, glabrous or fulvous outside ; tubes 15 - 18 mm long, 19 - 22 mm broad at the throat ; lobes 5.5 - 7 × 8 - 10 mm,

broadly ovate ; reddish at margins, acute. Filaments *ca* 6 mm long, glabrous ; anthers 4.5 - 5 mm long, linear - oblong, glabrous. Ovary semi-inferior ; style *ca* 5 mm long ; stigmatic - lobes *ca* 3 mm long, ovate. Capsules 13 - 17 × 8 - 9 mm, obconoid to subglobose, sparsely hirsute or glabrous, valves 3.5 - 5.5 mm long. Seeds minute, ellipsoid to oblong, reticulate.

Type : INDIA : Meghalaya : Maflong (Mawphlang), *Griffith s.n.*

Fls. & Frts. : Aug. - Oct.

Distrib. : INDIA : Meghalaya ; BHUTAN.

Exsicc. : Meghalaya : Molimi, Khasia & Jaintia hills, *Hooper* 34676 (BSIS) ; Near Umtenga gate, Khasia & Jaintia Hills, *Deka* 23138 (ASSAM).

Habitat : Twiner on road - side shrubs at elevations between 900 and 1800 m.

Notes : This species has been relegated to varietal status - "*var. hirsuta*" under *C. viridis* Wall. by Chipp (*l.c.*). J.D. Hooker and Thomson (*l.c.*) and Weibel (*l.c.*) considered it as conspecific with *C. viridis* and this was followed by Anthony (*l.c.*) also. However, Komarov (*l.c.*) treated it as a species distinct from *C. viridis*, this is followed here.

C. griffithii can be well differentiated from *C. viridis* by the leaves being sparsely to densely hirsute on the upper surface and densely hirsute on the lower surface, hirsute calyx and smaller flowers. The specimen *Clarke* 40366A (CAL) has its collection locality noted as "Bogapani, Khasia". However, this appears to be erroneous as "Bogapani" is situated in the Tirap district of Arunachal Pradesh and the species has so far not been reported outside Khasia and Jaintia hills of Meghalaya and Bhutan. Probably, the locality of Clarke's collection may be Barapani near Shillong.

The species was first recorded from Bhutan by A.S. Rao and Balakrishnan (*l.c.*) and these specimens could not be examined by the authors.

7. *Codonopsis ovata* Benth. in Royle, Ill. Himal. Bot. : 253, t. 69. f. 3. 1836 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 25. 1858, *incl. var.* ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 433. 1881 ; Komarov in Act. Hort. Petrop. 29 : 115. 1908 ; Chipp in J. Linn. Soc. 38 : 384. 1908, *p.p.* ; Anth. in Notes R.B.G. Edinb. 15 : 186. 1926 ; Blatt., Beaut., Fl. Kashmir 2 : 10, t. 3b. f. 2. 1928.

Local name : *Ludut* (Chenab basin dialect).

Ascending herbs, 11 - 58 cm high, sparsely foliate, glabrous to sparsely pilose, profusely branched near the base ; branches slender, densely foliate. Leaves opposite, 4.5 - 20 × 4.5 - 16 mm, ovate or at times ovate - lanceolate, truncate to attenuate at base, obtuse or acute at apex, entire to obscurely crenate, pilose on both surfaces ; petioles 1 - 3 mm long, sparsely to densely pilose. Flowers solitary, terminal ; pedicels 6.5 - 12.8 cm long, glabrous to sparsely pilose ; hypanthia 2.5 - 3 × 4.5 - 6 mm, subglobose or obconic. Calyx perigynous, glabrous ; teeth 7 - 9.5 × 3.5 - 6 mm, oblong - elliptic, approximate at base, acute at apex, entire, recurved, ciliate. Corolla blue, epigynous, infundibular - campanulate, partite to for *ca* 2/3 the length ; tubes 15 - 21 mm long and 21 - 26 mm broad at throat ; lobes 6 - 9 × 8 - 13 mm, broadly ovate, acute. Filaments 4.5 - 5.5 mm long ; anthers 3 - 3.5 mm long, linear, lanceolate, glabrous. Ovary semi inferior ; style 3.5 - 5 mm long ; stigmatic - lobes *ca* 2 mm long, oblong - ovate. Capsules 5 - 7 × 10 - 12 mm, broadly subglobose or obconoid, valves 5 - 6.5 mm long. Seeds brown, *ca* 2 mm long, oblong - ellipsoid.

Type : INDIA : Cashmere (Kashmir), *Royle* (LIV, photo !).

Fls. & Frts. : Aug. - Oct.

Distrib. : INDIA : Jammu & Kashmir and Himachal Pradesh ; CHINA.

Exsicc. : Jammu & Kashmir : Mirbil pass, *Clarke* 31310A ; Pir Panjal, Kashmir, *Gammie s.n.* Himachal Pradesh : Shrran valley, *Watt* 13490 ; Upper Chenab, *Ellis* 587.

Uses : Stewart (*Punjab Plants* : 132. 1869) has recorded : "Aitchison states that in Lahul its large tap root is ground into flour and eaten, and is applied as an enoiffient ... (?) to bruises and swollen joints, etc. Keshavanand (18/27638B BSIS) has reported about the usage of a small portion of the taproot, by the Guzars of the Kishanganga valley (Western Kashmir), for the separation of butter from butter milk (Lassi) by mixing it with (curdled) milk at the time of churning.

Habitat : on open moist rocks, hill slopes, stream banks amidst *Rhododendron* sp., *Juniperus* sp., at elevations between 3000 and 3400 m.

Notes : The plant is a foetid one like majority of the species of the genus. The separation of specimens of *C. ovata* and *C. clematidea* has often been difficult, though the original figure accompanying the description of *C. ovata* *Royle* (*l.c.*) varies much from that of *C. clematidea* (*Glosocomia clematidea* (Schrenk) Fisch. in *Regel Gartenflora* : 266, t. 167. f. 2. 1856). C.B. Clarke (*l.c.*) remarked : "*C. clematidea* Schrenk has larger subglabrous leaves, but

it probably only a form of *C. ovata*." Chipp merged *C. clematidea* with *C. ovata* and proposed 3 new varieties of which var. *cuspidata* includes *C. clematidea*. The other variety var. *obtusata* Chipp has been included by Federov (in Shishkin & Bobrov Fl. URSS : 313. 1957) under *C. clematidea*. The status of var. *obtusata* could not be decided as no specimen of it could be examined. Chipp has also merged the varieties var. *B. ramosissima* Hook.f. & Thoms. and var. *glabrata* Hook.f. MSS - with *C. ovata* which were segregated from *C. ovata* Benth. on the variation of leaf characters. Komarov (l.c.), Anthony (l.c.) and Nannfeldt (Notes R.B.G. Edinb. 78 : 156, 159. 1931) considered *C. ovata* as a distinct separate from *C. clematidea* because of the smaller (6 - 9 mm long), ciliate calyx teeth and infundibular - campanulate corolla in the former while the latter possesses larger calyx teeth (13 - 19 mm long) that are glabrous except towards the apices and broadly - campanulate corolla. The leaves of *C. ovata* are opposite while alternate to opposite phyllotaxy prevails in *C. clematidea*. The distributional data also point to their distinctness : *C. ovata* being reported from Sino-Himalayan ranges, and the distribution of *C. clematidea* extends from China to USSR.

8. **Codonopsis purpurea** Wall. in Roxb., Fl. Ind. 2 : 105. 1824 ; A.DC., Monogr. Camp. : 121. 1830 ; Hook f. & Thoms. in J. Linn. Soc. 2 : 12. 1858 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 432. 1881 ; Chipp in J. Linn. Soc. 38 : 390. 1908 ; Komarov in Act. Hort. Petrop. 29 : 113. 1908 ; Anth. in Notes R.B.G. Edinb. 15 : 185. 1926 ; Hara in Ohashi, Fl. E. Himal. Rep. 3 : 109. 1975. *Campanula purpurea* (Wall.) Spreng., Cura post. : 78. 1827. *Wahlenbergia purpurea* (Wall.) A. DC. in DC., Prodr. 7 : 425. 1839. Fig. 15

Rambling herbs, up to 57 cm high ; branches opposite, glabrous, fulvous at nodes. Leaves opposite or very rarely subopposite, remote, 2.9 - 8 x 0.8 - 3.5 cm, ovate - lanceolate or oblong - lanceolate, attenuate or rounded at base, acute or obtuse at apex, subentire, glaucous beneath, petioles 2 - 6 mm, furrowed, glabrous. Flowers foetid, terminal or leaf - opposite ; pedicels glabrous, 3 - 18 mm long. Hypanthia ca 7 x 13 mm, obconic. Calyx epigynous, glabrous ; teeth approximate at base, ca 13 mm long and ca 7 mm broad at base, oblong or triangular, acute, plane or recurved. Corolla purple, epigynous, campanulate, glabrous ; tubes ca 18 mm long and ca 22 mm broad at throat ; lobes ca 9.5 x 9 mm, triangular - ovate to ovate, acute. Filaments glabrous, twice as long as the anthers ; anthers ca 4 mm long, linear - oblong. Ovary inferior ; style ca 9 mm long ; stigmatic lobes ca 2 mm long, ovate. Capsules 17 - 18 x 15 - 17 mm, subglobose, glabrous, valves 5 - 11 mm long.

Type : NEPAL : Gosain Than, Wallich Cat. No. 1299 (K. Microfiche !).

Fls. & Frts. : Aug. - Sept.

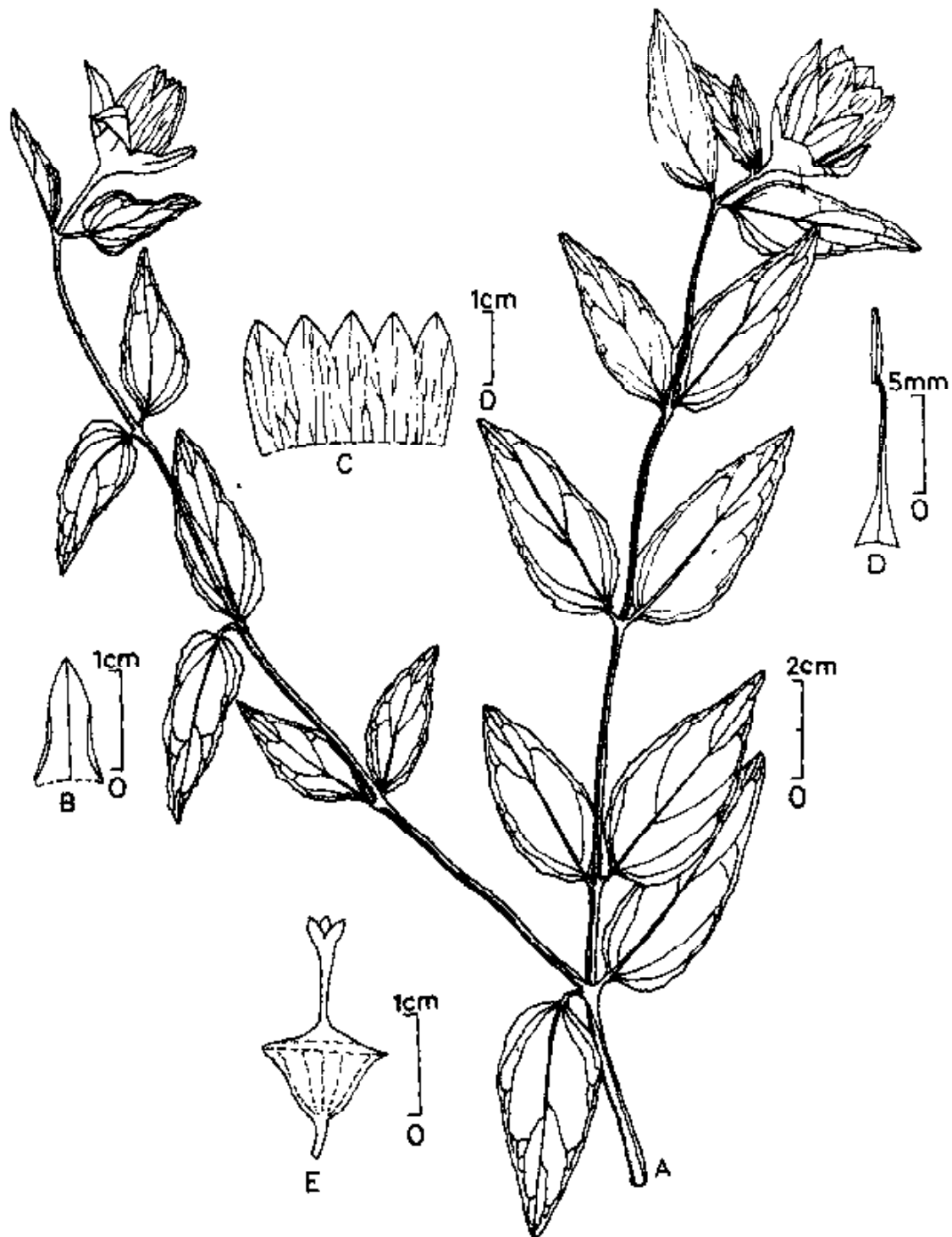


Fig. 15. *Codonopsis purpurea* Wall. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (*Collett 30*).

Distrib. : INDIA : Uttar Pradesh, Meghalaya, Nagaland ; NEPAL, CHINA.

Exsicc. : Meghalaya : Shillong, Khasi hills, *Collett* 30. Nagaland : Dzulak valley, *Bor's coll. s.n.* (DD ACC. NO. 131731).

Habitat : At elevations between 1500 and 2400 m.

Notes : Wallich (*l.c.*) described the flowers of *C. purpurea* as very disagreeable smell, somewhat like of *Bignonia indica*.

9. **Codonopsis rotundifolia** Benth. in Royle, Ill. Bot. Himal : 254, t. 62, f.2. 1836 ; Hook. in Bot. Mag. 82 : t. 4942. 1856 & 83 : t. 5018. 1957 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 14. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 432. 1881 ; Chipp in J. Linn. Soc. 38 : 382. 1908, *p.p.* ; Komarov in Act. Hort. Petrop. 29 : 107. 1908 ; Anth. in Notes R.B.G. Edinb. 15 : 180. 1926 ; Blatt., Beaut. Fl. Kashmir 2 : 9, t. 36, f. 1. 1928 ; Coventry, Fl. Kashmir Ser. 3 : 69, t. 35. 1980 ; Nair, Fl. Bashahr Himal. 170. 1977.

Twining herbs ; branches shiny, glabrous to patently pilose. Leaves alternate or opposite, 1.5 - 8 × 1 - 6 cm, ovate or rotundate, truncate at base, obtuse or acute of apex, coarsely crenate or serrate, often ciliate, membranous, glabrous or sparsely pilose on both surfaces ; petioles 3 - 21 mm long, slender, sparsely pilose. Pedicels leaf opposed or terminal, 2 - 16 cm long. Hypanthia 5 - 7 × 7.5 - 9 mm, broadly obconic to broadly subglobose. Calyx perigynous ; teeth foliaceous, 1.5 - 2.2 cm long and ca 9 mm broad in middle, elliptic to elliptic - ovate, remotely and minutely denticulate to remotely serrate, ciliate, often recurved, acute, slightly shorter than corolla. Corolla white becoming green or blue with purple nerves, epigynous, broadly campanulate ; tubes glabrous, 1.8 - 2 cm long and 2.5 - 3 cm broad at throat ; lobes 7.5 - 10 × 10 - 14 mm, broadly ovate, purplish and slightly thickened at margins, acute. Filaments thickened at margins, glabrous, 6 - 7 mm long ; anthers 5 - 6 mm, linear oblong, glabrous. Ovary semiinferior ; style 9 - 9.5 mm long ; stigmatic - lobes 2 - 2.5 mm long, ovate. Capsules 8.5 - 11 × 12 - 18 mm, obconoid to subglobose ; valves shorter than the calyx teeth. Seeds brownish - yellow, 1 - 1.5 mm long, oblanceolate, with reticulate testa, (mature ones not seen).

Type : Royle, Ill. Bot. Himal. t. 62, f.2.

Fls. & Frts. : July - Oct.

Distrib. : Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh ; CHINA.

Exsicc. : Jammu & Kashmir : Khanabal forests, Jhellum valley, *Keshavanand* 510 (DD). Himachal Pradesh : Manali, *Bor* 15315 (DD). Punjab : Rahla forest, *Singh* 22993 (BSD). Uttar Pradesh : Primula valley, East Almora divn., *C. Thomas* s.n. (DD).

Chr. No. : $2n=16$ (Zhukova in N.A. Avrorin plantarum Zonam Polarem Transportatio II : 139-149, 1967).

Habitat : On shady river banks facing slopes and on moist rocky places in association with *Osmunda* spp. at elevations between 1800 and 4500 m.

Notes : The type was not mentioned in the protologue. As it appears from J.D. Hooker & Thomson (1858), the taxon was cultivated in Kew by Royle. The accompanying figure in the protologue is considered as the type.

Bor (15315 - DD) and U.C. Bhattacharya (44681 - BSD) have reported the plant as "evil smelling" and "foetid" respectively."

10. *Codonopsis subsimplex* Hook. f. & Thoms. in J. Linn. Soc. 2 : 16, 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 432, 1881 ; Komarov in Act. Hort. Petrop. 29 : 113, 1908 ; Chipp. in J. Linn. Soc. Bot. 38 : 388, 1908 ; Hara, Fl. E. Himal. Rep. 1 : 129, 1971. (Fig. 16)

Suberect to ascending herbs, 20-50 cm high ; branches glabrous or pilose ; rootstocks simple or branched, 8-15 mm in diam. Leaves alternate to opposite, 1-6.2 x 0.4-4.5 cm, broadly ovate to elliptic-lanceolate, rounded to attenuate at base, sinuate to crenate-serrate, pubescent or pilose ; petioles 0.1-4.5 cm long, glabrous or pubescent. Pedicels 1.3-11 cm long, terminal, glabrous. Hypanthia ca 10.5 x 5 mm, broadly subglobose. Calyx perigynous, glabrous ; teeth 10-14 mm long and 5-8 mm broad at base, ovate to ovate-lanceolate with narrow sinuses, entire or crenate-serrate, acute or acuminate, more or less as long as the corolla-tubes. Crolla pale blue with greenish and whitish spots, perigynous, glabrous ; tubes 10-14 mm long and 11-14 mm broad at throat ; lobes 3-4 x 5-6 mm, broadly triangular, obtuse. Filaments 4.5-5 mm long, glabrous ; anthers 2.5-3 mm long, linear-oblong, glabrous. Ovary semi-inferior ; style 5-5.5 mm long ; stigmatic-lobes 2-3 mm long, oblong-ovate. Capsules 7-10 x ca 13 mm, subglobose, valves 5-6 mm long. Seeds ca 1 mm long, oblong-ellipsoid.

Type : INDIA : Sikkim : without precise locality, *J.D. Hooker* s.n. (K, photo !).

Fls. & Frts. : July-Dec.

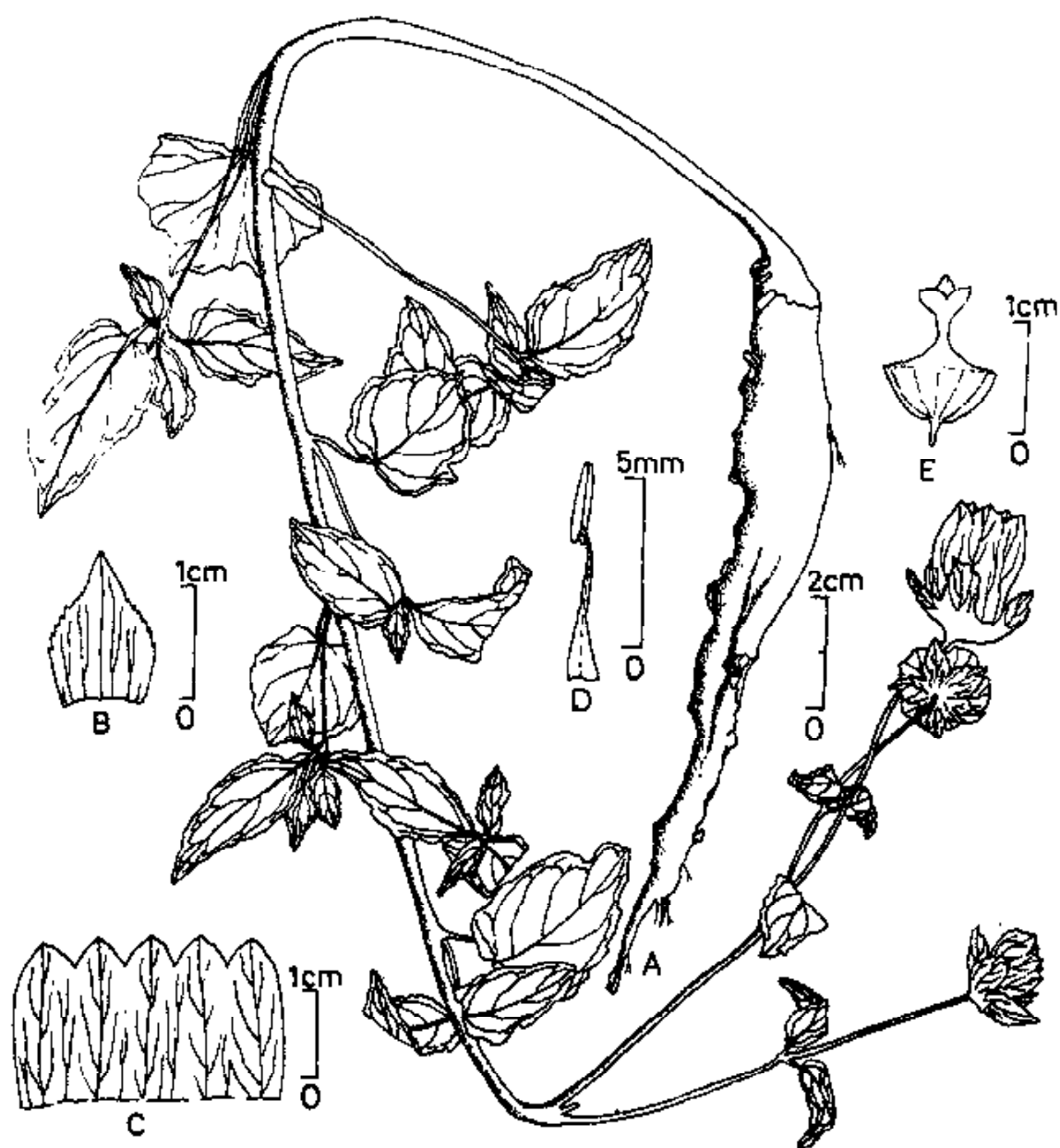


Fig. 16. *Codonopsis subsimplex* Hook.f. & Thoms. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (King's coll. s.n.).

Distrib. : INDIA. West Bengal, Sikkim ; NEPAL, BHUTAN, CHINA (Zizang Zizaqu).

Exsicc. : West Bengal : Singaleleh, Darjeeling dist., *Clarke* 13450C. Sikkim : Zemu valley, *Smith & Cave* 1653G ; Rothangoong, *Ribu* 111 ; South of Dzongri, *King's coll.* s.n.

Chr., No. : $2n=16$ (Rosen, Act. Hort. Gothob. 7 : 31 42. 1931).

Habitat : In temperate and alpine regions at elevations between 3300 and 4700 m.

11. **Codonopsis thalictrifolia** Wall. in Roxb., Fl. Ind. 2 : 106. 1824 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 16. 1858 ; C.B. Clarke in Hook.f., Fl. Brit. India 3 : 432. 1881 ; Komarov in Act. Hort. Petrop. 29 : 114. 1908 ; Chipp in J. Linn. Soc. 38 : 381. 1908 ; Anth. in Notes R.B.G. Edinb. 15 : 186. 1926 ; Nannf. in Notes R.B.G. Edinb. 16 : 159. 1931 ; Hara in Ohashi, Fl. E. Himal. Rep. 3 : 109. 1975. *Glosocomia tenera* D. Don, Prodr. Fl. Nepal. : 158. 1825, *nom. superfl.* *G. thalictrifolia* Wall. *nomen* in Wall. Cat. No. 1297. 1829. *Wahlenbergia thalictrifolia* (Wall.) A. DC. in DC., Prodr. 7 : 425. 1839. Fig. 17

Local name : *Mendo Gyawa* (Bhut.).

Ascending herbs, 11–33 cm high ; stems robust, sparsely pilose or glabrous, profusely branched near base ; rootstocks simple or branched, 6–8 mm in diam. Leaves alternate or opposite, sparse and remote on fertile stems and closely arranged on sterile branches, resembling those in *C. thalictrium*, 2–5.5 × 2–6 mm, orbicular, triangular-ovate to ovate, truncate to reniform at base, obtuse at apex, entire to remotely crenate, pilose on both surfaces ; petioles 0.5–2.5 mm long, very slender, glabrous to densely pilose. Pedicels 1.5–9 cm long, terminal. Hypanthia 1.5–2 × 6–8 mm, broadly obconic or subglobose, glabrous or scabrid-pilose. Calyx perigynous ; teeth separated by interstices of 1–1.5 mm, 5–7 × 2–2.5 mm, oblong, entire to obscurely denticulate, obtuse, glabrous or scabrid-pilose. Corolla blue, epigynous, tubular-campanulate, glabrous ; tubes 18–22 mm long ; lobes 4–5 × 6–8 mm, broadly triangular, obtuse. Filaments 8.5–10 mm long, glabrous ; anthers 3–3.5 mm long, carinate. Ovary semi inferior ; style 8–11 mm long ; stigmatic-lobes *ca* 1 mm long, ovate. Capsules 7–8 × 11–12 mm, broadly obconoid to subglobose, glabrous ; valves 6–7 mm long. Seeds *ca* 1.5 mm long, narrowly ellipsoid.

Type : NEPAL : Gosain - Than, *Wallich* Cat. No. 1297 (K, Microfiche !).

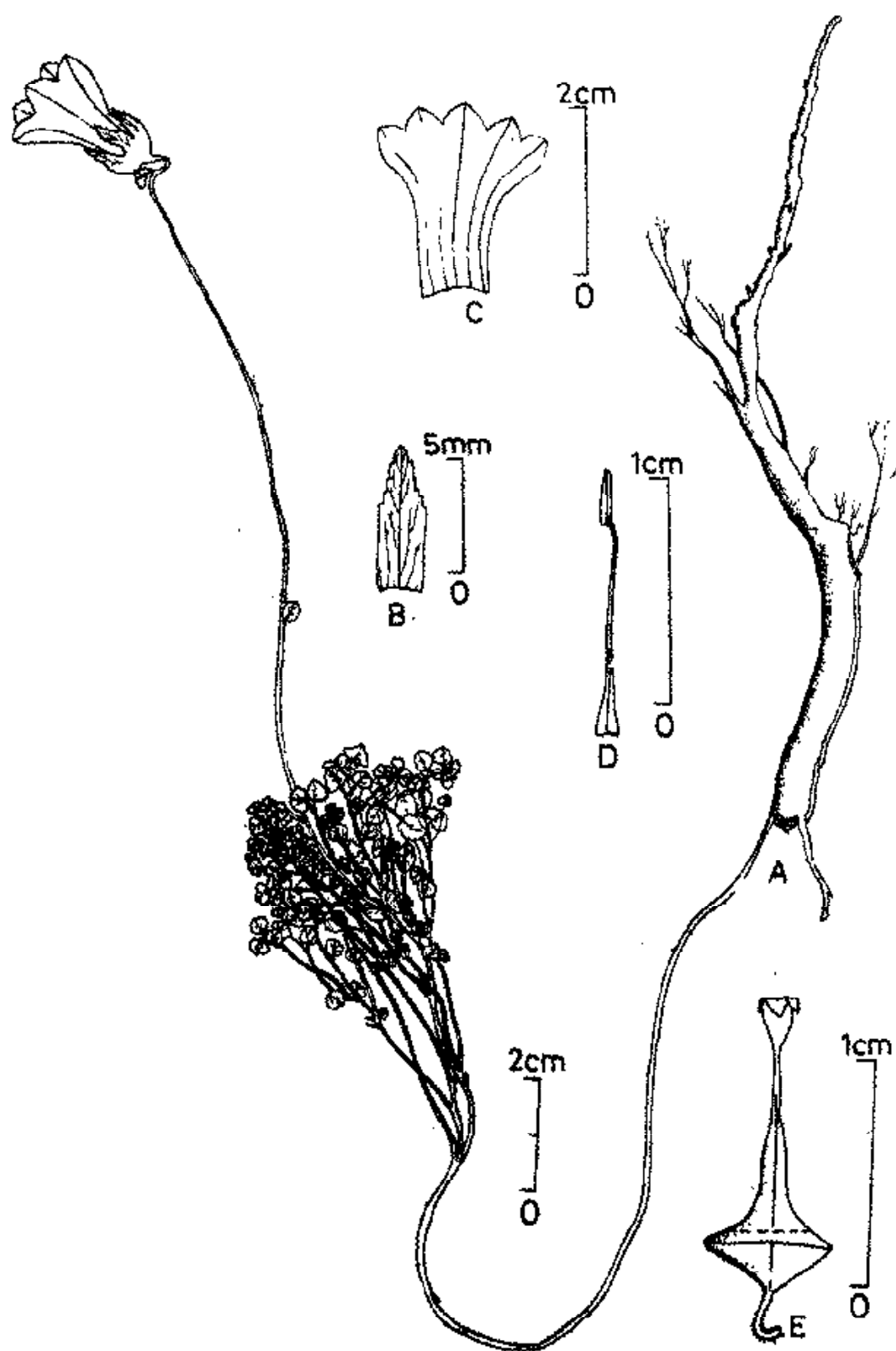


Fig. 17. *Codonopsis thalictrifolia* Wall. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (King's coll. s.n.).

Fls. & Frts. : July Dec.

Distrib. : INDIA : West Bengal, Sikkim ; NEPAL, BHUTAN, CHINA (Zizang Ziziqu).

Exsicc. : West Bengal : Singalelah, *Kurz s.n.* (CAL ACC. NO. 261994).
Sikkim : Dzongri ('Jongri') to Alokiong, *Anderson 760* ; Bhutan : Loc.? *King's coll. s.n.*

Habitat : At elevations between 3300 and 4800 m.

Notes : D. Don (*l.c.*) reported the number of locules in the ovary to be 5 while Wallich (*l.c.*) recorded 2. However, the specimens examined in this work showed uniformly 3 locular ovary.

12. *Codonopsis viridis* Wall. in Roxb., *Fl. Ind.* 2 : 103. 1824 ; A. DC., *Monogr. Camp.* : 120. 1830 ; Hook.f. & Thoms. in *J. Linn. Soc.* 2 : 12. 1858, *p.p.* ; C.B. Clarke in Hook.f., *Fl. Brit. India* 3 : 431. 1881 ; Komarov in *Act. Hort. Petrop.* 29 : 106. 1908 ; Chipp in *J. Linn. Soc.* 38 : 386. 1908, *excl. var.* ; Anth. in *Notes R.B.G. Edinb.* 15 : 180. 1926, *excl. var.* ; Weibel in *Candollea* 17 : 84. 1960, *p.p.* ; Hara, *Fl. E. Himal. Rep.* 1 : 326. 1966 ; A.S. Rao & Balakr. in *Rec. Bot. Surv. India.* 20 : 134. 1983. *Campanula viridis* (Wall.) Spreng., *Cur. post.* : 78. 1827. *Whlenbergia viridis* (Wall.) A. DC., in *DC. Prodr.* 7 : 424. 1839.

Fig. 18

Local name : Jophmi (Garhwali).

Twining herbs ; branches glabrous, sometimes densely villous when young. Leaves alternate or opposite, 2.5 - 8.7 × 1 - 1.5 cm, cordate - ovate to ovate - lanceolate, rounded or truncate to cordate at base, acute to acuminate at apex, sub - entire or obscurely crenate, puberulous above and with densely adpressed hairs beneath ; petioles 2.5 - 18 cm long, often twisted, pilose. Flowers foetid, supra axillary, axillary or leaf opposite ; pedicels 2 - 4 cm long, drooping, glabrous or pubescent. Hypanthia 7 - 10 × 17 - 23 mm, subglobose, pubescent. Calyx perigynous, teeth separated by interstices of 6.5 - 11 mm, 12.5 - 18.5 mm long and ca 2 mm broad in middle, oblong, linear, remotely denticulate, recurved, acute, pubescent at both surfaces. Corolla greenish - yellow, perigynous, broadly campanulate, densely pubescent while in buds and sparsely pilose later ; tubes 2 - 2.3 cm long and 2.5 - 3 cm broad at throat ; lobes 10 - 11 × 8 - 10 mm, ovate, acute. Filaments 6 - 6.5 mm long ; glabrous ; anthers ca 6 mm long, linear, glabrous. Ovary semi inferior ; style 8.5 - 12 mm long ; stigmatic - lobes 2.5 - 3 mm long, ovate. Capsules 1 - 1.2 × 1.6 - 2 cm, broadly subglobose ; valves 6 - 8 mm long. Seeds reddish - brown, minute, ellipsoid, compressed, reticulate.

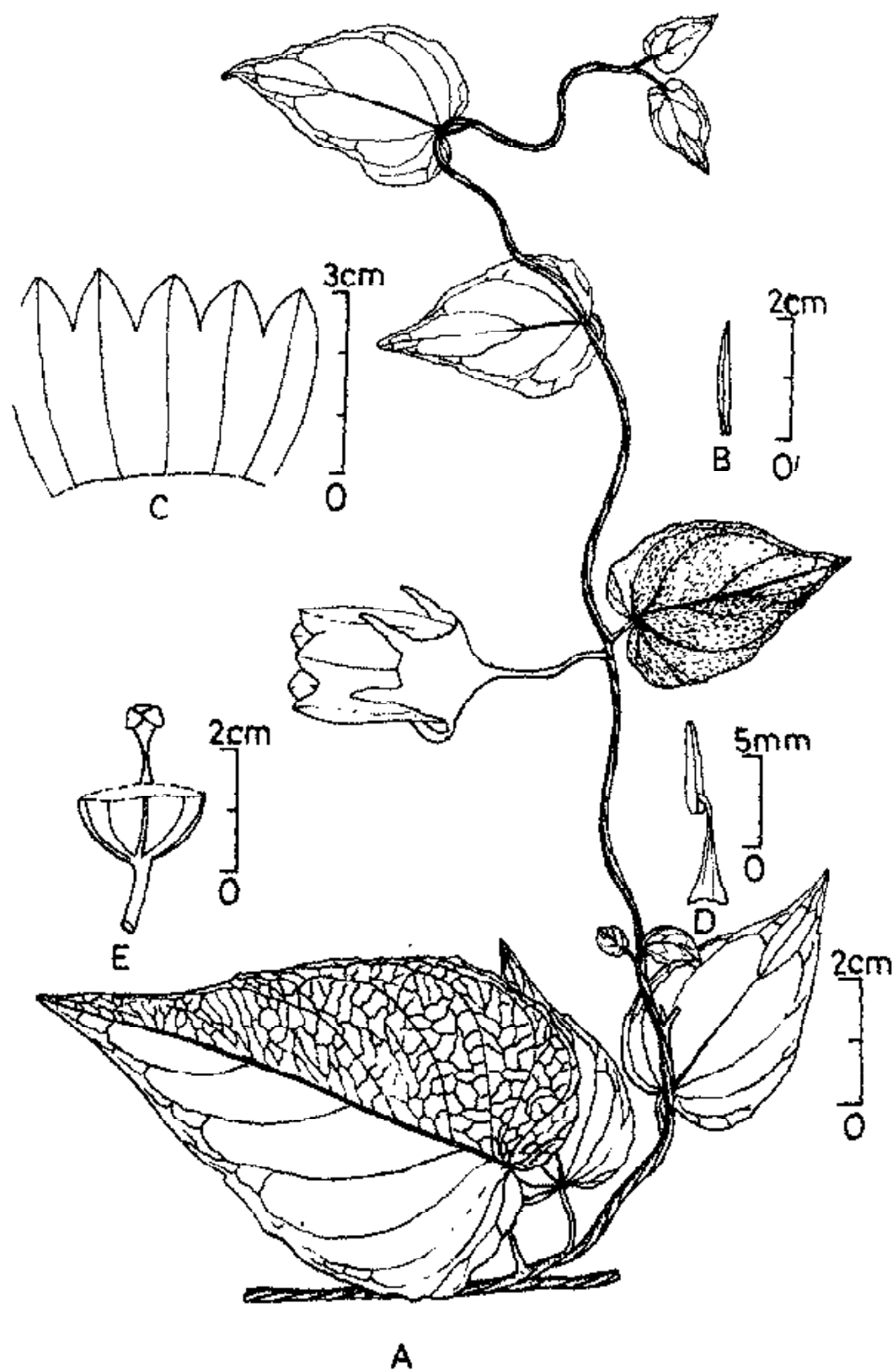


Fig. 18. *Codonopsis viridis* Wall. A. Habit. B. Calyx lobe. C. Corolla split opened. D. Stamen. E. Pistil (*Stainton et al 4224*).

Type : Nepalia, Wallich Cat. No. 1298 (K. Microfiche !).

Fls. & Frts. : Aug. Dec.

Distrib. : INDIA : Uttar Pradesh ; NEPAL, BHUTAN.

Exsicc. : Uttar Pradesh : Jikhani Bunglow, Chandipur, Garhwal, *Osmateon* 493 (DD) ; Wan, Garhwal, *Bhattacharya* 30829 (BSD) ; Kumaon ('Kamaon'), *Blinkworth* in Wallich, Cat. No. 1298 (CAL ACC. NO. 262052, Sub '*C. purpurea*') ; Ralam valley, Kumaon, *Inayat* 24631 ; Mana, *Stainton, Sykes & Williams* 4224.

Habitat : Among shady terrace - bank vegetation, dense forests, forest clearings at elevations between 1500 and 2300 m.

Notes : Komarov (*l.c.*) had described the corolla as densely pilose inside, a character which could not be observed in the specimens examined in this work. The species was first recorded from Bhutan by Rao and Balakrishnan (*l.c.*).

TAXA IMPERFECTLY KNOWN

1. *Codonopsis convolvulacea* Kurz in J. Bot. 11 : 195. 1873 ; Oliver in Hook., Leon. Pl. 24 : t. 2385. 1895 ; Prain in Bot. Mag. 134 : t. 8178. 1908 ; Komarov in Act. Hort. Petrop. 29 : 103. 1908 ; Chipp in J. Linn. Soc. 38 : 389. 1908, *excl. syn. C. vinciflora* Weibel in Candollea 17 : 83. 1960.

Twining herbs slender, glabrous. Rootstocks subspherical. Leaves alternate or opposite, short petiolate, ovate-lanceolate to lanceolate or linear, rounded to cuneate or rarely cordate at base, entire to subentire, recurved, acute or acuminate, glabrous on both surfaces or scarbrid-pilose on upper surface, 2.5 - 5 cm long. Pedicels terminal or axillary, incurved at apex, 7.5 - 10 cm long ; bracts linear or linear - lanceolate. Calyx teeth lanceolate or oblong, acuminate, curved and hirsute along margins, *ca* 12.5 mm long. Corolla blue, rotate, upto 4 cm broad at mouth ; lobes spreading, elliptic, longer than calyx. Filaments densely pilose internally.

Notes : This species has been reported from Nepal for the first time by Weibel (*l.c.*). However, no specimens of it could be traced in any of the major Indian herbaria and the above description is adopted from those given by Kurz (*l.c.*) and Komarov (*l.c.*). Komarov (*l.c.*) considered *C. convolvulacea* as allied to *C. vinciflora*, but differing by its entire, thick, reticulately venated leaves and from his description it appears that *C. convolvulacea* is a "good" species.

2. **Codonopsis nepalensis** Hara in J. Jap. Bot. 53 : 11. 138. 1978.

Twining glabrous herbs. Leaves alternate or opposite, petiolate ; petioles glabrous, 5-20 mm long ; ovate or lanceolate-ovate, rounded at base, entire, acute, minutely pilose on the margins above, 3-6 × 1.2 - 2.7 cm. Pedicels terminal or axillary, 3-5 cm long. Calyx perigynous ; hypanthia subglobose, glabrous, ca 7 mm × ca 14 mm, teeth triangular or lanceolate-oblong, acute entire, subacute (at apex), glabrous, 15-20 × 6-9 mm. Corolla cream-coloured, with reddish veins, epigynous, broadly-companulate, minutely pilose within upper region (longer than calyx-lobes), ca 2.5 cm long and 2 cm in diam. ; lobes triangular, minutely pilose internally, 8 - 10 × ca 10 cm. Filaments linear, glabrous, ca 4 mm long ; anthers linear, glabrous, ca 4 mm long ; anthers linear, glabrous, ca 4.5 mm long. Ovary semi inferior ; style slender, ca 5 mm long ; stigmatic-lobes 3, externally papillose. Fruits and seeds not seen.

Notes : No other specimen of this species could be examined than the photograph of the holotype and the description given above is adopted from that of Hara (*l.c.*) and is also based upon the photograph of the type specimen examined.

Hara (*l.c.*) considers the species as closely allied to *C. rotundifolia* Benth. but differing by its glabrous stems, acutish petioles and peduncles, entire, glabrescent leaves, and glabrous acutish calyx-teeth.

6. CYANANTHUS

Wall. ex. Benth. in Royle, Ill. Bot. Himal. 309. 1836 ; Hook. f. & Thoms. in J. Linn. Soc. 2 : 19. 1859 ; Benth. in Benth. & Hook. f., Gen. Pl. 2 : 557. 1876. C.B. Clarke in Hook. f., Fl. Brit. India 3 : 433. 1881 ; Franch. in J. de Bot. 1 : 257. 1887 ; Marquand in Kew Bull. 1924 : 243. 1924.

Annual or perennial herbs with slender roots or branched or unbranched rootstocks covered with scaly leaves ; stems decumbent to ascending, simple or branched, glabrous or hairy. Leaves alternate to opposite, sessile or petiolate, wedge shaped to caudate at base, acute to obtuse at apex, entire to serrate, very rarely incised-lobate, often recurved, glabrous or hairy. Flowers solitary, pedicellate or sessile, 5-merous ; pedicels terminal, short and concealed by involucre like leaves or well developed, sparsely to densely hirsute. Calyx hypogynous, free from ovary, 5-partite to various lengths in upper half ; tubes cylindric or cylindric-campanulate, rarely ovoid or inflated in fruits, sparsely to densely hirsute, rarely glabrous or glabrescent ; teeth induplicate-valvate,

triangular to lanceolate, acute, glabrous or sparsely to densely hirsute outside, always densely hirsute inside. Corolla inserted at base of ovary above calyx, tubular-campanulate to infundibular-campanulate, 5-partite to various lengths in upper half; tubes very sparsely pilose to densely villous at throats or rarely glabrous; lobes induplicate-valvate, broadly ovate to oblong, subapiculate, rarely barbate at apex. Stamens inserted at base of ovary and as long as ovary; filaments free, membranous, slightly dilated towards base, glabrous or pubescent in (*C. schimperi*) anthers basifixed, linear or cordate, dehiscing longitudinally, adhering by their sides when young forming a 'hood' covering stigma, pushed down later to base of style by upgrowing style and becoming free. Ovary superior, 3-5 loculed, conical, as long as calyx-tubes; ovules anatropous, many, on axile placenta; style short, cylindric, slightly thickened towards both ends; stigmatic-lobes 3-5, erect, later recurved, ovate to linear, densely hairy when young. Capsules conoid-ovoid to ovoid, loculicidally and apically (3-4-) 5-valved, many-seeded, more or less included in calyx-tube, glabrous, glabrescent or sparsely to densely hirsute. Seeds oblong to ellipsoid, tests obscurely reticulate or smooth.

Type : *Cyananthus integra* Wall. ex Benth.

Distrib. : Restricted to high regions of Himalaya extending from Western China to Jammu & Kashmir and hills of N.E. India, ca 30 species, 9 in India including 2 endemics.

KEY TO THE SPECIES

- | | | | |
|-----|--|-------|--------------------------|
| 1a. | Plants perennials; root stocks stout | ..... | 2 |
| b. | Plants annuals; root stocks slender | ..... | 8 |
| 2a. | Leaves entire to crenulate | ..... | 3 |
| b. | Leaves 3-7 incise-lobed | ..... | <i>C. lobatus</i> 6 |
| 3a. | Corolla densely villous at throat inside, lobes longer than broad | ..... | 4 |
| b. | Corolla glabrous or rarely sparsely-pilose at throat within, lobes broader than long | ..... | 6 |
| 4a. | Calyx tube much inflated after anthesis; seeds ca 1 mm long | .... | 5 |
| b. | Calyx-tube not inflated after anthesis; seeds ca 2 mm long | ..... | <i>C. microphyllus</i> 7 |

- 5a. Leaves subsessile or shortly petiolate (up to 1 mm), elliptic, elliptic-lanceolate or rarely oblanceolate *C. incanus* 3
- b. Leaves all petiolate, rhomboid, obovate or spatulate *C. spathulifolius* 9
- 6a. Leaves oblong to elliptic 7
- b. Leaves ovate lanceolate *C. cordifolius* 1
- 7a. Corolla sparsely pilose at throat ; leaves tapering at base 5. *C. integra*
- b. Corolla glabrous at throat, barbate at apex ; leaves mostly wedge-shaped and clasping the stems at base *C. pedunculatus* 8
- 8a. Leaves cordate at base ; capsules 8 - 14 × 7 - 13 mm *C. inflatus* 4
- b. Leaves truncate at base ; capsules ca 5 × 6 mm *C. hookeri* 2
1. ***Cyananthus cordifolius*** Duthie in Kew Bull. 1912 : 37. 1912 ; Marquand in Kew Bull. 1924 : 251. 1924. **Fig. 21**

Stems simple or branched, ascending, sparsely pilose or glabrous, 1.2 - 12 cm long. Leaves sessile or short petiolate, 5 - 15 × 4 - 9 mm, ovate-lanceolate, cordate at base, obtuse or subacute at apex, crenate-dentate, glabrous or sparsely white pilose on both surfaces ; petioles up to 2 mm long. Flowering pedicels 8 - 10 mm long. Calyx tubular, densely hirsute, lobed for 1/3 of the length ; tubes 7 - 9 mm long ; teeth 3.5 - 4.5 mm long, lanceolate, densely hirsute on both surfaces, at times reflexed at apex. Corolla blue to purple, glabrous or rarely sparsely pilose at throat, lobed for ca 1/5 the length ; tubes ca 23 mm long and ca 13 mm broad at throat ; lobes ca 6 × ca 8 mm, broadly ovate, subapiculate. Filaments ca 7 mm long ; anthers ca 2.5 mm long. Ovary ca 9 mm long ; style ca 3.5 mm long ; stigma ca 1.5 mm long. Fruits and seeds not seen.

Types : NEPAL, Nampa Gadh, *Duthie* 5730 (DD, K, Photo !)
INDIA : Kuti rangti valley, N. Kumaon, *Duthie* 3114.

Fls. : July - Aug.

Distrib. : INDIA : Uttar Pradesh ; NEPAL.

Exsicc. : Uttar Pradesh : Kultangti valley, Byans, *Duthie* 5730a ; Gurjakhari, *Stainton, Sykes & Williams* 3918.

Habitat : On steep cliffs along river at elevations between 330 and 4000 m.

Notes : This description is based on three specimens that could be examined. In the Nepalese specimen (*Stainton, Sykes & Williams* 3918 CAL) both sessile and petiolate leaves are seen. The corolla is divided for ca 1/5 of its length and is glabrous at throat ; *Duthie (l.c.)* describes the corolla as glabrous but "ad medium divisa". The corolla being 5 - partite up to 1/2 of the length has been observed in the specimen *Duthie* 5730a (CAL) which is sparsely pilose at throat also.

The collection locality and field no. of the specimen *Duthie* 5730 a (CAL ACC. NO. 262185) and *Duthie* 5730 (DD, K, Photo) does not tally with each other and with that in the protologue.

2. **Cyananthus hookeri** C.B. Clarke in Hook.f., Fl. Brit. India 3 : 435. 1881. *Cyananthus* sp. no. 6. Hook.f. & Thoms. in J. Linn. Soc. 2 : 21. 1858. *Cyananthus hookeri* var. *levicaulis* Franch. in J. Bot. 1 : 281. 1887, *syn. nov.* *Cyananthus hookeri* var. *hispidus* Marquand in Kew Bull. 1924 : 248. 1924, *non* Franch., 1887. **Fig. 22**

Stems 7 -20 cm long, branched, ascending, sparsely white hirsute towards base and densely towards apex, at times glabrescent. Leaves alternate, 3 - 6 x 2 - 4 mm, ovate, truncate at base, acute at apex, subentire to sinuate-dentate, densely white hirsute on both surfaces or very rarely lower leaves sparsely hirsute ; petioles 1 - 4 mm long, densely white hirsute. Calyx in fruit fulvous, patently hirsute, lobed for 1/2 of the length, lobes 5 - 6 x 4 mm. Capsules ca 5 x 6 mm, ellipsoid, 3 - 5 valved, included in the calyx. Seeds ca 1 mm long, ellipsoid.

Type : NEPAL : Wallanchoon, J.D. Hooker s.n. (K. Photo !).

Fls. & Frts. : Aug. Oct.

Distrib. : INDIA : Sikkim ; NEPAL, CHINA.

Exsicc. : Sikkim, Sebu Valley, *Gammie* 1155.

Habitat : In the alpine meadows and dry fields, foot of snow clad mountains at elevations between 2900 and 4200 m.

Notes : Franchet (*l.c.*) described 2 varieties under *Cyananthus hookeri* of which the description of var. *hispidus* (plants with intensely hirsute stems) corresponds well with those of the typical *Cyananthus*

hookeri from Nepal. *Cyananthus hookeri* var. *levicaulis* Franch. and *Cyananthus hookeri* var. *hispidus* Marquand are superfluous names as they both are based on the type of *Cyananthus hookeri* C.B. Clarke.

Marquand (*l.c.*) described two more varieties var. *densus* from Tibet and Szechuan and var. *grandiflorus* from Yunan and stated that "the four varieties following are distinct enough in extreme examples, but transitional stages occur" a statement which questions the basis of the splitting the species into so many varieties. The Indian elements are treated under *Cyananthus hookeri* as described by Clarke (*l.c.*)

Only two imperfect specimens from Sikkim could be examined from the Indian herbaria along with the type photograph. No specimens from Sikkim and Bhutan as reported by Marquand (*l.c.*) for *C. hookeri* var. *hispidus* Marquand are not available in any of the Indian herbaria. The above description is drawn from study of the available specimens and descriptions given by J.D. Hooker & Thomson (*l.c.*) C.B. Clarke (*l.c.*), Franchet (*l.c.*) and Marquand (*l.c.*)

3. ***Cyananthus incanus*** Hook. f. & Thoms. in J. Linn. Soc. 2 : 20. 1858 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 434. 1881 ; Franch. in J. Bot. 1 : 279. 1887, *incl. var. trichocalyx* ; Weibel in Candollea 17 : 84. 1960, *p.p.* ; Hara, Fl. E. Himal. Rep. 2 : 129. 1971.

Rootstocks branched or unbranched, 3 - 13 mm in diam. Stems branched or unbranched, decumbent, sparsely to densely hirsute, 2 - 17 cm long. Leaves subsessile to short petiolate, 3 - 11 × 1 - 3 cm, elliptic, elliptic-lanceolate or rarely oblanceolate, tapering sharply at base, acute at apex, sinuate-crenate, sparsely to densely hirsute on both surfaces ; petiols *ca* 1 mm long. Pedicels 1 - 15 mm long, sparsely to densely brown hirsute. Calyx tubular, lobed for 1/3 - 1/2 of the length ; tubes 3.5 - 8 mm long, glabrescent in fruits ; teeth 2.5 - 4 mm long, triangular to triangular-lanceolate, glabrous or sparsely to densely brown hirsute outside, brown hirsute inside. Corolla blue, infundibular-companulate, lobed for slightly less than 1/2 of length ; tubes 12 - 17.5 mm long and 4 - 6.5 mm broad at throat ; lobes 10 - 14 × 2.5 - 4 mm, oblong. Filaments 5 - 8.5 mm long ; anthers *ca* 2 mm long. Ovary 6.5 - 9 mm long ; style 3.5 - 5 mm long ; stigma-tic lobes *ca* 1.5 mm long. Capsules 5 - 7 × 6 - 9 mm, reticulately 10-nerved, 5-valved, valves 3 - 4 mm long. Seeds dark brown, minute, oblong.

Type : INDIA : Sikkim : Tunga (Thangu), Giagong, J.D. Hooker s.n. (K, Photo !).

Fls. & Frts. : July Oct.

Distrib. : INDIA : West Bengal, Sikkim, CHINA (Zizang Ziziqu, Yunnan, Schechuan).

Exsicc. : West Bengal : Phalloot, *Kurz s.n.* (CAL ACC. NO. 262205). Sikkim : Tallum, Pandong, *King's coll. s.n.* (CAL ACC. NO. 262200) ; Momey Samdony, Lachung valley, *Gammie 793*.

Habitat : In ravines, on moist rocks, mountain pastures at elevations between 3500 and 4600 m.

Notes : Of the 2 varieties var. *trichocalyx* and var. *leiocalyx* described by Franchet (*l.c.*) the former refers to the typical *C. incanus*, with hirsute calyx that turns more or less glabrescent in fruits, while var. *leiocalyx* is considered as synonymous with *C. spathulifolius* Nannf.

4. **Cyananthus inflatus** Hook. f. & Thoms. in J. Linn. Soc. 2 : 21. 1858 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 435. 1881, & in J. Linn. Soc. Bot. 25 : 42. 1890 ; Hara, Fl. E. Himal. Rep. 1 : 326. 1966 ; *Cyananthus inflatus* var. *rufus* Franch. in J. Bot 1 : 281. 1887, *syn. nov.* ; Marquand in Kew Bull. 1924 : 249. 1924. **Fig. 20**

Stems 5.5 - 58 cm long, slender or robust, , branched or unbranched, decumbent to ascending, sparsely foliate, glabrous throughout or rarely sparsely to densely rufous upwards. Leaves alternate and those close to flowers alternate to opposite and bracteiform, 2 - 6.5 x 2.5 - 7 mm, elliptic - ovate to rhomboid, sharply tapering or attenuate at base, obtuse at apex, sinuate or crenate dentate, sparsely to densely scabrid-pilose on both surfaces ; petioles very slender, 1.5 - 7 mm long. Flowers solitary, terminal, suberect, sessile or with pedicels up to 2.5 mm long, brown or white hirsute, rarely glabrescent in fruits. Calyx ovoid, lobed for 1/5-1/4 the length, sparsely to densely brown or white hirsute outside, glabrescent in fruits ; teeth 1.5 - 2.5 mm long, densely hirsute inside. Corolla blue, tubular, sparsely pilose, lobed for ca 1/4 the length ; tubes 10.5 - 14.5 mm long, 3 - 6 mm broad at throat ; lobes 3.5 - 5.5 x 1.5 - 2.5 mm, oblong. Filaments 6.5 - 9.5 mm long ; anthers ca 1.5 mm long. Ovary 8 - 11 mm long, 3 - 4 or 5 - loculed ; style 4 - 5.5 mm long ; stigmatic - lobes minute. Capsules 8 - 14 x 7 - 13 mm, ovoid-conoid, 3 - 4 or 5-valved, valves 2 - 3 mm long. Seeds ca 1 mm long.

Types : INDIA : Sikkim : Gnatong, *King's Coll s.n.* ; Chola, *J. D. Hooker s.n.*(K, Photo !). NEPAL : Wallanchoon, *J.D. Hooker s.n.*(K,

Photo !). 'BHOOTAN' (Bhutan) : Without precise locality, *Griffith* 1771 (K, Photo !).

Fls. & Frts. : Aug. - Nov.

Distrib. : INDIA : West Bengal, Sikkim, Nagaland; NEPAL, BHUTAN, CHINA.

Exsicc. : West Bengal : Phallot, *Burkill* 25258. Sikkim : Karponang, Sikkim East dist., *Hajra* 723.

Habitat : On moss covered boulders, dry open grassy lands, mountain slopes, fence walls near cultivated fields, at elevations between 2700 and 4800 m.

Notes : Franchet (*l.c.*) described two varieties under this species, of which var. *tenius* refers to the typical plant, distinguishing itself by its slender glabrous or glabrescent stems from var. *rufus* which is characterised by its robust densely hispid-pilose. The stems of the Indian plants vary from slender to robust, glabrous for the whole length, or sparsely to densely rufous pilose upwards and are often difficult to be grouped under any of the varieties. Franchet (*l.c.*) himself has commented that the two varieties of *Cyananthus inflatus* (var. *tenius* & var. *rufus*) are considered as distinct taxa with intermediate forms a statement that creates doubt about their recognition.

Clarke (*l.c.*) had reported the occurrence of this species in Manipur. However, no specimens from that state could be located in the herbaria consulted during the course of this study.

5. *Cyananthus integra* Wall. ex Benth. in Royle, Ill. Bot. Himal. : 309, t. 69, f.2. 1836; Hook. f. & Thoms. in J. Linn. Soc. 2 : 19. 1858; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 434. 1881; Franch. in J. Bot. 1 : 259. 1887; Marquand in Kew Bull. 1924 : 252. 1924; M.A. Rau, Fl. Pl. West. Himal. 139. 1975.

Rootstocks branching; stems 6.5 - 37 cm long, unbranched or with short branches, decumbent, glabrous towards base, sparsely to densely pilose towards tips. Leaves alternate, subsessile to petiolate, 4 - 16 x 2 - 8 mm, broadly oblong to elliptic, cuneate at base, acute at apex, subentire to crenate, at times recurved, adpressed pilose on both surfaces; petioles up to 1.5 mm long. Flowers sessile to pedicellate; pedicels up to 15 mm long. Calyx tubular; lobed for 1/3-1/2 the length; tubes 6 - 11 mm long, dark brown hispid outside, teeth 6- 7.5 mm long, lanceolate, densely black

hirsute. Corolla blue, infundibular, sparsely pilose at throat, lobed for 1/3 to 1/4 the length; tubes 1.8 - 2.7 cm long and 8 - 11 mm at throat; lobes 6 - 12 × 7.5 - 14.5 mm, broadly ovate, few barbate at apex. Filaments 7.5 - 9 mm long; anthers *ca* 2.5 mm long, linear-oblong. Ovary 10 - 11.5 mm long; style 4 - 7 mm long; stigmatic-lobes *ca* 0.5 mm long. Capsuls 14 - 17.5 × 7.5 - 9 mm, ovoid-conoid, 5 valved. Seeds *ca* 2 mm long, narrowly oblong-ellipsoid.

Types : INDIA : Uttar Pradesh, Kumaon (Kumaon), *Blinkworth* in Wall. Cat. No. 1472 (K, Photo !); Kedarkanta, *Royle s.n.*

Fls. & Frts. : Aug. - Oct.

Distrib. : INDIA : Uttar Pradesh.

Endemic.

Exsicc. : Uttar Pradesh : Tungnath, *Edgeworth s.n.* (K, Photo !); Kedarkanta, above the forests, *Duthie* 1194; Jamunotri near the snow, coll. ?, 854.

Habitat : In temperate and alpine Himalays on moist rocks amidst *Rhododendron* spp. at elevations between 2800 and 4000 m.

Notes : The specimen : Tihri Garhwal, hill above Juki in Ganges valley, *Duthie* 607 (CAL) varies considerably from others in having smaller leaves and flowers may represent a new variety. However, further collections and studies are necessary to assign any status to these variants.

6. ***Cyananthus lobatus*** Wall. ex Benth. in Royle, Ill. Bot. Himal. : 309, t. 69, f. 1. 1836; Hook. f. & Thoms. in J. Lin. Soc. 2 : 19. 1858; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 433. 1881; Franch. in J. Bot. 1 : 259, 190. 1887; W.W. Smith in Rec. Bot. Surv. India 4 : 389. 1913; Marquand in Kew Bull. 1924 : 246. 1924; Hara, Fl. E. Himal. Rep. 1 : 326. 1966, 2 : 129. 1971; M.A. Rau, Fl. Pl. West Himal. : 139. 1975. *Cyananthus hayanus* A.M. in J. Roy. Hort. Soc. 59 : 445, f. 173. 1934. *Cyananthus hayana* Marquand in New Flora & Silva 8 : 207. 1936, *nom. illegit.*

Local name : Nirbishi (Nep.).

Rootstocks 2 - 12 mm in diam. Stems 3 - 6.2 mm long, branched or unbranched, decumbent, glabrous towards the base, sparsely pilose

upwards. Leaves alternate, sessile or petiolate, 6 - 32 × 2 - 18 mm, obovate-triangular or spatulate, caudate at base, acute at apex, variously incised/lobed (3 - 5 or 7 - lobed), lobes at times further lobed, sometimes crenate, revolute, sparsely pubescent to glabrous above and sparsely to densely hispid or rarely glabrous beneath ; petioles up to 6 mm long. Pedicels 2 - 40 mm long, sparsely black or brown hirsute. Calyx tubular, rarely ovoid, lobed for 1/4 - 1/3 the length, densely black or brown hirsute outside ; tubes 5.5 - 13 mm long ; teeth 3 - 6.5 mm long, lanceolate or triangular - lanceolate, hirsute. Corolla blue, lobed for slightly less than 1/2 the length, tubular or infundibular, glabrous at throat ; tubes 11 - 23 mm long, 5 - 7 mm broad at throat ; lobes 8 - 17 × 6 - 10.5 mm, broadly ovate, barbate apically. Filaments 4.5 - 10 mm long ; anthers 2 - 3.5 mm long, linear-oblong. Ovary 8.5 - 13 mm long ; style 2 - 6 mm long ; stigmatic-lobes ca 1 mm long. Capsules 10 - 15 × 8.5 - 10 mm, cylindric or ovoid - canoid ; valves 3 - 4 mm long. Seeds dark brown, 1.5 - 2 mm long, oblong to oblong-ellipsoid.

Types : INDIA : Uttar Pradesh : Kumaon (Kumaon), *Blinkworth* in Wall. Cat. No. 1473 (K, Microfiche!) ; Kedarkanta, *Royle*. NEPAL : Gossain than, *Wallich s.n.*

Fls. & Frts. : July - Oct.

Distrib. : INDIA : Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal Pradesh ; NEPAL, BHUTAN, CHINA (including Zizang Zizhiq).

Exsicc. : Jammu & Kashmir : Kistwar, *Badrhali s.n.* (DD ACC. NO. 79413). Himachal Pradesh : Andran Pass, Chamba, *Gammie* 18616 (DD). Uttar Pradesh, Nila valley, Tehri-Garwal, *Duthie* 608 (DD). Sikkim, Boktu pasture, *Prain's coll.* 116. Arunachal Pradesh, Se La, *R.S. Rao* 1625 (ASSAM & CAL).

Habitat : In alpine meadows, stoney slopes, mossy boulders, near streams, at elevations between 2800 and 5000 m.

Notes : *Cyananthus hayanus* A.M. matches well to *Cyananthus lobatus* in all essential characters and is therefore considered as synonymous.

7. *Cyananthus microphyllus* Edgew. in Trans. Linn. Soc. 20 : 81. 1846 ; Marquand in Kew Bull. 1924 : 253. 1924 ; Ballard in Curtis

Bot. Mag. : t. 9598. 1940 ; Weibel in Candollea 17 : 85. 1960 ; Hara in Ohashi, Fl. E. Himal. Rep. 3 : 110. 1975 ; M.A. Rau, Fl. Pl. West. Himal. 139. 1975. *Cyananthus linifolius* Wall. Cat. No. 3722. 1830, *nomen*. *Cyananthus linifolius* Wall. ex Hook. f. & Thoms. in J. Linn. Soc. 2 : 20. 1858, *p.p.* ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 434. 1881 ; Franch. in J. Bot. 1 : 260. 1887. *Cyananthus nepalensis* Kitam. in Act. Phytotax. Geobot. 15 : 109. 1954 & in Kihara, Fauna Fl. Nepal Himal. 1 : 241. 1955.

Local name : Mendo guhumbo (Nep.).

Rootstocks 3.5 - 15.0 mm in diam. Stems 4 - 20 cm long, branched or unbranched, decumbent to ascending, glabrous towards the base and scabrid-pilose upwards. Leaves sessile or shortly petiolate, alternate, 3.5 - 10 × 1-2 mm, elliptic-ovate, elliptic or narrowly oblong, truncate to tapering at base, acute at apex, subentire or crenate, often recurved, glabrous or scabrid-pilose on the upper surface, densely or rarely sparsely scabrid-pilose above ; petioles up to 1.5 mm long. Pedicels black to brown hirsute, 1 - 11 mm long. Calyx cylindric, lobed for 1/2 - 1/3 the length ; tubes 3 - 5 mm long, densely or laxly black to brown hirsute outside ; teeth 2.5 - 5 mm long, lanceolate to triangular, black to brown hirsute on both surfaces. Corolla blue, infundibular-campanulate, densely villous at the throat ; tubes 9 - 10.5 × 7 - 9 mm ; lobes 6.5 - 12 × 3 - 6.5 mm, oblong, often 2-barbate near the apex. Filaments 4.5 - 7 mm long ; anthers 1 - 2 mm long, linear-oblong. Ovary 6 - 10 mm long ; stigmatic-lobes *ca* 5 mm long. Capsules *ca* 12.5 mm long. Seeds *ca* 2 mm long, oblong-ellipsoid.

Type : Himalaya, Mana, Edegeworth

Fls. & Frts. : July - Oct.

Distrib. : INDIA : Jammu & Kashmir, Uttar Pradesh, NEPAL.

Exsicc. Uttar Pradesh : Ralam valley, Kumaon, *Blinkworth* in Wall. Cat. No. 3722 (CAL ACC. NO. 262349) ; Kali valley below Kama, *Duthie* 5729.

Habitat : On dry rocky or grassy slopes amidst Juniperus spp. at elevations between 2500 and 4700 m.

Notes : Kitamura (l.c.) while proposing his species C. nepalensis did not mention its allied taxa. But on the holotype he has stated that "C. microphyllus folius minoribus utrinque dense hispidulis floribus multo

majoribus ad 32 mm longis distinguendus". Weibel (*l.c.*) first indicated the similarity of *C. nepalensis* with *C. microphyllus* and contended "*C. nepalensis* nous semble, d'après la description et la figur qui l'accompagne, n'être qu'une forme de *C. microphyllus*." Hara (*l.c.*) followed Weibel and merged *C. nepalensis* with *C. microphyllus*. As type of *C. microphyllus* could not be examined, Weibel's treatment is followed in this work.

The specimen *Polunin, Sykes & Williams* 3537 (CAL) has slightly larger leaves (up to 6 mm broad).

8. ***Cyananthus pedunculatus*** C.B. Clarke in Hook. f., *Fl. Brit. India* 3 : 434. 1881 ; Franch. in *J. Bot.* 1 : 260. 1887 ; W.W. Smith in *Rec. Bot. Surv. India* 4 : 389. 1913 ; Maquand in *Kew Bull.* 1924 : 251. 1924. *C. linifolius* Wall. ex Hook.f. & Thoms. in *J. Linn. Soc.* 2 : 20. 1838, *p.p.* *C. pedunculatus* var. *crenatus* Marquand in *New Flora Silva* 8 : 208. 1936, *syn. nov.* Fig. 19

Rootstocks branched or unbranched, 4 - 16 mm in diam. Stems branched or unbranched, decumbent, glabrous at the base and scabrid-pilose upwards or throughout. Leaves alternate, lower sessile or very shortly petiolate, upper ones sessile, 2.5 - 16 × 1.5 - 5 mm, (in flowering branches 2 - 7.5 × 1 - 3.5 mm), narrowly to broadly oblong - lanceolate, rarely elliptic, wedge-shaped and clasping or rarely caudate at base, acute or obtuse at apex, subentire or crenate, scabrid-pilose or glabrous on both surfaces ; petioles *ca* 1 mm long. Pedicels 4 - 36 mm long, black or brown hirsute, very rarely glabrescent. Calyx cylindric, black or brown hirsute without, lobed for 1/3 - 1/2 the length ; tubes 4.5 - 9 mm long ; teeth 3.5 - 7.5 mm long, lanceolate to triangular, black or brown hirsute on both surfaces. Corolla blue, infundibular campanulate, glabrous at throat, lobed for 1/5 - 1/3 the length ; tubes 17.5 - 32 × 11 - 17 mm ; lobes 6.5 - 11 × 7.5 - 13 mm, broadly ovate, few barbate at apex. Filaments 7 - 9.5 mm long ; anthers 2 - 3 mm long, linear - oblong. Ovary 8 - 16 mm long ; style 5.5 - 9 mm long ; stigma minute. Capsules *ca* 12 × 5 mm, ovoid-conoid. Seeds *ca* 1.5 mm long, oblong-linear.

Types : INDIA : Sikkim : Lachoong, *J.D. Hooker s.n.* (K, Photo !); Momey Samdong, *J.D. Hooker s.n.* (K, Photo !)

Fls. & Frts. : June - Nov.

Distrib. : INDIA : West Bengal and Sikkim ; NEPAL, BHUTAN, CHINA (Zizang Zizhiqu).

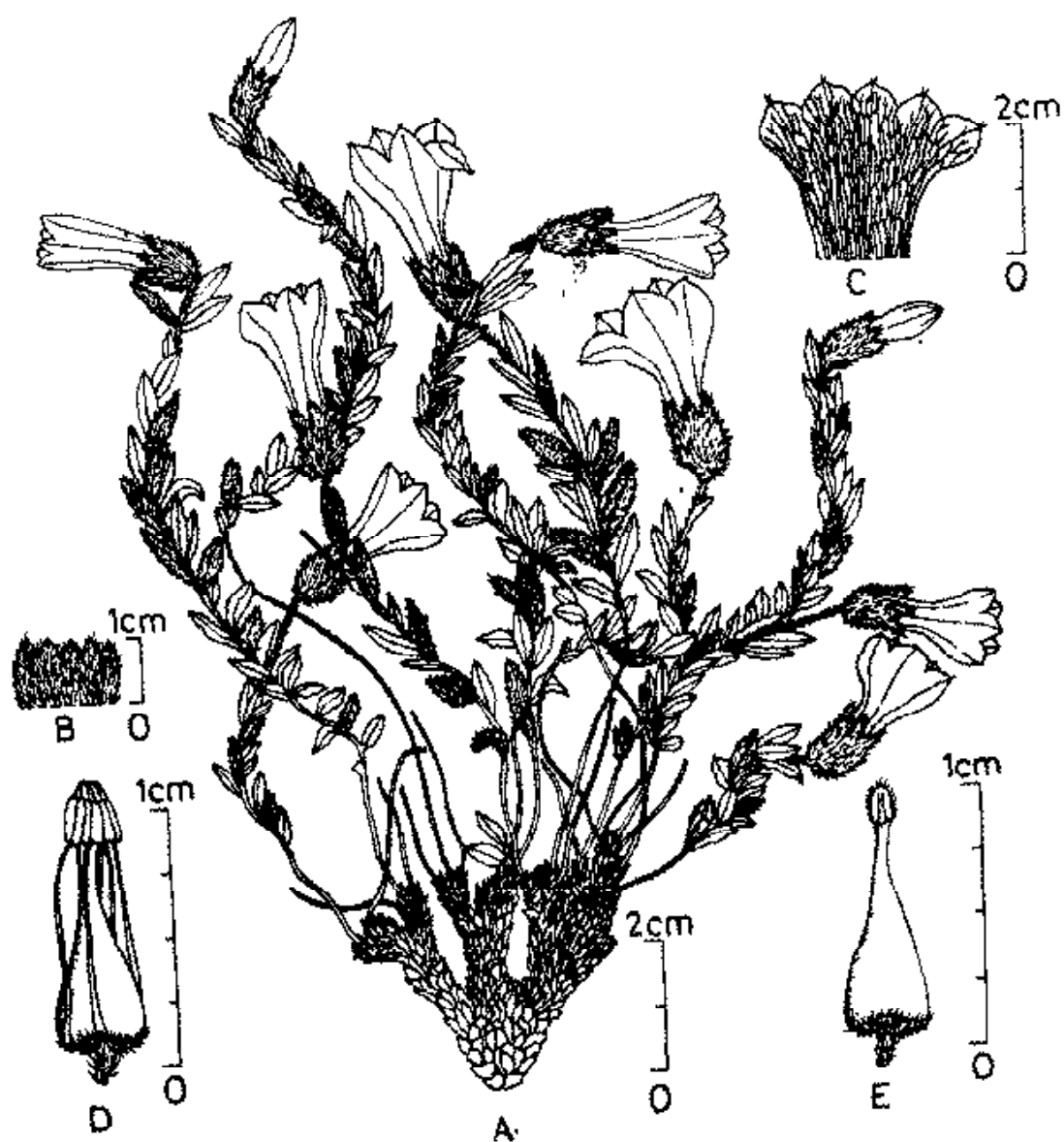


Fig. 19. *Cynanthus pedunculatus* Clarke. A. Habit. B. Calyx split opened. C. Corolla split opened. D. Androecium. E. Pistil. (Gammie 864).

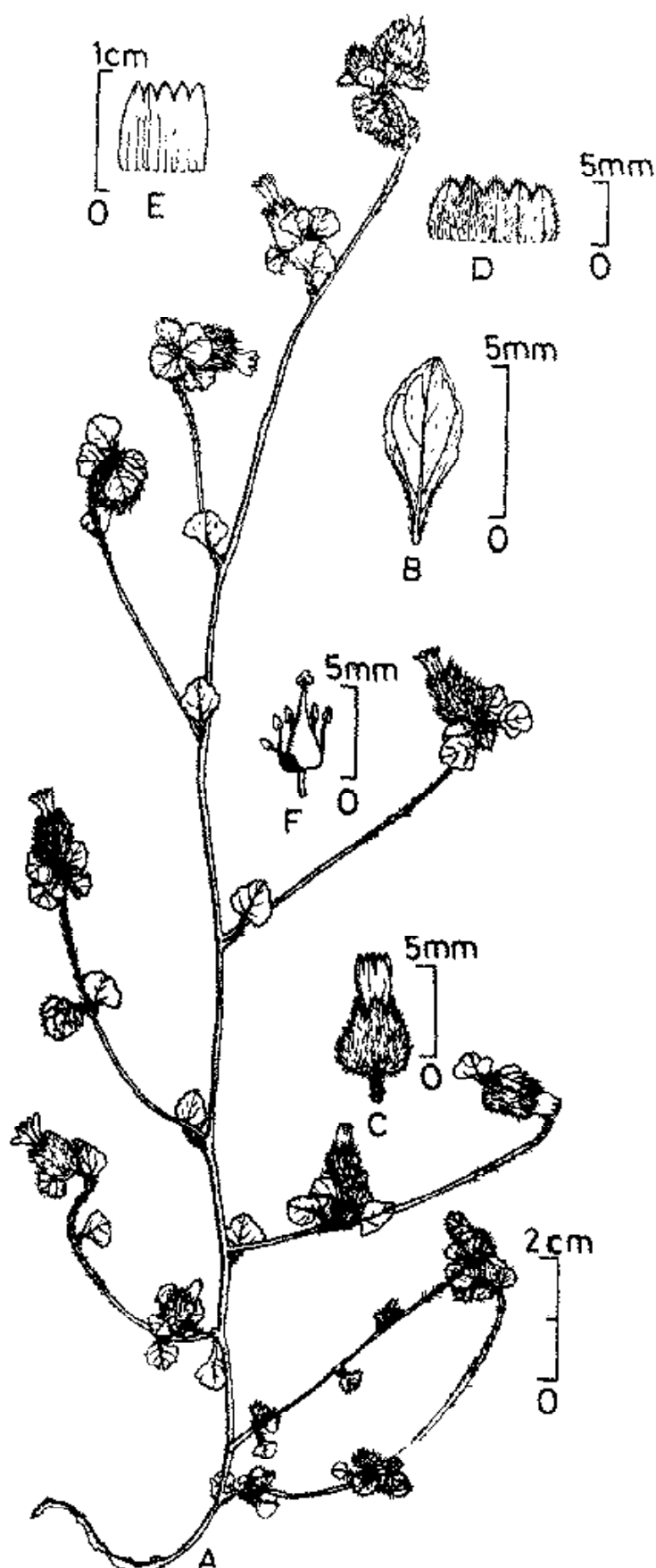


Fig. 20. *Cyananthus inflatus* Hook.f. & Thoms. A. Habit. B. Bract. C. Flower. D. Calyx split opened. E. Corolla split opened. F. Stamens and Pistil (King's coll. s.n.).

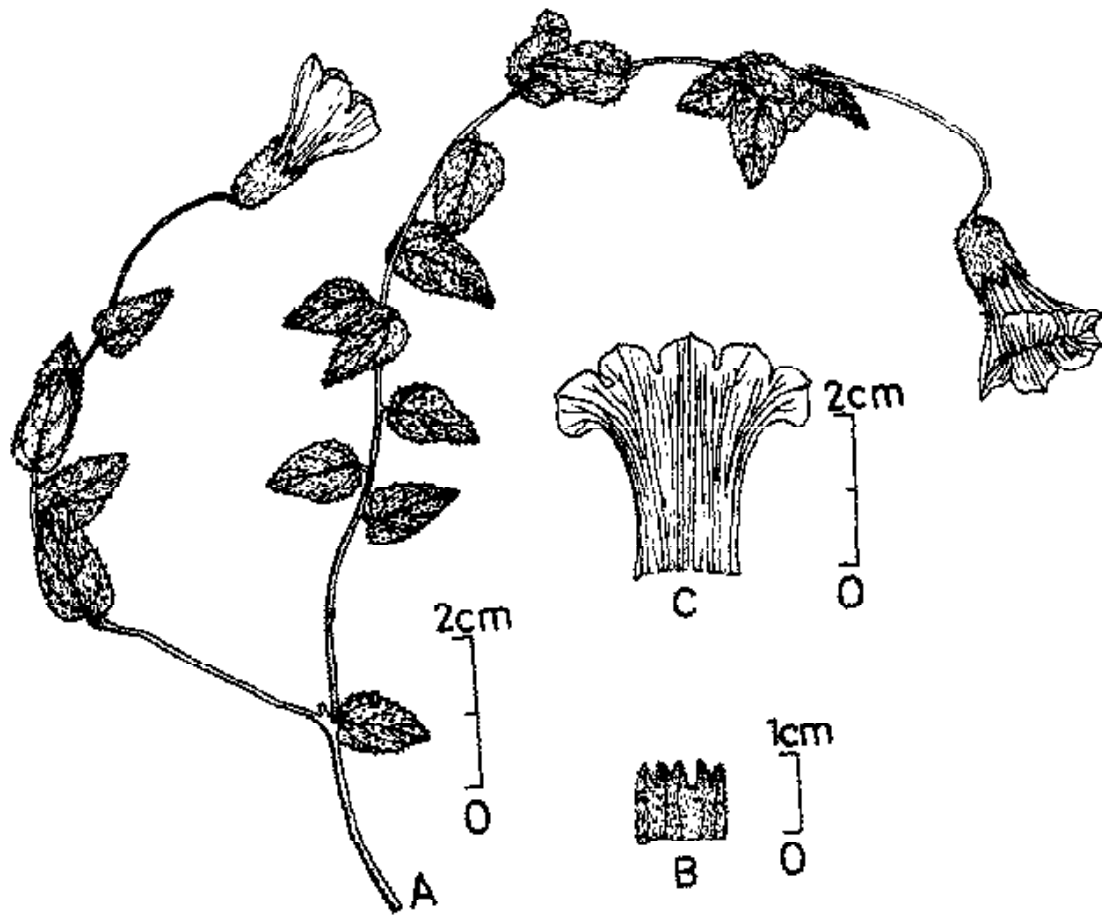


Fig. 21. *Cyananthus cordifolius* Duthie. A. Habit. B. Calyx split opened. C. Corolla split opened (Stainton et al 3918).

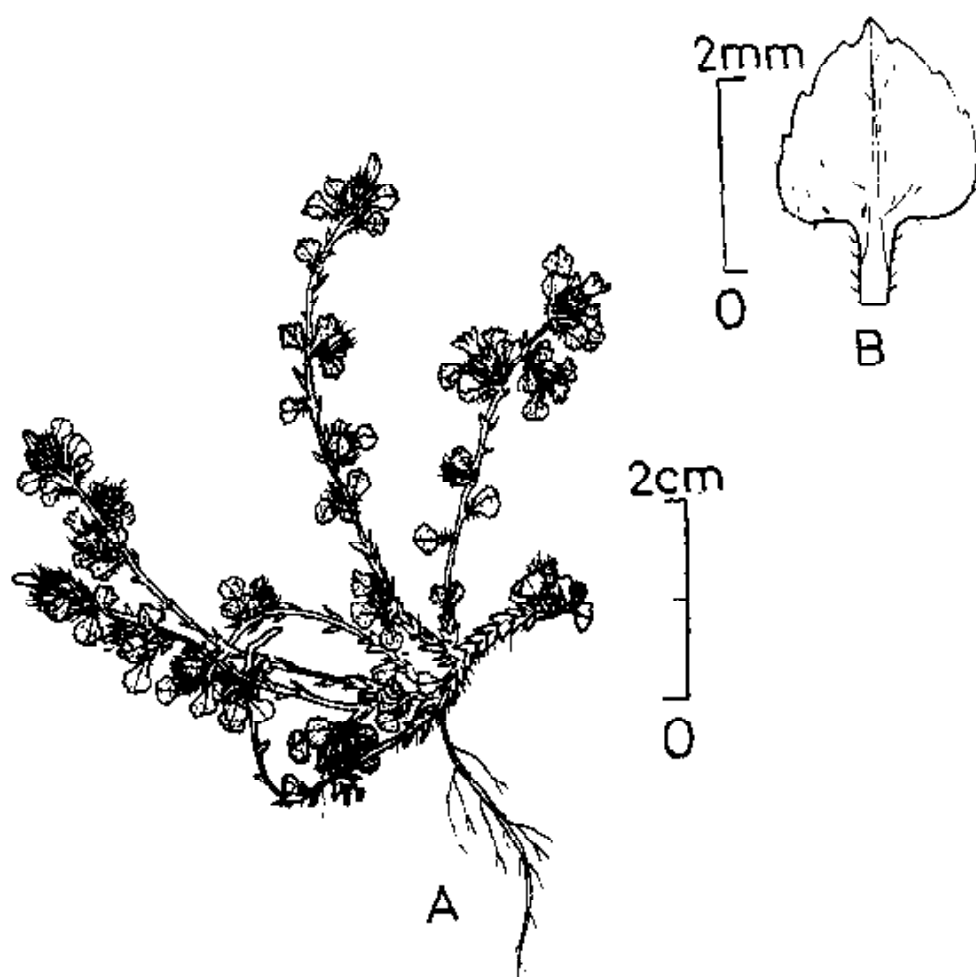


Fig. 22. *Cyananthus hookeri* A. Habit. B. Bract (Gammie 1155).

Exsicc. : West Bengal : Phallot, Kurz *s.n.* (CAL ACC. NO. 262337) ; Sikkim : Dzongri ('Jongri'), Anderson 758 ; Momcy Samdong, Lachung, Gammie 864.

Habitat : Alpine regions of Himalaya at elevations between 3500 and 5000 m.

Notes : Marquand (*l.c.*) distinguished var. *crenatus* as "A type differ foliis angustioribus crenatus ad 10 mm longis, 3 mm latis". The leaf length of the specimens from India and adjacent regions show a range of 2.5 - 15 mm on the fertile branches and 2 - 7.5 mm on the sterile branches. The leaf margins vary from subentire to crenate and are often recurved so that the margins appear as entire, therefore, it is merged with *C. pedunculatus*.

9. **Cyananthus spathulifolius** Nannf. in Act. Hort. Gothob. 5 : 31. 1930 ; Cowan, New Flora Silva 10 : 183. 1938. *Cyananthus incanus* var. *leiocalyx* Franch. in J. Bot. 1 : 279. 1887, *syn. nov.* ; Marquand in Kew Bull. 1924 : 252. 1924. *Cyananthus leiocalyx* (Franch.) Cowan in New Flora Silva 10 : 187. 1938, *syn. nov.* **Fig. 23**

Rootstocks 4 - 13 mm in diam., unbranched. Stems 2.5 - 15.2 cm long, branches decumbent, sparsely patent hirsute. Leaves alternate, 3 - 7 × 2 - 6 mm long, rhomboid - spathulate or obovate, sharply caudate at base, acute to obtuse at apex, crenate to crenulate, recurved, green and sparsely to densely hirsute above, glaucous and sparsely to densely hirsute beneath ; petioles 1 - 4 mm long, winged. Pedicels 2 - 11 mm long, patently hirsute. Calyx campanulate, slightly inflated, much inflated in fruits, lobed for *ca* 1/3 the length ; tubes 5 - 8 mm long, glabrous ; teeth 3 - 3.5 mm long, triangular to lanceolate, glabrous outside and densely hirsute inside. Corolla pale blue, blue or yellowish with purple veins and a blue rim, infundibular - campanulate, lobed for 1/3 - 1/2 the length, tubes 12 - 16 mm long and 4 - 6 mm broad at throat ; lobes 6.5 - 11 × 2 - 3.5 mm, oblong. Filaments 6.5 - 10 mm long ; anthers *ca* 2 mm long. Ovary 8.5 - 12.5 mm long ; style 5 - 8 mm long ; stigmatic lobes *ca* 1.5 mm long. Capsules *ca* 10 × 12 mm ; globose campanulate, valves *ca* 4 mm long. Seeds dark brown, *ca* 1 mm long, oblong.

Type : CHINA : Szechuan bor. ; Tsipula, H. Smith 3042 (UPS, Photo !).

Fls. & Frts. : April - Sept.

Distrib. : INDIA : Sikkim ; BHUTAN, CHINA (including Zizang Zizhiqu).

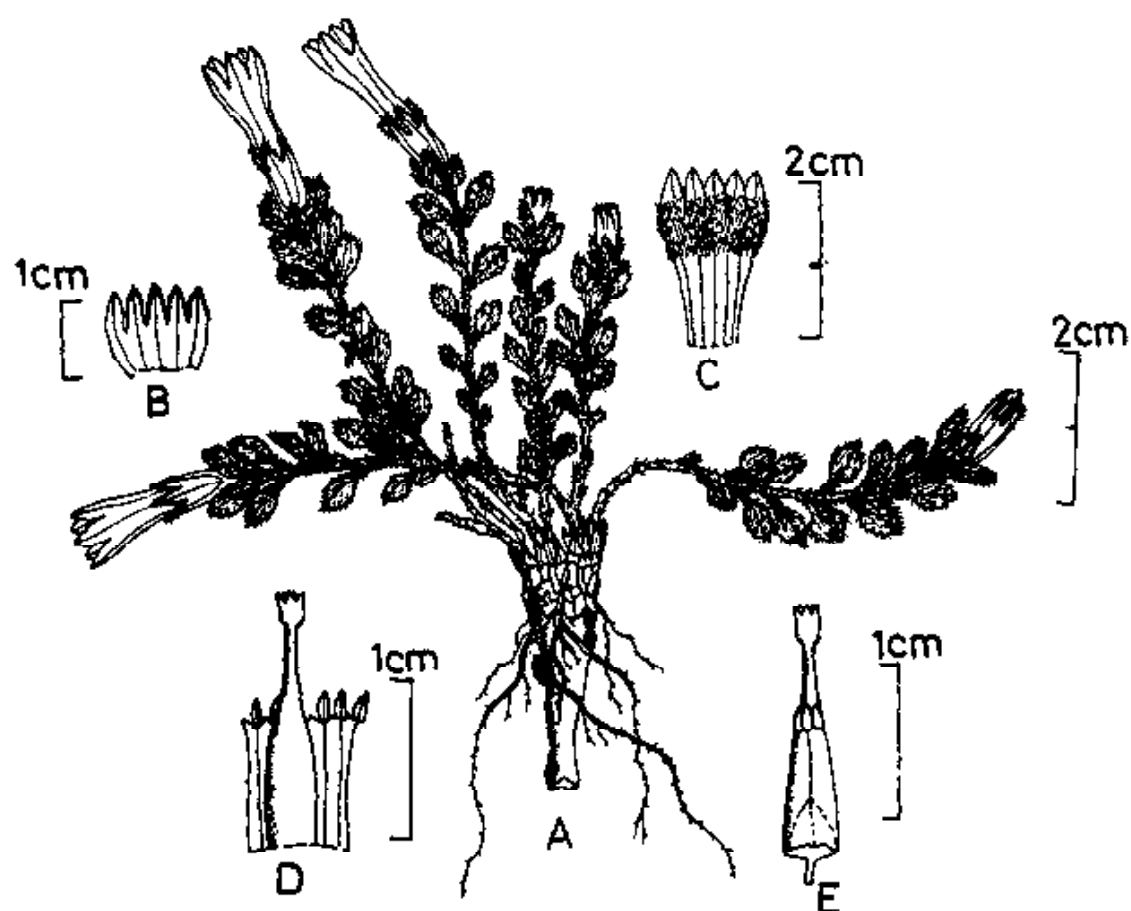


Fig. 23. *Cyananthus spathulifolius* Nannf. A. Habit. B. Calyx split opened. C. Corolla split opened. D. & E. Stamens and Pistil (*Gammie s.n.*).

Exsicc. : Sikkim : Without precise locality, *Gammie s.n.* (CAL ACC. NO. 262365). Mey-gola, near Jongri (Dzongri), *King's coll. s.n.* (CAL ACC. NO. 262187).

Notes : An examination of the type photograph and protologue of *C. spathulifolius* and *C. incanus* var. *leiocalyx* it is clear that they belong to a single taxon and do not differ from each other in any of the characters.

The corolla colour vary from light blue (Thanchen, *Dungboo s.n.* CAL ACC. NO. 262237) to yellow (Nannfeldt, *l.c.*), Cowan (*l.c.*) while *Ludlow, Sheriff & Taylor* (6059, CAL) described the corolla tubes as "pale yellow with longitudinal purple lines and segments as pale yellow and pale blue at apex within". Thus the hitherto used differentiating character, appears to be of doubtful value.

The leaves also vary considerably in shape, size, margin and proportionate sizes of calyx and corolla.

7. LEPTOCODON

(Hook. f. & Thoms.) Lem. in Ill. Hort. 3, Misc. : 49. 1856 ; Hook. f. & Thoms. in J. Linn. Soc. 2 : 17. 1858 ; Benth. in Benth. & Hook. f., Gen. Pl. 2 : 557. 1876 ; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 430. 1881. *Codonopsis* sect. *Leptocodon* Hook. f. & Thoms. in Hook. f., Ill. Himal. Pl. : t. 16A. 1855.

Delicate, twining, lactiferous herbs, foetid when bruised ; branches densely interwoven. Leaves opposite to alternate, elliptic to rounded ovate, truncate to caudate at base, obtuse at apex, crenate - lobate, glabrous, glaucous ; petioles slender, glabrous, rarely pilose. Flowers solitary, terminal, axillary, supra axillary or leaf opposed. Hypanthia broadly obconic ; pedicels glabrous. Calyx perigynous, glabrous ; teeth 5, spreading, ovate to linear - oblong, obscurely crenate to serrate, glabrous or ciliate along margins. Corolla tubular - campanulate, constricted towards middle and then inflated upwards, very shortly 5 - lobed. Stamens 5 ; filaments linear, slightly dilated towards base, glabrous ; anthers subbasifixed, narrowly oblong ; glands 5 ; alternating with the stamens, erect, linear. Ovary semi inferior, obconic in the lower and conical in upper half, 3 - loculed ; ovules few, attached to placenta on walls of dissepiments ; style cylindric, densely hairy ; stigmatic - lobes 3, ovate to oblong, densely hairy. Capsules obconic in lower part and elongate - conic in upper part, 3 - valved. Seeds shiny, black, oblong - ellipsoid, slightly shrunken.

Type : *Leptocodon gracilis* (Hook. f. & Thoms.) Lem.

Distrib. : Monotypic. INDIA : West Bengal, Sikkim and Arunachal Pradesh ; W. CHINA.

Notes : This genus was considered as a section under *Codonopsis* by J. D. Hooker and Thomson (1856) but elevated to the generic rank by Lemaire (*l. c.*). J. D. Hooker and Thomson (*l. c.*) also subsequently revised their decision and raised the subgenus to the rank of a genus "in accordance with Mr. De Candolle's views" though they also commented "we have no means altered our opinion of their relationship..."

The genus closely resembles *Codonopsis* and *Campanumoea* in habit, branching and foetid nature but can be easily differentiated by the presence of 5 glands alternating with the stamens.

The ovules are according to J.D. Hooker & Thomson (1858) fixed to placenta on the walls of the dissepiments, but not in the axis of the cells of the ovary - a condition not reported among members of Indian Campanulaceae.

1. ***Leptocodon gracilis*** (Hook. f. & Thoms.) Lem. in Ill. Hort. 3, Misc. : 49. 1856 ; Hook.f. & Thoms. in J. Linn. Soc. 2 : 17. 1858 ; Clarke in Fl. Brit. India 3 : 430. 1881 ; Biswas, Pl. Darjeeling Sikkim Himal. 1 : 492. 1966 ; Rao & Balkar. in Rec. Bot. Surv. India 20 (2) : 135. 1973. *Codonopsis gracilis* Hook. f. & Thoms. in Hook. f., Ill. Himal. Pl. : t. 16A. 1855.

Leaves 3 - 22.5 × 2 - 14 mm ; petioles 1 - 27 mm long. pedicels 2 - 5 cm long. Hypanthia 1 - 2 × 3 - 4 mm ; Calyx teeth 3 - 4.5 × 1 - 1.2 mm. Corolla 26 - 37.5 mm long, 9 - 19 mm broad at mouth. Filaments 20 - 22.5 mm long ; anthers 1.7 - 2 mm long. Capsules 5 - 8 × 8.5 - 16 mm ; valves 5 - 9 mm long. Seeds 1 - 1.2 mm long.

Type : INDIA : Sikkim, without precise locality, *J.D. Hooker s.n.*

Fls. & Frts. : May - Nov.

Ersicc. : Sikkim : Without precise locality, *J. D. Hooker s.n.* (CAL ACC.NO. 261953) ; Karponang, *Bor's coll.* 249 (DD). Arunachal Pradesh : 12 kms from Bomdila towards Dirang, Kameng F.D., *Joseph* 40051 (ASSAM) ; Ziro - Hong villages, Subansiri F.D., *Panigrahi* 19777 (ASSAM).

Habitat : In open areas of forests and near water courses at elevation between 1500 - 2400 m.

8. PERACARPA

Hook. f. & Thoms. in J. Linn. Soc. 2 : 26. 1858 ; Benth. in Benth. & Hook. f., Gen. Pl. 558. 1876 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 437. 1881 ; Feer in Bot. Jahrb. 12 : 620, t. 713. 1896 ; Moeliono in Steenis, Fl. Males. 1, 6 : 110. 1960.

Annual, prostrate, succulent, glabrous herbs ; rooting at nodes. Leaves alternate, petiolate, rotund - ovate to elliptic, truncate to cordate at base, crenate to crenate - dentate, rarely ciliate, acute to obtuse at apex, scabrid - pilose above, glabrous beneath. Flowers solitary or clustered, axillary or terminal ; pedicels glabrous. Calyx epigynous ; tuberculate to ovary. Hypanthia obconic ; teeth triangular to linear, entire, glabrous. Corolla purple to bluish-white, campanulate, 5-partite for more than 2/3 the length, glabrous ; lobes oblong to elliptic, acute or obtuse, prominently mid-veined. Stamens free from corolla ; filaments linear, finely ciliate ; anthers basifixed, linear. Ovary inferior, 3-loculed, glabrous ; ovules few, on axile placenta ; style cylindric, densely hairy ; stigmatic-lobes 3, oblong, densely hairy ; glabrous later. Fruits pendulous, dry, indehiscent, sac-like, ovoid to elliptic, rarely obovoid, apically contracted, with thin pericarp. Seeds fusiform-ellipsoid, flattened at ends.

Type : *Peracarpa carnos*a (Wall.) Hook. f. & Thoms.

Distrib. : Extending from Russia to Malesian islands and Japan through the Himalayas and China ; monotypic.

1. ***Peracarpa carnos*a** (Wall.) Hook. f. & Thoms. in J. Linn. Soc. 2 : 26. 1858 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 437. 1881 ; W.W. Smith in Rec. Bot. Surv. India 4 (7) : 389. 1913 ; Moeliono in Steenis, Fl. Males. 1, 6 : 110. 1960 ; Hara, Fl. E. Himal. Rep. 1 : 328. 1966 & 2 : 129. 1971. *Campanula carnos*a Wall. in Roxb., Fl. Ind. 2 : 102. 1824 ; A.DC. in DC., Prodr. 7 : 474. 1839. Fig. 24

Local name : *Kalamunte* (Nep.).

Stems 4 - 20 cm long. Leaves 3 - 25 × 2.5 - 15 mm ; petioles 1.5 - 18 mm long. Pedicels 6 - 38 mm long ; hypanthia 1.5 - 2.5 × 1 - 1.5 mm. Calyx teeth 0.75 - 2 mm long. Corolla lobes 3 - 4.5 × 0.7 - 1.5 mm. Filaments 2 - 3.5 mm long, anthers 1 - 1.2 mm long. Style 3 - 5 mm long ; stigmatic-lobes ca 1 mm long. Fruits 3 - 5 × 2.5 - 4 mm. Seeds 1 - 1.5 mm long.

Type : Nepal, Wallich 1282 (K, microfiche !).

Fls. & Frts. : Feb. Oct.

Exsicc. : Uttar Pradesh, Datmir, Tehri Garwal, Gamble 24279 (DD) ; Forest below Gini, Kumaon, Duthie 3126. West Bengal : Sandakpu, Watt 4345 (BSIS). Sikkim : Rungroom, Lister s.n. (CAL ACC. NO. 262599). Meghalaya : Khasia, J.D. Hooker & Thomson s.n. (CAL ACC. NO. 262592). Arunachal Pradesh : Perila, Kameng F.D., Panigrahi 16097 (ASSAM). Nagaland : Japvo mts., Watt 11424 (BSIS). Manipur : On march to 2nd peats on north-east Chingsow, Watt 6598.

Chr. No. $2n = ca\ 30$ (Kurasawa in Hara, Fl. East. Himal. 2 : 360. 1971).

Habitat : In shady moist forests, on rocks near rivulets at elevations between 1500 - 3400 m.

Notes : A. De Candolle (l.c.) has described the fruits as "ima basi 3 valvis minimis dehiscens" and consequently placed the species in the section *Eucodon* of the genus *Campanula* that included species with basally dehiscent fruits. Though the fruits were considered indehiscent, the presence of basal proes formed as a result of tension in the pericarp was reported by Feer (l.c.) and "ein besonderer Dehiscenzapparat fehlt." Report of capsules dehiscing by the outward hygroscopic movement of the sclerenchymatous parts of the septa near the base as in some species of *Campanula* was made by Thulin (Bot. Notiser 127 (2) : 165-182. 1974). However, no such basal pores could be observed in the Indian specimens.

9. WAHLENBERGIA

Schrad. ex Roth, Nov. Pl. Sp. : 399. 1821, *nom. cons.* ; A.DC., Monogr. Camp. : 129. 1830 & in DC., Prodr. 7 : 424. 1939 ; Benth. & Hook. f., Gen. : Pl. 2 : 555. 1876 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 429. 1881 ; Tuyn in Steenis, Fl. Males. 1, 6 : 111. 1960 ; Thulin in Symb. Bot. Upsal. 21 (1) : 70. 1975. *Cephalostigma* A.DC., Monogr. Camp. : 117. 1830 & in DC., Prodr. 7 : 420. 1839 ; Hook. f. & Thoms. in J. Linn. Soc. 2 : 9. 1858 ; Benth. in Benth. & Hook. f., Gen. Pl. 2 : 555. 1876 ; C.B. Clarke in Hook. f., Fl. Brit. India 3 : 428. 1881.

Annual or perennial herbs. Stems slender, branched or unbranched, glabrous or hairy. Leaves alternate (opposite in *W. peduncularis* and in a few African species) rarely opposite or subverticillate upwards, petiolate

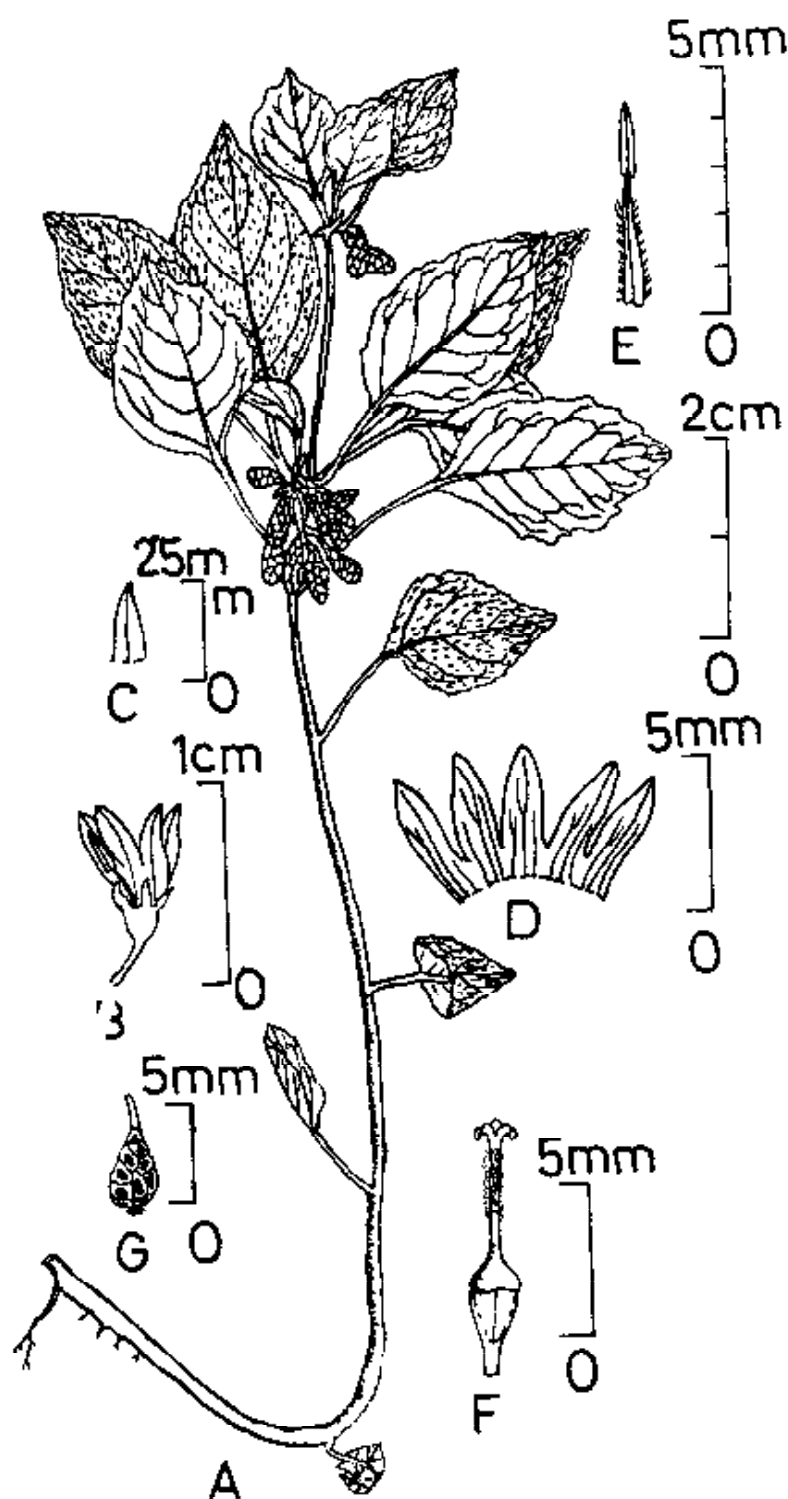


Fig. 24. *Peracarpa carnososa* (Wall.) Hook.f. & Thoms. A. Habit. B. Flower. C. Calyx lobe. D. Corolla split opened. E. Stamen. F. Pistil. G. Fruit (Duthie 3226).

to sessile, evenly distributed on stems or crowded at base, rounded or caudate at base, entire to denate, often cartilagenous, hairy or glabrous. Flowers 3-5 merous, solitary or in cymes, terminal, axillary or leaf-opposed; pedicels stout or slender, glabrous or hairy. Hypanthia 10 or 5 nerved. Calyx epigynous or perigynous; tubes adnate to the ovary; teeth 5, oblong to linear, acute or obtuse. Corolla campanulate forming a distinct tube at base or partite upto base with stellate lobes, glabrous or hairy inside; lobes 5, lanceolate to oblong-ovate, often slightly dilated towards base. Stamens 5, free; filaments variously dilated and ciliate at base; anthers basifixed, oblong to narrowly oblong. Ovary (5-)3(-2)-loculed, inferior or semi inferior; ovules few to many on axile placenta; style cylindric, slightly dilated towards both ends, glabrous or hairy on upper part; stigma (5-)3(-2)-lobed, lobes clavate, erect, later spreading (in African taxa, lobes bear glands at their sinuses or slightly below). Capsules subglobose, narrowly cylindric or obconoid, dehiscent through apical valves; valves as many as the carpels, rarely much reduced. Seeds few to many, compressed, ellipsoid or trigonous, shiny.

Type : *Wahlenbergia elongate* Schrad. ex Roth

Distrib. : Chiefly pantropical and southern hemispheric with ca 220 species (Thulin, l.c.) with probable centre of diversity in African continent, 6 in India with 1 endemic.

KEY TO THE SPECIES

- | | | | |
|-----|--|-------|--------------------------|
| 1a. | Seeds narrowly or broadly ellipsoid | ..... | 2 |
| b. | Seeds trigonous | ..... | 5 |
| 2a. | Hypanthia hispid; corolla cleft upto the base | ..... | 3 |
| b. | Hypanthia glabrous; corolla forming a distinct tube at least near the base | ..... | 4 |
| 3a. | Inflorescence pyramidal; corolla pink to pale-blue; lateral veins of leaves indistinct; seeds narrowly ellipsoid | ..... | <i>W. erecta</i> 1 |
| b. | Inflorescence spreading; corolla yellow; lateral veins of the leaves distinct; seeds broadly ellipsoid | ..... | <i>W. flexuosa</i> 2 |
| 4a. | Calyx teeth twice as long as hypanthia; leaves distinctly (1-4 mm) petiolate, uniformly distributed on the stem | | <i>W. peduncularis</i> 6 |
| b. | Calyx teeth shorter or as long as hypanthia; leaves sessile, more or less crowded towards lower half | ..... | <i>W. marginata</i> 5 |

- 5a. Pedicels and hypanthia patently hirsute ; calyx teeth oblong-linear to broadly lanceolate, longer than hypanthia 3. *W. hirsuta*
- b. Pedicels and hypanthia glabrous ; calyx-teeth triangular, shorter than hypanthia 4. *W. hookeri*

Notes : Three genera - *Lightfootia* L'herit., *Cephalostigma* A. DC. and *Wahlenbergia* Schrad. ex Roth were recognised by the earlier workers until Tuyn (in Moeliono & Tuyn 1960) merged the three into a single genus *Wahlenbergia*. The genus *Lightfootia*, essentially an African genus, does not fall under the purview of the present work. A. De Candolle (*l.c.*) differentiated *Cephalostigma* from *Wahlenbergia* and *Lightfootia* in having "Stigmate capitate". However, the presence in *Cephalostigma* of three short stigmatic lobes, that in outline may appear as globular, especially when young, was reported by Tuyn (*l.c.*) just as those in *Wahlenbergia*. Tuyn's views were mildly criticised by R.C. Carolin (J. Linn. Soc. N.S.W. 89 : 235-240. 1964) that the former has been a "little precipitate in combining these genera " However, the merger of the two genera was accepted by Thulin (*l.c.*) who had worked extensively on the genus. Palynological evidences also point to the similarities in the two genera Thulin, *l.c.*). In the present work, the Indian species are treated under *Wahlenbergia* following Tuyn and Thulin.

The generic name *Wahlenbergia* Schard. ex Roth is a name conserved against *Cervicina* Del. (Fl. Aegypte : 7. 1813) by van Steenis (Taxon 9 : 125. 1960) with the type species being *W. elongata* Schrad. ex Roth (*W. capensis* (L.) A. DC.). The generic name *Lightfootia* L' Herit. (Sert. Angl. : t. 4. 1789) though can claim priority over *Wahlenbergia* is a later homonym of *Lightfootia* Sw. (1788).

1. ***Wahlenbergia erecta*** (Roth ex Roem. & Schult.) Tuyn in Steenis, Fl. Males, 1, 6 : 113. 1960 ; Thulin in Symb. Bot. Upsal. 21 (1) : 155. 1975 ; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan Dist. : 569. 1976. *Dentella erecta* Roth ex Roem. & Schult., Syst. Veg. 5 : 25. 1819 ; DC., Prodr. 4 : 419. 1830. *D. perotifolia* Willd. ex Roem. & Schult., Syst. Veg. 5 : 25. 1819, *nom. illeg.* ; DC. Prodr. 4 : 419. 1830. *Wahlenbergia perotifolia* Wight & Arn., Prodr. : 405. 1834, *nom. illeg.* ; A. DC. in DC., Prodr. 7 : 434. 1839 ; Wight, Ic. 3 : 4, t. 842. 1843. *Cephalostigma schimperi* Hochst. ex Richard, Tent. Fl. Abyss. 2 : 2. 1851 ; Clarke in Hook. f., Fl. Brit. India 3 : 428. 1881 ; Prain, Beng. Pl. 1 : 633. 1903 ; Cooke, Fl. Pres. Bombay 1 : 73. 1904 ; Gamble, Fl. Pres. Madr. 2 : 738. 1921 ; Haines, Bot. Bih. & Or. 2 : 502. 1922. *C. erectum* (Roth ex Roem. & Schult.) Vatke in Linnaea 38 : 699. 1874, *quoad specim., p.p.*

Annual, erect herbs, 8 - 37 cm high. Stems branching, spirally twisted or zig-zaggad upwards, hirsute. Leaves alternate, sessile, narrowly to broadly oblong or lanceolate, caudate or truncate at base, undulate-dentate to crisped-dentate and cartilagenous at margins, acute to acuminate, glabrous to sparsely hirsute above and sparsely to densely hirsute below, 4 - 28 × 1 - 12 mm. Pedicels slender, pubescent, 1 - 19 mm long. Calyx perigynous ; hypanthia 10 - nerved, obconic to subglobose, 1.0 - 1.5 × 1 - 2 mm ; calyx teeth oblong to broadly lanceolate, entire to subentire, cartilagenous and with a few stiff long hairs along margins, 1.5 - 3.0 mm long. Corolla-lobes oblong, dilated at base, acute, at times with a few stiff long hairs without at apex, 1.5 - 3.0 mm long. Filaments tapering towards apex, ciliate, 1.0 - 1.5 mm long ; anthers narrowly oblong, ca 0.5 mm long. Ovary semi inferior, 3 - loculed ; style 1 - 2 mm long ; stigmatic - lobes 3, very short. Capsules obconic to subglobose, 1.5 - 2.0 × 2 - 3 mm ; valves 1.5 - 2.0 mm long. Seeds slightly compressed, ca 0.5 mm long.

Type : India orientali, B. Heyne (B, Photo !).

Fls. & Frts. : Oct. - Feb.

Distrib. : INDIA : Throughout ; TROPICAL AFRICA, SRI LANKA, SUMATRA.

Ecol. : On open or slightly shady waste-lands, border of forests, rice fields etc. at elevations between 500 - 2000 m.

Notes : Tuyn (*l.c.*) has described the hypanthium as 5 - nerved. However, the Indian specimens possess 10 -nerved hypanthia, which is also reported by Thulin (*l.c.*) for the African plants.

2. **Wahlenbergia flexuosa** (Hook. f. & Thoms.) Thulin in Symb. Bot. Upsal. 21 (1) : 158. 1975. *Cephalostigma flexuosum* Hook. f. & Thoms. in J. Linn. Soc. 2 : 9. 1858 ; Clarke in Hook. f., Fl. Brit. India 3 : 428. 1881 ; Cooke, Fl. Pres. Bombay 1 : 73. 1904 ; Gamble, Fl. Pres. Madr. 2 : 738. 1925 ; Santapau, Fl. Purandhar 74. 1957.

Annual, erect herbs, 12 - 24 cm tall. Stems flexuous, repeatedly and patently branching, hirsute ; branches ascending. Leaves alternate, sessile or shortly petiolate (petiole ca 1.5 mm) ; lower ones elliptic and upper ones ovate - lanceolate to lanceolate, rounded to caudate at base, subentire to remotely undulate-dentate and cartilagenous at margins, acute to acuminate, thin, glabrous to sparsely hirsute above and patently hirsute especially on veins or rarely glabrous beneath, 4 - 27 × 1 - 15 mm. Pedicels slender, glabrous, 1.5 - 28 mm. Calyx perigynous ; hypanthia subglobose, 10 -

nerved, 1.5 - 3.0 mm in diam. ; teeth broadly lanceolate, subentire and cartilagenous at margins, acuminate, glabrous or with a few stiff long hairs, 1.25 - 1.75 mm long. Corolla lobes oblong, dilated at base, acute, externally with a few stiff long hairs, 1.75 - 2.0 mm long. Filaments rhomboid, tapering towards both ends, ciliate, 1.0 - 1.25 mm long ; anthers oblong, ca 0.5 mm long. Ovary semi inferior, 3-loculed, with a conical beak ; styles 1.0 - 1.5 mm long ; stigmatic-lobes 3, very short. Capsules subglobose, 3-valved, 2 - 3 mm long and as much broad ; valves ca 1 mm long. Seeds slightly compressed, ca 0.5 mm long.

Type : Malabar - Concan, *Stocks* ; Bombay, *Dalzell* (K, Photo !).

Fls. & Frts. : Oct. - Jan.

Distrib. : INDIA : Karnataka, Maharashtra ; TROPICAL AFRICA.

Exsicc. Karnataka : Hankala forest, Banupur, Mysore dist., *Naithani* 23249 (MH) ; Ramandrug, Bellary dist., *Lawson* (MH-29067) ; Malabar-Concan ; *Stocks & Law. s.n.* (CAL ACC. NO. 261657 ; MH ACC. NO. 29068). Maharashtra : Hill-tops, north of Lahada, between Amraoti and Lewada in the Sipna valley, Amraoti dist., *Burkill* 31173 (BSIS).

Ecol. : In grassy hill-tops and areas of moderate rainfall at elevations between 800-1200 m above sea level.

Notes : Cooke (*l.c.*) has reported the flower colour as 'blue' which was also noted by Naithani (23249, MH). However, yellow flowers were recorded by Lawson (MH 29067). Burkill (31173 BSIS) also mentioned the flower colour as "yellow" but also added "or Cooke says blue". Thulin (*l.c.*) also has recorded yellow flowers for the African plants.

3. ***Wahlenbergia hirsuta*** (Edgew.) Tuyn in Steenis, Fl. Males. 1, 6 : 113. 1960 ; Thulin, in Symb. Bot. Upsal. 21 (1) : 174. 1975. *Cephalostigma hirsutum* Edgew. in Trans. Linn. Soc. 20 : 81. 1846 ; Hook. f. & Thoms. in J. Linn. Soc. 2 : 9. 1858, *p.p.* ; Clarke in Hook. f., Fl. Brit. India 3 : 429. 1881 ; Prain, Beng. Pl. 1 : 635. 1903 ; Haines, Bot. Bih. s Or. 2. 502. 1922 ; Nair, Fl. Bashahr Himal. 170. 1977. *Lightfootia hirsuta* (Edgew.) Wimm. ex Hepper in Kew Bull. 15 : 61. 1961, *p.p.* ; Rao & Balakr. in Rec. Bot. Surv. India 20 : 135. 1973.

Annual, erect herbs, 3 - 11 cm high. Stem spirally twisted and branching upwards, hirsute. Leaves alternate, upper ones sessile and

lower ones up to 1.5 mm, petiolate, uniformly distributed, oblong to ovate-lanceolate, attenuate to cuneate at base, undulate-serrate and cartilagenous at margins, obtuse to acute, glabrous to sparsely hirsute above, distinctly veined and sparsely to densely hirsute below especially on midveins, 1.5 - 2.5 × 1 - 9 mm. Inflorescence lax, spreading; pedicels 2 - 13 mm long. Calyx perigynous. Hypanthia subglobose to broadly subglobose, 5 nerved, 1 - 4.5 mm in diam.; teeth 5, acute to acuminate, entire to subentire and cartilagenous at margins, with a few long hairs without, as long as or slightly shorter than corolla-lobes, 1 - 1.75 mm long. Corolla lilac or blue; lobes linear-oblong, dilated at base, acute, glabrous within and with a few stiff long hairs without towards apex, 1.25 - 2.25 mm long. Filaments rhomboid at base and tapering upwards, ciliate, ca 1 mm long; anthers ca 0.5 mm long. Ovary semi inferior, 3 - loculed; style slender, 1 - 2 mm long; stigmatic-lobes 3, very short. Capsules sub-globose to broadly subglobose, 3 valved, 1.5 - 2.5 mm in diam.; valves ca 1 mm long. Seeds ca 1 mm long.

Type : INDIA : Himachal Pradesh : Banasar, *Edgeworth* 252 (Holo : K, Photo !)

Fls. & Frts. : Sept. Oct.

Distrib. : INDIA : Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Bihar ; TROPICAL AFRICA, MADAGASCAR.

Exsicc. : Himachal Pradesh : Taranda, Bashahr State, *Raizada* 19905 (DD). Uttar Pradesh : near Mussourie, *King s.n.* (CAL ACC NO. 261676). Bihar : Parasnath, Hazaribagh, Chotanagpur, *Clarke* 22798 (CAL).

Chr. No. : For African *W.hirsuta*, the chromosome number has been reported as $2n = 42$ (Thulin, 1975).

Ecol. : On the grassy openings of woodlands, slopes, cultivated and waste grounds, etc. at elevations between 600-2000 m above sea level.

Notes : Often mistaken with *W. erecta* but readily separable from the latter by its trigonous seeds. No specimen from Jammu & Kashmir could be examined though it has been reported from that place by Clarke (*l.c.*).

4. **Wahlenbergia hookeri** (Clarke) Tuyn in Steenis, Fl. Males. 1, 6 : 114. 1960 ; Thulin in Symb. Bot. Upsal. 21 (1) : 181. 1975. *Cephalostigma hookeri* Clarke in Hook. f., Fl. Brit. India 3 : 429.

1881 ; Prain, Beng. Pl. 1 : 635. 1903 ; Gamble, Fl. Pres.Madr. 2 : 738. 1921 ; Haines, Bot. Bih. & Or. 4 : 502. 1922. *Cephalostigma* nov. sp. Hook. f. & Thoms., Herb. Ind. Or. Mss.

Annual, erect, 9–26 cm high herbs, hirsute, profusely and repeatedly branched above ; branches slender, ultimately glabrous. Leaves alternate, rarely becoming subverticillate just below inflorescence, sessile or up to 3 mm petiolate, oblong-elliptic to elliptic-lanceolate, caudate to cordate at base, sinuate-dentate to crenate serrate and cartilagenous at margins, acute, sparsely to densely hirsute, 7–35 × 3.5–14 mm. Inflorescence lax, spreading, paniculate ; pedicels slender, 3.5–25 mm long. Calyx epigynous ; hypanthia subglobose, 5-nerved, ca 1 mm in diam. ; teeth triangular to narrowly triangular, entire and cartilagenous at margins, acute, ca 0.5 mm long. Corolla blue, almost cleft up to base, glabrous ; lobes oblong to linear-oblong, acute, slightly dilated at base, 1.5–2 mm long. Filaments slightly dilated towards middle and tapering towards both ends, glabrous, ca 1 mm long ; anthers narrowly oblong, ca 0.3 mm long. Ovary ca inferior, 2-loculed ; style ca 1 mm long ; stigmatic-lobes 2, very short. Capsules subglobose, 1–1.5 mm in diam. ; valves ca 0.5 mm long. Seeds ca 0.5 mm long.

Types : INDIA : Bihar : Parasnath, J.D. Hooker s.n. ; Watt s.n. ; Clarke 24796A (K, Photo !).

Fls. & Frts. : Sep.-Nov.

Distrib. : INDIA : Bihar, Meghalaya, Nagaland, Tamil Nadu and Kerala (?) ; TROPICAL AFRICA, THAILAND, JAVA.

Exsicc. : Bihar : Parasanath, Clarke 24796 B (CAL) & 24796 (CAL). Meghalaya : Khasia mts., Clarke 15958 (CAL). Nagaland : Kohima, Naga hills, Clarke 41573 D (CAL) ; s.l., Coll. ? 18 (CAL). Tamilnadu : Anaimalai hills, Coll. ? B 185 (CAL).

Ecol. : On open grasslands at elevations between 900-1200 m above sea level.

Notes : Often confused with the Burmese *Wahlenbergia candollei* Tuyn (*Cephalostigma paniculatum* A. DC., Monogr. Camp. : 117. 1830, non *Wahlenbergia paniculata* (Thunb.) A.DC., *ibid* 153. 1830) but easily distinguishable by its smaller flowers and subglobose hypanthia. Clarke (l.c.) had described the ParasNath plants as with erect simple stems and larger leaves almost whorled below the inflorescence and the Khasian

specimens as with stouter, more hirsute stems, branched from the base and leaves with no tendency to whorl, a fact borne out by the present study also.

An anomalous condition of 3-lobed stigma and 2-valved capsule has been described and had also been presented in the accompanying diagram by Tuyn (*l.c.*) However, only 2-lobed stigma and 2-valved capsules had been observed for the Indian examples, which is corroborated by Thulin (*l.c.*) also for the African collections.

Very few specimens could be examined and no specimen from Kerala (Western ghats, Kumili) could be located as reported by Gamble (*l.c.*).

5. ***Wahlenbergia marginata*** (Thunb.) A.DC., Monogr. Camp. : 143. 1830 & in DC., Prodr. 7 : 1839 ; Hara, Fl. E. Himal. Rep. 2 : 131. 1971 ; Bennett, Fl. Howrah dist. : 365. 1975 ; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan dist. 569. 1976 ; Babu, Herb. Fl. Dehradun 295. 1977 ; Balakr., Fl. Jowai 1 : 279. 1981. *Campanula marginata* Thunb., Fl. Jap. 89. 1784. *C. gracilis* Forst., Fl. Ins. Austr. Prodr. : 84. 1786. *C. dehiscens* Roxb. ex Wall., As. Res. 12 : 571, t. 6. 1816, & in Roxb., Fl. Ind. 2 : 96. 1824. *C. agrestis* Wall. in Roxb., Fl. Ind. 2 : 97. 1824. *Wahlenbergia gracilis* (Forst.) Schrad. in Blumenbachia : 38. 1827 ; A.DC., Monogr. Camp. : 143. 1830, *p.p.* & in DC., Prodr. 7 : 433. 1839, *p.p.* ; Clarke in Hook. f., Fl. Brit. India 3 : 429. 1881 ; Prain, Beng. Pl. 1 : 636. 1903 ; Cooke, Fl. Pres. Bombay 1 : 74. 1904 ; Duthie, Upp. Gang. Pl. 1 (2) : 498. 1905 ; Gamble, Fl. Pres. Madr. 2 : 738. 1921 ; Haines, Bot. Bih. Or. 2 : 503. 1922. *W. dehiscens* (Roxb.) A. DC., Monogr. Camp. : 145. 1830 & in DC., Prodr. 7 : 434. 1839. *W. agrestis* (Wall.) A. DC., Monogr. Camp. : 145. 1830 & in DC., Prodr. 7 : 434. 1839 ; Wight, Ic. 4 : t. 1175. 1848 & Spic. Neilgh. 2 : 21, t. 123. 1851 ; Hook. f. & Thoms. in J. Linn. Soc. 2 : 21. 1858. *W. indica* A. DC. Monogr. Camp. : 146. 1830 & in DC., Prodr. 7 : 734. 1839 ; Wight, Ic. 4 : t. 1176. 1848.

Local names : Kerdi (Mar.) ; Aleka (Tam.).

Annual herbs (or perennial ?) 4 - 65 cm tall, decumbent to ascending. Stems simple or branched, glabrous to densely hirsute. Leaves alternate, sessile, elliptic to linear, truncate to cuneate at base, subentire to serrate, often undulate, rarely ciliate, at times recurved and cartilagenous or non-cartilagenous, acute to obtuse, glabrous to densely hirsute, 2 - 68 × 1 - 10 mm. Flowers solitary or in subpaniculate inflorescence ; pedicels

terminal or axillary, glabrous, 2.2 - 8.2 cm long. Calyx *ca* epigynous, hypanthia obconic to campanulate, 10 - nerved, $2.5 - 4.5 \times 1.5 - 3.0$ mm ; teeth 5, broadly lanceolate to linear, entire to denticulate and cartilagenous at margins, glabrous, 1.5 - 3.5 mm long. Corolla blue, campanulate ; tubes 1.5 - 3.0 mm long ; lobes 5, oblong-ovate to lanceolate, acute, 1.5 - 10.0 mm long. Stamens 5 ; filaments rhomboid to linear, ciliate ; anthers narrowly oblong, 1.0 - 2.5 mm long. Ovary *ca* inferior, 2 - 3 or 5-loculed ; style 1.5 - 3.0 mm long ; stigmatic-lobes 2 - 3 - 5, very short. Capsules obconic to campanulate, $2 - 9 \times 1.5 - 5.5$ mm, valves very short, rarely sunken. Seeds ellipsoid, *ca* 0.5 mm long.

Type : ".....inter Arai et Quana," *Thunberg* (UPS, Photo !).

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : Throughout ; CHINA, JAPAN, MALAYSIA, INDONESIA, PHILIPPINES, NEW GUINEA, AUSTRALIA, NEW ZEALAND.

Chr. No. : $2n = 64$ (Sugiura in *Cytologia* 12 : 418 - 434. 1942) ; $2n = 18, 36$ (Hsu in *Taiwania* 13 : 117 - 130.1967) ; $n = 9$ (Gadella, in *Wentia* 11 : 1-104. 1964) ; $2n = 18, 36, 54, 72$ and *ca* 90 (Thulin in *Symb. Bot. Upsal.* 1975).

Ecol. : On moist grasslands, nallahs, river-bed, etc. at elevations up to 3000 m.

Notes : This species exhibits a high degree of variability in respects of habit and morphology. The variable habit (annual vs. perennial), indumentum of the stems, leaves, and floral whorls, and variations in the shapes and dimensions of the floral parts, capsules, etc. have been utilised by N.E. Brown (quoted in Tuyn *l.c.*) and Lothian (1947) for specific delimitations.

The distinction into annual and perennial plants had been considered as impractical by Tuyn (*l.c.*) who reported the occurrences of thin plants with very small flowers along with vigorous old plants with very small flowers along with vigorous old plants in the same locality. Clarke (*l.c.*) also recorded the occurrences of plants with flowers of the first year along with those with woody bases giving rise to many annual shoots. The variability in morphological characters correspond with that in habitat and seems to be of little importance in the specific delimitation and often intergrade. The high degree of polypoidy presented by populations of the species also may account for these variations. J.D. Hooker and Thomson

(*l.c.*) first pointed out the possible similarity of the Indian and Australian plants. They were followed by Bentham (quoted in Lothian, 1947) who remarked that the Australian and Asian species "run so variously into one another that they would require to be differently defined in every separate collection". Clarke (*l.c.*) treated the Asian and Australian plants under a single species *W. gracilis* with whom Tuyn (*l.c.*) also agreed, though the latter proposed *W. marginata*, the earliest available epithet as the correct name. The Indian plants are treated here under *W. marginata* following Tuyn (*l.c.*).

6. ***Wahlenbergia peduncularis*** (Wall. ex A.DC.) Hook. f. & Thoms. in J. Linn. Soc. 2 : 22. 1858 ; Clarke in Hook. f., Fl. Brit. India 3 : 430. 1881. *Campanula peduncularis* Wall. ex A. DC. in DC., Prodr. 7 : 483. 1839. Fig. 25

Perennial herbs, decumbent to ascending, 6–16.5 cm high. Rootstocks simple or branched. Stems arising in numbers from the rootstock, simple or branched, glabrous to hirsute. Leaves lower opposite and upper alternate, ovate to lanceolate, truncate to caudate at base, sub-entire to remotely sinuate, acute, glabrous or sparsely puberulous, glaucous below, 2–18 × 1–8 mm. Flowers solitary ; pedicels terminal, axillary or leaf-opposed, glabrous, 0.7–4.2 cm long. Calyx perigynous ; hypanthia obconic to subglobose, 10-nerved, 2.0–2.5 × 3.0–3.5 mm, teeth oblong, slightly dilated towards base, entire and cartilagenous at margins, obtuse, glabrous, 4.0–5.5 mm long. Corolla free for 3/4 the length, glabrous ; tubes ca 2 mm long ; lobes oblong, acute, 5–6 mm long. Filaments oblong linear, dilated towards the base, ciliate, 2–2.5 mm long ; anthers oblong, 2.0–2.5 mm long. Ovary semi inferior, 3-loculed ; style ca 3.0 mm long ; stigmatic-lobes 3, ca 1.5 mm long. Capsules obconic to subglobose, 4.5–5.0 × 3.5–4.0 mm (while young). Seeds slightly compressed, narrowed at one end, ca 0.8 mm long.

Type : INDIA : Uttar Pradesh : Kumaon (Kumaon). *Blinkworth* in Wall. Cat. No. 7139 (K, Photo !).

Fls. & Frts. : Apr.–May.

Distrib. : INDIA : Uttar Pradesh ; apparently endemic.

Exsicc. : Uttar Pradesh : Girgaon, Pithorgarh dist., *Nair* 35692 (BSD) ; Gouri, Madhkote, *Bhattacharya* 21312 (BSD).

Ecol. : On moist shady places, beneath forest trees, shrubs, rock-shades, near streams, etc., at elevations between 1800 and 2200 m.

II. Campanulaceae Juss. subfam. **Sphenocleideae** Fedorov in Shishkin & Bobrov, Fl. URSS. 24 : 448. 1957. *Sphenocleaceae* Mart. ex Lindl., Nat. Syst. ed 2 : 238. 1836 ; A. DC. in DC., Prodr. 7 : 548. 1839 ; Airy-Shaw in Steenis, Fl. Males. 1, 4 : 27. 1948. *Campanulaceae* tribe *Sphenocleae* School in Engler & Prantl, Nat. Pflanzenfam. 4, 5 : 60. 189 ; Steenis, Fl. Males. 1, 6 : 109. 1960.

Annual erect herbs. Stems branched or very rarely simple, fistular with a peripheral whorl of air-channels, glabrous. Leaves alternate, petiolate to sessile, oblong to elliptic, attenuate at base, entire to subentire, acute to obtuse. Spikes terminal or leaf-opposed, cylindric ; peduncles cylindric. Flowers sessile, subtended by a bract basally and two bracteoles laterally, compressed and wedge-shaped at base, minute. Bracts and bracteoles sessile, spatulate, acute to acuminate. Calyx perigynous ; hypanthia urceolate ; teeth imbricate, ovate, obtuse. Corolla perigynous, white to greenish-white, urceolate, 5-partite for $ca\ 1/2$ of the length ; lobes imbricate in bud, erect later, inflexed, ovate to triangular. Stamens 5, epipetalous, attached ca towards lower half of corolla-tube ; filaments very short ; anthers subdorsifixed, subrotundate, slightly longer than the filaments. Ovary semi-inferior, 2-loculed, syncarpous ; ovules very many on pendulous placentas ; styles glabrous, deciduous, very short, stigma capitate. Capsules vertically placed on the peduncle, cuneate and compressed at base and rhomboid-ovoid at top ; opercula rhomboid, ca rigid, removed at level of calyx-teeth during dehiscence. Seeds yellowish-brown, narrowly oblong with pilate costate testa, very minute.

Type : *Sphenoclea* Gaertn.

Distrib. : Pantropical with 2 species of which *S. dazielli* N.E. Brown is endemic to W. Africa (Jafri in Nasir & Ali Fl. West Pakistan 25 : 1. 1972) and *S. zeylanica* Gaertn. is with cosmopolitan distribution.

10. SPHENOCLEA

Gaertn., Fruct. 1 : 113, t. 24. f. 5. 1788 ; Benth. in Benth. & Hook. f., Gen. Pl. 2 : 560. 1876 ; Clarke in Hook. f., Fl. Brit. India 3 : 433. 1881 ; Airy Shaw in Steenis, Fl. Males. 1, 4 : 27. 1948. *Pongatium* Juss., Gen. Pl. : 423. 1789.

1. ***Sphenoclea zeylanica*** Gaertn., Fruct. 1 : 113, t. 24. f. 5. 1788 ; Clarke in Hook. f., Fl. Brit. India 3 : 438. 1881 ; Prain, Beng. Pl. 1 : 635. 1903 ; Cooke, Fl. Pres. Bombay 1 : 75. 1904 ; Duthie, Fl. Upp. Gang. Pl. 1 : 499. 1905 ; Gamble, Fl. Pres. Madr. 2 : 739. 1921 ; Haines, Bot. Bih. Or. 2 : 503. 1922 ; Airy-Shaw in Steenis, Fl.

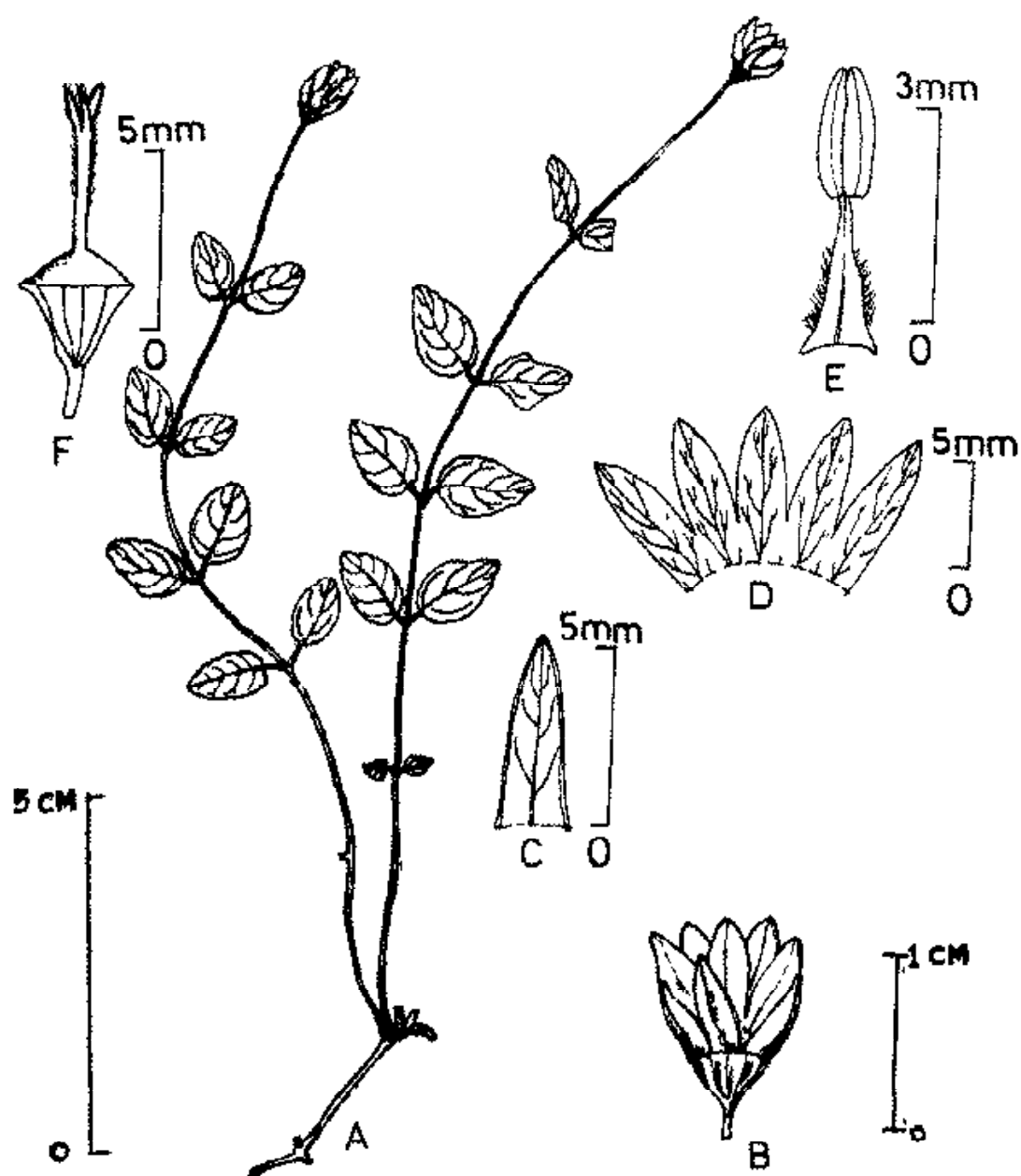


Fig. 25. *Wahlenbergia peduncularis* (Wall. ex A.DC.) Hook. f. & Thoms. A. Habit. B. Flower. C. Calyx lobe. D. Corolla split opened. E. Stamen. F. Pistil (*Bhattacharya* 21312).

Males. 1, 4 : 27. 1948 ; Hara, Fl. E. Himal. Rep. 1 : 329. 1966 ; Bennett, Fl. Howrah dist. 365. 1975 ; Babu, Herb. Fl. Dehradun : 295. 1977. *Pongatium indicum* Lam. Tabl. Encycl. 1 : n. 1991. 1791. *Sphenoclea pongatium* A.DC. in DC., Prodr. 7 : 548. 1839. *Sphenoclea* sp. Griff., Notul. Pl. As. 4: 276. 1854.

Local names : *Jhil Marich* (Beng.), *Mirchi*, *Phulanghas*, *Tatuli* (Hind) ; *Pongati* (Mal.)

Herbs 7.3 - 59 cm tall, leaves 0.9 - 9.6 × 0.5 - 3 cm ; petioles up to 14 mm long. Peduncles up to 5.8 cm long ; spikes up to 9 cm long. Bracts 1.5 - 2.25 mm long. Bracteoles as long as bracts. Hypanthia 1.0 - 1.5 × 1.25 - 2 mm ; teeth 1 - 1.5 × 0.75 - 1 mm. Corollalobes 1 - 1.25 × ca 0.75 mm. Filaments ca 0.25 mm long ; anthers 0.3 - 0.5 mm long. Styles ca 0.25 mm long ; stigma very short. Capsules 3 - 4 mm in diam. Seeds ca 0.5 mm long.

Type : Zeylonens (Ceylon), coll. ?

Fls. & Frts. : June - Jan.

Distrib. : INDIA : Throughout ; BANGLADESH, PAKISTAN, TURKESTAN, IRAN, TROPICAL AFRICA, MADAGASCAR, TAIWAN, MALAYSIA, INDONESIA, PHILLIPPINES, TROPICAL AMERICA.

Chr. No. : 2n = 42 (Bhattacharya in Cytologia 37 (3) : 435 - 443. 1972) ; 2n = 40 (Larsen in Dansk. Botanisk. Arkiv. 23 : 375 - 398. 1966) ; 2n = 24 (Lewis et al, in Rhodora 64 : 147 - 161. 1962).

Ecol. : A weed in paddy fields, swamps, ponds, ditches, riverbanks and other marshy habitats up to an altitude of 1200 m.

Notes : The systematic position of the genus has been much discussed. The genus was raised to a family level by Lindley (*l.c.*) ; which was also accepted by A. De Candolle (*l.c.*). However, the genus was included in the family Campanulaceae by Bentham (*l.c.*), Clarke (*l.c.*) and Hutchinson (The Families of Flowering Plants 292 - 294. 1926). Scholnland (*l.c.*) kept the genus in the tribe Sphenocleae followed by van Steenis (*l.c.*) under Campanulaceae while Fedorov (*l.c.*) maintained the separate identify of the genus as a subfamily (Sphenocleoideae). The family status of the genus was revived by Airy-Shaw (*l.c.*) & in Willis dictionary of flowering plants and ferns, 1973) accepted by Takhtajan (Flowering plants, origin and dispersal 232. 1969). Jafri (*l.c.*) assigned it a position intermediate between Campanulaceae and Primulaceae. Cronquist (The Evolution and Classification of Flowering Plants 300 - 303. 1968),

Dahlgren (Nord. Jour. Bot. 3 : 119 - 149, 1983) and Thorne (*ibid.* : 85 - 117, 1983) have accepted it as belonging to the family Campanulaceae. A subfamilial rank has been preferred by Thorne drawing evidence from Dunbar & Wallentinus (*Bot. Notiser.* 129 : 69 - 72, 1976) and Monod (*Adansonia* Ser. 2, 20 : 147 - 164, 1980) though later Thorne (*Bot. Rev.* 58 : 225 - 348, 1992) accorded a family rank. In the present work *Sphenoclea* is treated under the family Campanulaceae accepting the views of Cronquist and Dahlgren.

ELLISIOPHYLLACEAE

Honda M., Syst. Pl. Japonicum. ed. 1. 372. 1930.

T.A. Rao*

Perennial prostrate herbs ; stems slender, creeping, rooting at nodes, hairy. Leaves alternate, reniform or rounded, crenate or pinnatifid, laxly hairy, membranous ; petioles erect. Flowers small, axillary, solitary on long, slender pedicels, bisexual, zygomorphic, ebracteate. Calyx campanulate, lobes imbricate, persistent. Corolla subrotate, tube infundibuliform, lobes subequal, imbricate. Stamens 4, epipetalous, anthers sagitate. Ovary superior, bilocular with a cupuliform disc, ovules aborted into a few ; stigmas conspicuously to inconspicuously bifid. Capsules globose or subglobose, membranous, compressed. Seeds small, orbicular, plano - convex, rugulose, mucilaginous when moist, endospermous ; embryo straight or concentric.

Monotypic.

ELLISIOPHYLLUM

Maxim in Bull. Acad. St. Peterb. 16 : 223. 1871 ; Benth. & Hook. f., Gen. Pl. 2 : 829. 1876 ; Peter in Engler & Prantl, Nat. Pflanzenfam. 31 (4) : 67. 1897 ; Hutch., Fam. Fl. Pl. 605. 1973. Brand in Engler, Pflanz. 59, 4 (251) : 185. 1913, *excl. gen. Sibthorpia* L. 1754 ; Hook.f., Fl. Brit. India 4 : 281. 1884.

One species (*E. pinnatum* (Benth.) Makino), India to Japan, Taiwan to E. New Guinea.

Pollen : Grains 3 colporate, $21 \times 35 \times 17 \times 29 \mu$; colpi $17 \times 31 \times 2 - 3 \mu$, exine $1.5 - 2 \mu$, reticulate, tectate (Huang in Taiwania 13 : 52. 1967).

Notes : The significant morphological features, namely multicellular hairs, coiled pedicels, obscurely didynamous stamens, glabrous ovary, conical septum, a few seeds at maturity and seeds minutely pubescent when wet are highly characteristic of the genus and taken together are sufficient

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to assign a separate status. On embryological features this genus is considered to hold an unique position in the Scrophulariaceae (Yamasaki in Bot. Mag. Tokyo 70 : 162-168, 1957).

Straight or coiled pedicels appear to have some relation with the seasonal variation and temperature. Further, they are helpful to bury the fruit in the soil.

Ellislophyllum pinnatum (Wall.) Makino in Bot. Mag. Tokyo 20 : 91. 1906. *Ourisia pinnata* Wall. in Benth., Scroph. Ind. : 47. 1835. *Hornemannia pinnata* (Wall.) Benth. in DC., Prodr. 10 : 428. 1846. *Sibthorpia pinnata* (Wall.) Benth. in Benth. & Hook. f., Gen Pl. 2 : 959. 1880 ; Hook. f., Fl. Brit. India 4 : 288. 1884. *Moseleya pinnata* (Wall.) Hemsl. in Hook., Ic. Pl. 4 ser. 6 : t. 2592. 1899. **Fig. 26**

Trailing herbs, *ca* 25 cm long, puberulous to hirsute ; stems 10 - 35 cm long, straggling, rooting at nodes. Leaves 2 - 5 × 3 - 4 cm, broadly oblong or ovate, membranous ; segments 5 - 7, obovate, crenate or lobulate towards apices ; petioles 2.5 - 8 cm long. Flowers white *ca* 7 mm across ; pedicels axillary, *ca* 4 cm long, slender, coiled in fruits. Calyx *ca* 6 mm long, persistent, lobes ovate, acute, membranous. Corolla *ca* 9 mm long, infundibuliform, white, throat orange, hairy inside, lobes 5, obovate to spatulate, patent nerved. Stamens *ca* 4 mm long, obscurely didynamous ; anthers 2-loculed, diverging. Discs sinuate along margins. Ovary 2 - 2.5 mm across, glabrous, septum conical ; styles slender, obscurely swollen at base. Capsules *ca* 6 mm across, 1 - 2 seeds in each locule. Seeds minute, concave-convex, rugulose, pubescent.

Type : NEPAL, Sheopore, April 1821. Wallich. Cat. No. 3915 (CAL !)

Fls. : Jan. - July ; **Frts.** : June - Oct.

Distrib. : INDIA : E. Himalayas ; W. Bengal (near Tezpur), Nagaland (Zekwere), Sikkim ; NEPAL, BHUTAN, JAPAN, NEW GUINEA, CHINA, TAIWAN, PHILIPPINES.

Uses : Ornamental with its white flowers grown in gardens as potheb.

Chr. No. : 2n = 18 Kurosawa (in Hara, Fl. Himal. (1st report) : 662. 1966 and (2nd report) : 360. 1971). 2n = 16 has also been reported by Borgmann (in Zeit. f. Bot. 52 : 118. 1964).

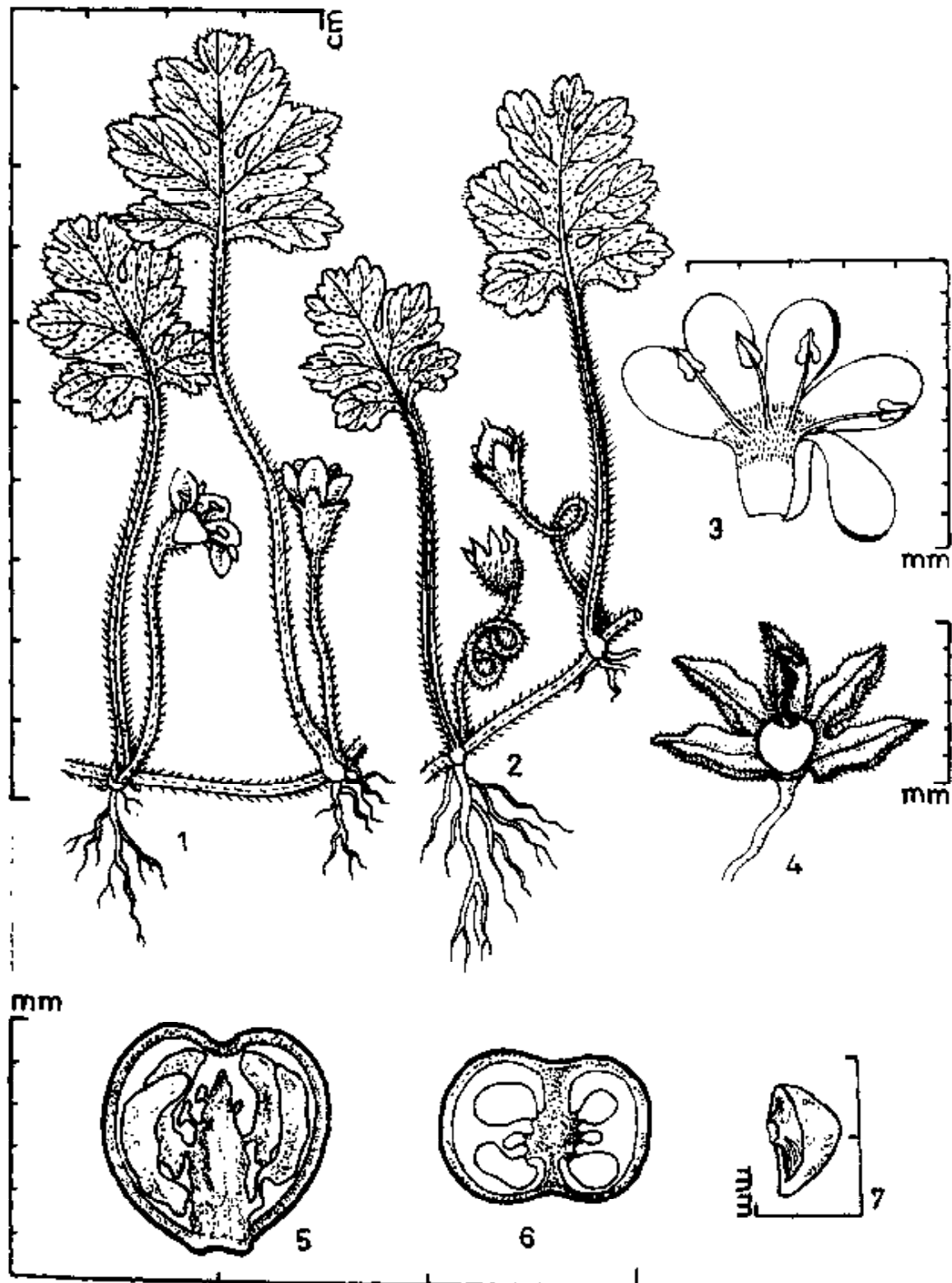


Fig. 26. *Ellisophyllum pinnatum* (Wall.) Makino. 1 & 2. Habit. 3. Flower. 4. Fruit. 5. V.S. of fruit. 6. T.S. of fruit. 7. Seed.

APONOGETONACEAE

J. Agardh, Theor. Syst. Pl. Fam. Phan. 44. 1858 (Aponogetaceae)

R. Sundara Raghavan*

Perennial, glabrous hydrophytes (fresh water or brackish). Rootstock tuberous, rhizomatous or stoloniferous, elongate or cylindrical, often branched ; roots fibrous. Leaves in a radical rosette, submerged and/or floating, very rarely emerged, membranaceous, alternate, long petiolate and sheathing at base ; lamina oblong - elliptic, lanceolate or linear with a distinct midrib and 2 or more pairs of parallel nerves connected by numerous transverse nervules. Inflorescence long peduncled scape, solitary or 2 - 10 spikes, emergent, enclosed in a caducous or persistent spathe, simple or forked, or contracted in to a head, peduncles much elongating in fruits. Flowers minute, hypogynous, ebracteate, bisexual or if unisexual plants dioecious, rarely apogamous, spirally or rarely dorsiventrally arranged on rachis, turned towards all directions. Tepals 1 - 3, rarely reduced to 0 or up to 6, often petaloid and bract - like, equal or unequal, membranous, 1 - 3 veined, mostly persistent, rarely caducous. Stamens 6 or more, sometimes reduced to 4 or 5, biseriate, free, persistent ; filaments unequal, filiform or subulate, persistent ; anthers didymous, extrorse, 2 - loculed, basifixed ; pollen subglobose or ellipsoid, monosulcate ; pollination entomophilous. Gynoecium apocarpous, carpels (2 -) 3 (- 9), sessile, 1 - loculed ; ovules 1 - 8 per carpel, basal, anatropous, bitegamic ; style short ; stigma discoid or decurrent with stigmatic ridge on ventral suture, persistent. Follicles distinct, membranous with outer skin soon disintegrating, beak terminal or lateral, often curved. Seeds without endosperm, testa single or double, if double, outer one fitting loose and transparent, inner one closely fitting ; embryo straight with a single terminal cotyledon.

Monotypic. The genus *Aponogeton* L. f. is confined to warmer tropics of the world ; ca 44 species, 7 in India.

Engler treated this family under Helobiae. Takhtajan (Systema et phylogenia Magnoliophytorum, 1966 Soviet Science Press, Moscow & Leningrad) as well as Cronquist (Evolution and classification of flowering plants. Houghton Mifflin, Boston, 1968) included this family under Najadales. Bentham & Hook.f. (Gen. Pl. 3 : 1013 - 1014. 1883) consider this in Naidaceae

* R. Sundara Raghavan (since deceased).

(Najadaceae) under tribe Aponogetoneae. Thorne (in Aliso 6(4) : 57-66, 1968) views it under Zosteriales but Dhlagen (in Bot. Notiser 128 : 119-147, 1975) places it under Hydrocharitales. Hutchinson (Fam. Fl. Pl. ed. 2, 2 : 552, 1959 & in ed. 3, 2 : 682, 1971) however, regards both Aponogetonaceae and Zosteraceae under Aponogetonales, which is followed in this work. The family is closely allied to Najadaceae, Potamogetonaceae and Zosteraceae. It differs from Potamogetonaceae by the coloured perianth and straight embryo.

APONOGETON

L.f., Suppl. Pl. 32, 1781 ; Edgew. in Hook., London J. 3 : 402, 1844 ; Hook.f. in Benth. & Hook.f., Gen. Pl. 3: 1013, 1883 ; Engler & Prantl, Nat. Pflanzenfam. 2, 1: 218, 1889 ; Engler & Krause in Engler, Pflanzenr. 24 (413) : 9, 1906 ; Hook.f., Fl. Brit. India 6: 564, 1893 ; Bruggen in Blumea 16 : 245, 1968 & in Steenis, Fl. Males. 1, 7: 213, 1971. *Uvirandra* Mirbel, Hist. Nat. Gen. Part. Pl. 4 : 117, 1803 ; Thouars., Gen. Nov. Madag. 2, 1806 (*Ouvirandra*). *Spathium* Egew. in J. Asiat. Soc. Bengal 11: 145, 1842 & in Calcutta. J. Nat. Hist. Soc 3: 533, tt. 15-16, 1843, *non* Lour. 1790.

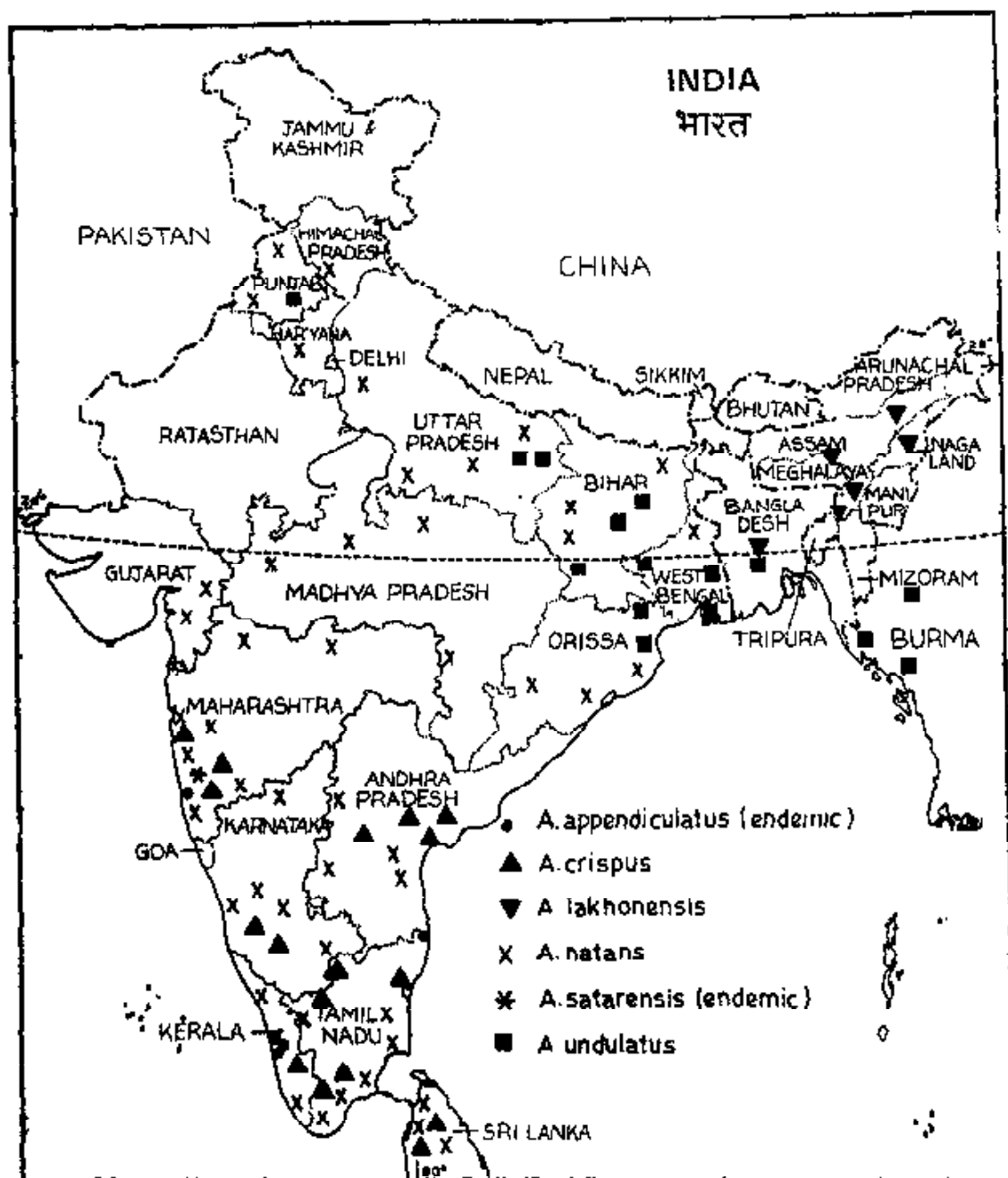
Type : Aponogeton natans (L.) Engler & Krause.

Distrib. : A genus of ca 44 species. Tropical, from Africa, Madagascar, Asia, South-east Asia extending through Malesia to Australia ; 12 in Asia and South-east Asia, 4 in Australia, 1 in Madagascar and 14 in Africa with maximum diversity in Africa and Madagascar. 7 (including an introduced) species in India. Map I

Notes : Common in tanks, ponds, lakes etc. often in temporary pools of muddy, stagnant or even brackish water from sea level to 1300 m altitude. Flowering and fruiting is mostly confined to post-monsoon period. The starting tubers are edible and are consumed either boiled or roasted, often serving as famine food. *A. crispus* and *A. natans* are cultivated in aquaria plants in India.

A. satarensis endemic to restricted areas in peninsular India and endangered as well. The report of *A. abyssinicus* Hochst. ex Rich. from Kerala is possibly based on a cultivated/introduced specimen.

Four species have been studied cytologically, of which only two viz. *A. natans* and *A. satarensis* occur in India. The basic number in the genus probably is $x = 8$ (and 12 ?). Three species i.e. *A. distachyos* L.f. *A. madagascariensis* (Mirbel) Bruggen and *A. satarensis* have $x = n = 8$. Varying somatic numbers $2n = 76, 78, 92$ displaying aneuploidy have been reported in *A. natans* indicating a basic number $x = 12$, as well.



Map 1. Distribution of *Aponogeton* species in the Indian subcontinent.

Pollen 1 colpate (occasionally trichotomocolpate) grains ellipsoidal, spindle shaped or spheroidal ; exine reticulate or subreticulate (Sharma in *J. Polyn. Spl. issue* 34, 1968). The pollen size varies from $21\ \mu$ - $45\ \mu$ long.

KEY TO THE SPECIES

- 1a. Inflorescences forked and 2 spiked. 2
- b. Inflorescences simple, 1 spiked 3
- 2a. Wild. Plants unisexual and dioecious. Leaves undifferentiated, all floating
..... *A. satarensis* 6
- b. Introduced. Plants bisexual (or apogamous). Leaves differentiated into
primary submerged and secondary floating ones
..... *A. abyssinicus* 1
- 3a. Rootstock stoloniferous. Tepals 5 - 6 mm long, caducous
..... *A. undulatus* 7
- b. Rootstock non-stoloniferous. Tepals under 3 mm long, persistent
..... 4
- 4a. Leaves all submerged. Spathes 5 - 6 cm long. Embryo crowned with a row
of linear appendages *A. appendiculatus* 2
- b. Leaves submerged and / or floating. Spathes under 3 cm long. Embryo
otherwise 5
- 5a. Tubers 3 - 6 cm, ovules 2. Fruits echinate ; testa simple ; plumule attached
to base of embryo *A. crispus* 3
- b. Tubers under 3 cm. Ovules 4 - 8. Fruits smooth ; testa double ; plumule
absent 6
- 6a. Tepals yellow, obovate. Beak of fruit short *A. lakhonensis* 4
- b. Tepals never yellow. Beak of fruit long *A. natans* 5
- 1. *Aponogeton abyssinicus* Hochst. ex A. Rich., Tent. Fl. Abyss. 2 : 351.
1851 ; A. Benn in Dyer, Fl. Trop. Afr. 8 : 218. 1902 ; Bruggen in Bull.
Jard. Bot. Nat. Belg. 43 : 221. f. 2. 1973. *A. leptostachyus* var.
abyssinicus (Hochst. ex A. Rich.) Engler & Krause in Engler,
Pflanzenr. IV. 13 (heft 24) : 14. 1906.

Tubers obovoid or elongate, ca 1.5 cm across. Leaves both submerged and floating ; petiole variable in length ; primary leaves submerged, ca 1.8×1.2 cm, obovate, main parallel veins 7 ; secondary leaves floating.

various, linear (up to 8×1.3 cm), lanceolate or ovate (up to 4×1.8 cm), rounded or truncate at base, main parallel veins 5 - 7. Spike bifid, 2.5 - 3 cm long; spathe caducous, up to 1.4 cm long. Flowers dense, mauve or purplish - violet. Tepals 2, ca 2.8×2.5 mm, obovate, 1 nerved. Stamens 6, purplish, ca 2.5 mm. Carpels 3; ovules 4 per carpel. Follicles ca 6×2.5 mm, long beaked with double testa.

Type : Ethiopia, near Aksum, Schimper 1483 (K!, L!).

Fls. & Frts. : Aug.

Distrib. : AFRICA (ETHIOPIA, KENYA, MALAWI, RWANDA, TANZANIA, ZAIRE).

Notes : Bruggen, while confirming the identification of specimen from India (Kerala) had commented that its report from India is interesting for it has never been earlier known to occur outside Africa. It might have been either cultivated or accidentally introduced in the area. Attempts to recollect the species from Kerala were not successful.

Specimen cited : INDIA : Kerala, Trivandrum, V. Nair s.n. (K).

2. *Aponogeton appendiculatus* Bruggen in Blumea 16 : 265, f. 5. 1968 & 18 : 461, f. 2. 1970.

Tubers ca 10 mm across, elongate and creeping, usually occurring in brackish water. Leaves submerged; lamina strap shaped, $25 - 35 \times 2 - 3$ cm, at base undulate, with 2 - 4 pairs of slender parallel veins on either side; petioles up to 25 cm long. Peduncles 90 - 120 cm long; spathe 5 - 6 cm long, caducous. Spike lax, 8 - 10 cm long, elongating in fruits. Flowers white, turned in all directions. Tepals 2, ca $1 - 1.5$ mm, obovate, 1 nerved. Stamens 4 - 6, ca 1 mm long. Carpels 2 - 3, ca 1×0.8 mm, 1 - ovuled. Follicles $10 - 12 \times 6 - 8$ mm, beak terminal. Seed : testa simple; embryo obovate, crowned with a row of linear tortuous appendages.

Type : Alleppey, Nov. 1893, Lawson 113 (K, holo ! isotype CAL !, K !)

Fls. & Frts. : Aug. - Dec., when water turns brackish.

Distrib. : INDIA : along coastal belt. Kerala, Maharashtra and Tamil Nadu endemic.

Notes : 1. Though collected as early as 1887 it was misidentified as *A. crispus* Thunb. till 1968 when Bruggen described it as a new species. It has been collected from Spurtank at Egmore (Madras, India) but it has not

been recollected. Many specimens labelled as "*A. crispus* Thunb." by C.E.C. Fischer at K or MH are misidentification of the species. Stocks collection from 'Concan' is actually from Chorla ghat bordering Ratnagiri district (Maharashtra) but he too had misidentified it as '*A. undulatum* Roxb.'. Bennets report of this species from West Bengal (*Fl. Howrah district* 25, 1974) with tepals measuring ca 5 mm is again a misidentification of *A. undulatus* so common in West Bengal, having similar undulate submerged leaves and such large tepals. This species, as known at present, is confined to peninsular India especially in Vembanad lake between Cochin and Alleppey in Kerala from where C.D.K. Cooke, has very recently rediscovered it.

Due to its close similarity to both *A. natans* and *A. undulatus* especially in the vegetative state, it has often been either overlooked or misidentified, hence its apparent rarity. Nevertheless it is a threatened species but wherever it could be located it is locally abundant. In the fruiting it is readily distinguished from other species by its characteristic embryo. In the shape of its embryo it superficially resembles *Cryptocoryne ciliata* (Roxb.) Fischer ex Wydl. (ARACEAE) also occurring in brackish waters.

2. *Habitat* : This species occurs mostly in brackish waters at depths ranging from 1.5 - 4 m. From April to September the reclaimed rice fields along side the canals and backwaters are flushed with rain waters from the mountains but from November to April the level of water recedes and brackish water displaces fresh water. It flowers only when the brackish water inundates the rice fields during the post monsoon period. The inflorescence escapes attention as it occurs at great depths when water is very much turbid, leaves not quite visible and the flowers scarcely emergent (based on field notes by C.D.K. Cook).

3. *Uses* : Tubers still form part of diet to farmers at Vembanad and neighbourhood in Kerala and two year old tubers are preferred by them.

4. *Conservation status* : It is a vulnerable species and if the habitat is disturbed or destroyed it is likely to become extinct. Efforts should be made to propagate the tubers in similar habitats along coastal regions of Karnataka, Kerala, Tamil Nadu and Maharashtra.

Specimens cited : MAHARASHTRA : Chorla ghat, near Ratnagiri, Stocks s.n. (K, L). KERALA : Alleppey backwaters, August 1887, Madras Herb. No. 52935 (MH) ; Nov. 1893, Lawson 113 (K, CAL) ; Nov. 1901, Alleppey, Ambalapuzha, K. Rangachari s.n. (K) ; Vembanad lake near Alleppey, K. Venkoba Rao 4073 (K) and C.D.K. Cook s.n. (WAG). TAMIL NADU : Madras Spurtank, Egmore, Madras Herb. No. 73304 (MH).

3. *Aponogeton crispus* Thunb., Nov. Gen. 4 : 73. 1781 (*crispum*) ; Thwait., Enum. Pl. Zeyl. 333. 1864, *excl. descr.* ; Hook. f., in Fl. Brit. India 6 : 564. 1893 ; Engler & Krause in Engler, Pflanzenr. 24 (4, 13) : 12. 1906, *excl. descr.* ; Fischer, Fl. Pres. Madras 9 : 1598. 1931 (Repr. ed. 3 : 1115. 1957) *p.p.* ; Bruggen in Blumea 18 : 481, f. 1, 6. 1970. *A. echinatus* Roxb., Fl. Ind. 2 : 210. 1832 (*echinatum*) ; Hook. f., Fl. Brit. India 6 : 564. 1893 ; Subramanyam, Aquatic Angiosperms 92. 1962 ; Bruggen in Blumea 18 : 483. f. 1 & 7. 1970 ; Saldanha & Nicolson, Fl. Hassan dist. 635, f. 106. 1976 ; Matthew, Ill. Fl. Tamil Nadu Carnatic : t. 774. 1982 & Fl. Tamil Nadu Carnatic 3 : 1713. 1983.

Local names : *Kekatiya* (Sans.), *Kotikilangu* (Tam.)

Tubers 3 - 5 × 2 - 2.5 cm, ovoid, obovoid or globular. Leaves variable ; submerged ones membranaceous, 15 - 20 × 4 - 5 cm, oblong - lanceolate, rounded to subacute at apex, truncate at base, undulate, main veins parallel, 7 - 9 ; floating leaves chartaceous, 6 - 18 × 1.7 - 4 cm, linear - oblong, elliptic - lanceolate or lanceolate, rounded at apex, subcordate at base, nerves 7 - 11, connecting nervules obsolete ; petioles up to 50 cm long. Spathe 2 - 2.5 cm long, caducous. Spikes solitary, 8 - 15 cm long, oblong, densely flowered. Flowers white to pinkish, turned all directions, mildly fragrant. Tepals 2, 2 - 2.2 × 1.5 - 1.8 mm, obovate - cuneate, 1 nerved. Stamens 6, 2 - 2.5 mm long ; filaments subulate, broadened at base ; anthers violet. Carpels 3, ca 2 × 1 mm, with some excrescences, 2 - ovuled ; styles thick. Follicles 6.5 - 12 × 2 - 5 mm, ovoid, with some hard excrescences, beak terminal, 2 seeded. Seeds 6 - 8 × 2 - 3 mm, oblong, flat on one side, turgid on other side.

Type : Ceylon, Thunberg s.n. (UPS, n.v.).

Fls. & Frts. : Aug. - Apr. ; [peak flowering between Jan. - Apr.].

Distrib. : INDIA : West Bengal, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu and Kerala ; SRI LANKA.

Habitat : Common in lakes, ponds and tanks. Associated with species of *Caldesia parlatore*, *Potamogeton* L., *Limnophyton* Miq., *Najas* L. etc.

Notes : Bruggen (Blumea 18 : 485. 1970) remarks that *A. echinatus* is closely related to *A. crispus* but later personal communication (1984) that based on experimental cultivation of both *A. crispus* (from Sri Lanka) and *A. echinatus* (from India) under identical conditions, he confirmed that both represent one and the same species.

In herbaria, this species is often confused with *A. natans* in vegetative state mainly due to their superficial similarity and overlapping distribution

pattern. This is mainly because both species are superficially similar in the vegetative state and besides the distribution of *A. natans* extends to regions where *A. crispus* also occurs. However, in flowering or fruiting they are distinct for *A. natans* has 6 - 8 ovules (as against 2) per carpel and the seeds possess a double testa (as against simple testa). Roxburgh himself has contributed to this confusion on the identity for in his brief description of *A. echinatus*, he inadvertently mentions the number of seeds as 6 (instead of 2) possibly referring to the entire gynoeceum instead of a single carpel. Moreover, while dealing with *A. natans* (Pl. Corom. 1 : 58. t. 81. 1795) he supplements the description mentioning that "there is a variety, if not a distinct species, with hedgehoged two seeded carpels but in all other respects the same". Further in his plate he illustrates, apart for the 6 - seeded follicles, three echinate and 2 seeded carpels as well, the latter undoubtedly referable to '*A. echinatus*'

2. Prain (*l.c.*), Haines (*l.c.*), Duthie (*l.c.*) and N.C. Nair (*l.c.*) report the occurrence of "*A. crispum* Thunb." from Bengal, Punjab or Uttar Pradesh but a scrutiny of specimens at CAL, BSD and DD reveal that they are mis identifications of *A. undulatus* Roxb. so common in North & Eastern India. The distribution of *A. crispus* does not extend to these regions.

3. Edgeworth (in Hooker, *London J. Bot.* 3 : 404. 1844) refers to *A. dispermus* *nom. nud.* but there is a specimen of Wight *s.n.* at K labelled *A. dispermus* which is none other than *A. echinatus* Roxb. Evidently *A. dispermus* is synonymous to *A. crispus*.

Uses : Tubers are edible. This species is often cultivated as an aquarium plant.

Specimens cited : Andhra Pradesh : Biccaval, Godavari district, 25.12.1901, Bourne 3200 (K, CAL, neotype of *A. echinatus* Roxb.) ; Nellore, 2.2.1929, Jacob 18519 (CAL) ; Srikakulam, 6.9.1982, Balakrishnan 89489 (CAL) ; Narsapur, Medak district, 20.9.1958, Sebastine 6752 (MH) ; Kolleru lake, E. Godavari, 22.1.1958, Subramanyam 5066 (MH) ; Pakhal, Warangal dist. 27.2.1963, Henry 15945 (MH). Karnataka : Biligirirangan hills, Mysore district, 6.9.1961, A. S. Rao 73715 (BSI). Tamil Nadu : Palani, Madura dist., 18.1.1969, Blanco (RHT) ; Palacode, Dharmapuri dist. 14.2.1980, Jayseelan 26525 (RHT) ; Ulundurpettai, S. Arcot, 13.12.1978, Matthew & Perumal 20164 (RHT) ; Puducottai, 7.2.1980, Diraviam 26349 (RHT). Pondicherry, Puthupatti chavadi, 23.2.1972, Thanikaimani *s.n.* (HIFP).

4. ***Aponogeton lakhonesis*** A. Camus, *Nat. Syst.* 1 : 273, f. 18. 1909 & in Lecomte, *Fl. Gen. Indochine* 6 : 1226. 1942 ; Bruggen in *Blumea* 18 : 479, f. 2, 3a. 1970 ; Steenis in *Fl. Males.* 1 (7) : 216, f. 1 & 3. 1971. *A. luteus* A. Camus, *Not. Syst.* 2 : 204. 1911 & in Lecomte, *Fl.*

Gen. Indochine 6 : 1227. 1942. *A. monostachyon* A. Camus in Lecomte, Fl. Gen. Indochine 6 : 1225. 1942.

Tubers up to 2 cm across, elongate to obovoid. Leaves variable ; submerged leaves membranaceous, 12 - 20 × 0.8 - 3 cm, linear to ovate or narrowly oval to linear, attenuate at base, narrowly cuneate or rounded at apex, main parallel veins 7 - 9 ; floating leaves (not seen in Indian collections), up to 17 × 4 cm, cordate or rounded at base, cuneate and rounded or blunt at apex, main veins parallel, 7 - 9 ; petioles 7 - 30 cm long. Spathe ca 1.5 cm, caducous ; spikes dense, 15 - 20 cm long with peduncle, slightly thickening towards apex. Flowers yellow. Tepals 2, obovate, 1 - 2 × 0.8 - 1.5 mm, 1 - nerved. Stamens 6, 1.5 - 3 mm ; filaments broadened towards base. Carpels 3 - 5, 1 - 1.7 × ca 1 mm, 4 - 8 - ovuled. Follicles ca 3 × 2 mm, beak terminal or lateral. Seeds 2 - 3 × ca 1 mm with double testa, outer one loose, inner closely fitting.

Type : Laos, river Attapeu - Lakhon mountains, *Harmand s.n.* (P !).

Fls. & Frts. : Oct. - March.

Distrib. : INDIA : Assam, Meghalaya, Nagaland ; BANGLADESH, CHINA, THAILAND, VIETNAM, LAOS, CAMBODIA, AND MALESIA.

Notes : This species is most common in S.E. Asia but infrequent in India. Confined to hilly tracts of North Eastern India. It is readily distinguished from other Indian species by the yellowish tepals.

Specimens cited : Assam : Tengal, Oct. 1898, *Prain's coll.* 170 (CAL) ; Talap, 23.3.1894, *G.A. Gammie s.n.* (CAL) ; 1836, Unknown collection Acc. No. 499658 (CAL) ; Haflong, N. Cachar hills, *Craib* 556 (CAL).

5. *Aponogeton natans* (L.) Engler & Krause in Engler, Pflanzenr. 24 (4, 13) : 11. 1906 ; Fischer in Fl. Pres. Madras 9 : 1598. 1918 (Repr. ed. 3 : 1115. 1957) ; Fyson, Fl. South Ind. Hill Stat. 684. t. 563. 1932 ; Subramanyam in Aquatic Angiosperms : 92, t. 5 f. 54. 1962 ; Maheshwari, Fl. Delhi 248. 1963 & Ill. Fl. Delhi t. 209. 1966 ; Nair in Rec. Bot. Surv. India 21 (1) : 256. 1978 ; Bruggen in Blumea 18 : 477, f. 2. 1970 ; Bennet, Fl. Howrah dist. 25. 1979 ; Manilal & Sivarajan, Fl. Calicut 306. 1982 ; Matthew, Fl. Tamil Nadu Carnatic 3 : 1714. 1983. *Saururus natans* L., Mant. 2 : 227. 1771. *Aponogeton monostachyon* L.f., Suppl. Pl. 214. 1781 ; Roxb. Pl. Corom. 1 : 58, t. 81. 1795 & Fl. Ind. 2 : 210. 1832 ; Edgew. in Hook., London J. Bot. Kew Gard. Misc. 3 : 405. t. 17. 1844 (*monostachys*) ; Hook.f., Fl. Brit. India 6 : 564. 1893 ; Prain, Beng. Pl. 2 : 1122. 1903 (Repr. ed. 2 : 845.

1963) ; Cooke, Fl. Pres. Bombay 2 : 837. 1908 (Repr. ed. 3 : 348. 1958) ; Haines, Bot. Bih. Or. 846, 1249. 1924 ; Duthie, Fl. Upp. Gang. Plain 3 : 313. 1929 (Repr. ed. 2 : 373. 1960). *Spathium monostachyum* Edgw. in Calcutta J. Nat. Hist. 3 : 533, t 16. 1843.

Local names : Jechu (Hindi, Sans.) ; Parua - Kilangu (Mal.) ; Kalkangi (Sans.) ; Koddi, Kotechi - Kilangu, Neidhal (Tam.) ; Namma Nammadumpa, Namma Kilangu (Tel.).

Tubers 1.5 - 2 cm across, elongate, up to 3×2 cm. Submerged leaves $3 - 6 \times 0.4 - 1.5$ cm, lanceolate or oblong, cuneate at both ends, membranous, transparent with 2 - 3 parallel main nerves on either sides, floating leaves $8 - 12 \times 1.8 - 3$ cm, linear - oblong, cuneate, rounded, hastate or cordate at base, acute or obtuse at apex, main parallel nerves 5 - 7 [9], distinct ; petioles much longer than blade. Spathe ca 1.5 cm long, caducous ; spike 3 - 8 cm long, 4 - 5 mm in diam., solitary ; peduncles up to 30 cm long. Flowers inodorous, blue, bluish - violet, lilac or rosy pink, turned in all directions. Tepals 2, $1.5 - 2 \times 0.5 - 1$ mm, suborbicular, obovate or spatulate. Stamens 6, 2.5 - 3 mm long ; filaments purple ; anthers bluish - purple. Carpels 3, ca 2×1 mm, 6 - 8 ovuled. Follicles 3, longer than tepals, ca 4×3 mm, subglobose, smooth, beak terminal. Seeds 4 - 8, $1.2 - 1.8 \times 0.5 - 0.8$ mm, oblong, ribbed, outer testa loose, winged and transparent, inner one brown and closely fitting the embryo.

Types : India, Koenig s.n. 479.1 (LINN !).

Fls. & Frts. : Almost throughout the year ; peak flowering in peninsular India is from July - Oct., in N. India from Aug. - Nov. and in Eastern India from Feb. - April.

Habitat : Common in stagnant shallow temporary water ponds, water logged rice fields, marshes from sea level up to 1300 m.

Uses : Tubers edible.

Cytology : $2n = 76$, Sharma & Chatterjee in *Cytologia* 32 : 289 - 291. $2n = 78, 92$, Misra in *Bull. Bot. Soc. Beng.* 26 : 47 - 51. 1972.

Distrib. : Almost throughout India except in arid areas and at altitudes above 1300 m ; SRI LANKA.

Notes : As stated under *A. crispus*, Roxburgh's plate and description partly depicts *A. echinatus* as well, an error repeated by Subramanyam (l.c.).

Though in the vegetative state it is similar and often confused with *A. crispus*, *A. undulatus* or *A. appendiculatus*, it is readily distinguished from them in the flowering or fruiting by the number of ovules per carpel and the seeds with double testa.

This is the most common species found in India and is displaced by *A. lakhonensis* in S.E. Asia.

Specimens cited : INDIA. Andhra Pradesh, Sriharikota, Nellore dist., Aug. 1883, *Gamble* 12387 (CAL); Dachuru, Nellore dist., 10.7.1917, *Fischer* 4098 (CAL); Srungavarapukota, Visakhapatnam dist., 21.10.1964, *G.V.S. Rao* 21820 (MH); Digurametta, Kurnool dist., 6.8.1972, *Ellis* 42150 (MH). Gujarat : Mandvi, Kutch, *Indraji Thaker* s.n. (BSI). Karnataka : Someshwar tank, Biligirirangan hills, 25.4.1962, *A.S. Rao* 79784 (BSI). Kerala : Puthiyara, Calicut dist., *Sivarajan* 1728 (CALI); Quilon, Nov. 1910, *Meebold* 12610 (CAL). Maharashtra : Katejhari, Chandrapur, 11.8.1973, *Wadhwa* 137278 (BSI). Punjab : Rohtak, *V. J. Nair* 23274 (BSD); Amritsar, *Chopra* (DD). Tamilnadu : Vandalur, Chengalpeta dist., 1.10. 1974, *Henry* 45546 (MH); Ilengi tank, Courtallam, 28.7.1953, *Subramanyam* 3901 (MH); Karaikudi, 28.11. 1977, *N.C. Nair* 51671 (MH); Veeranam lake, 2.10.1978, *Matthew & Perumal* 17873 (RHT). West Bengal : Jagatballavpur, *Bennett* 1162 (CAL).

6. *Aponogeton satarensis* Sundararaghavan *et al.* in Kew Bull. 36 : 687, f.1. 1982.

Plate 3, Fig. 27 & 28

Scapigerous, partly submerged annuals, 16–25 cm high, dioecious, both sexes similar in shape and size; tubers 14–16 mm across, light brown, globose to ellipsoid. Leaves glossy, glaucous, 3.5–8.2 × 0.4–1.4 cm, lanceolate, cuneate to rounded at base, tapering and acute at apex, main parallel veins 2–3 pairs; petioles 4–13 cm long. Spathe conical, caducous, 8–12 × 2.5–3 mm; peduncles 16–18 cm long. Spikes dioecious, once forked, purplish, inodorous. Flowers turned in all directions. Male inflorescences 5–7 cm long. Tepals 2, purple, turning rosy to pale white, ca 1.6 × 1.3 mm, obovate, 1-nerved. Stamens 56, ca 2 mm long; filaments purple, subulate; pistillodes 3, purple, conical. Female inflorescences 2.5–5.5 cm long. Tepals and staminodes absent. Carpels 3, purple, ca 1.8 × 0.9 mm; ovules 2 per carpel, fruiting peduncles up to 12 cm long. Follicles 6–7 × ca 4 mm, beak terminal, 1–2 seeded. Seeds ca. 5 × 3 mm, testa simple.

Types : Mavashi plateau, Salara district, Maharashtra, 1200 m, *Yadav* 15 (holotype CAL !, iso K! BSI and Ram Narain Ruia College, Bombay).

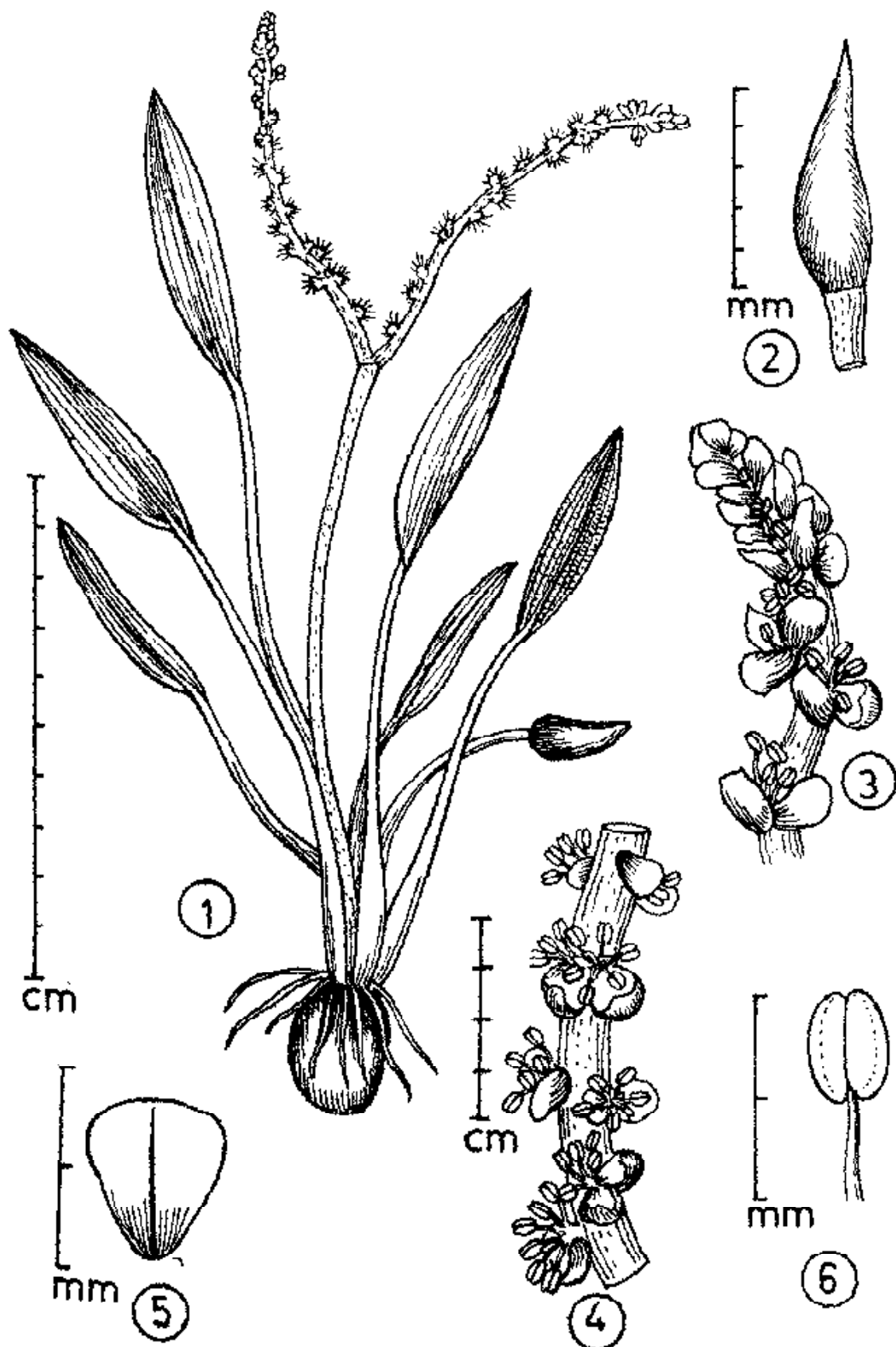


Fig. 27. *Aponogeton satarensis* Sundararaghavan *et al.* 1. Male Plant. 2. Spathe. 3. Young inflorescence. 4. Open flowers. 5. Tapal. 6. Stamen.

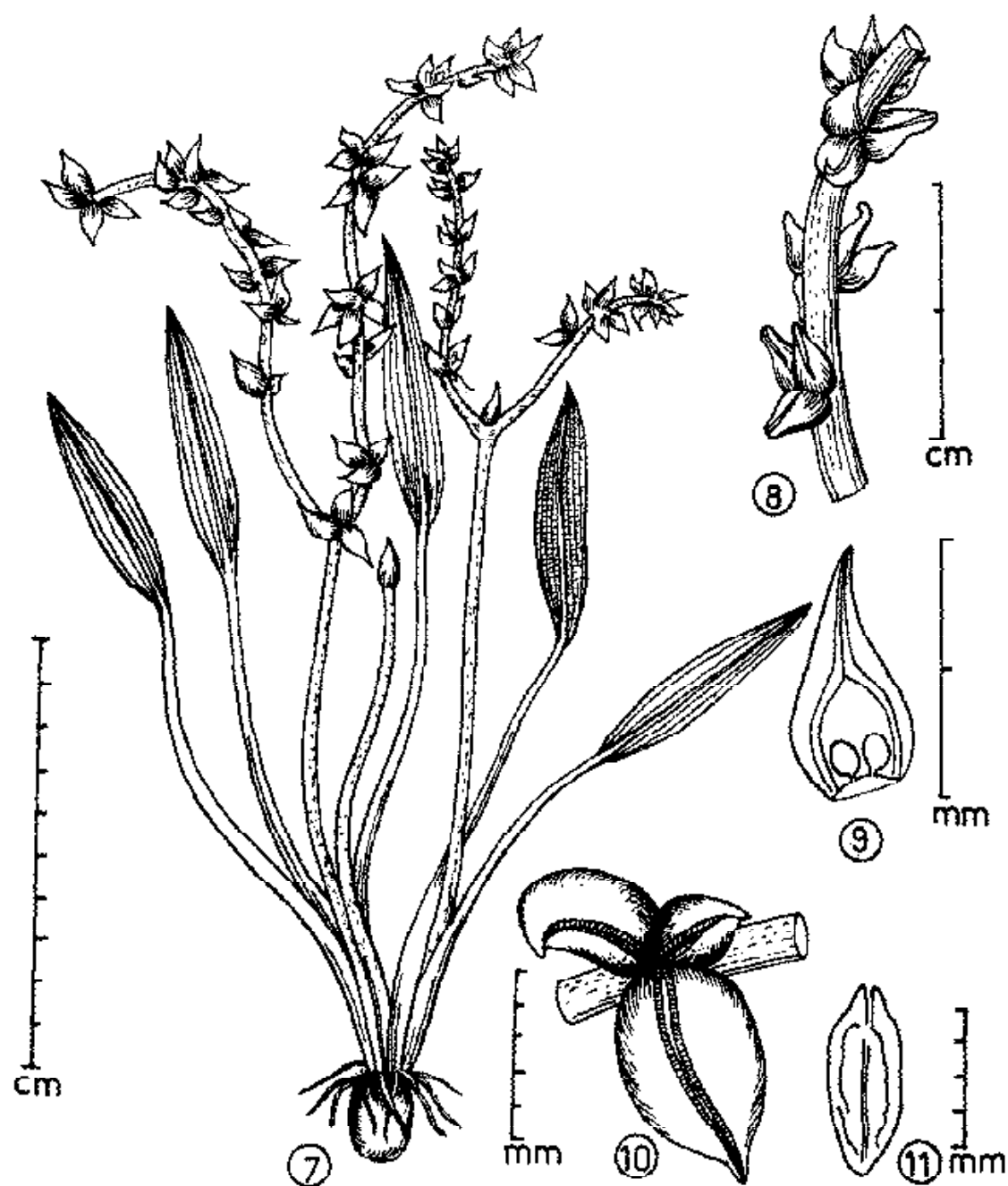


Fig. 28. *Aponogeton sutarensis* Sundararaghavan. 7. Normal Plant. 8. Portion of inflorescence. 9. L.S. of carpel. 10. Follicles. 11. Seed.

Fls. & Frts. : May Sept.

Distrib. : INDIA : endemic to Mavashi plateau, Satara district, Maharashtra.

Habitat : In temporary shallow stagnant pools, associated with common hydrophytes and semiaquatic or marshy species of *Burmannia*, *Cyperus*, *Drosera*, *Eriocaulon*, *Pogostemon*, *Rotala* and *Utricularia*. The depth of soil water never exceeds 60 cm, the tubers mostly rooted in mud along the periphery where the depth of water is less than 25 cm. This species completes its life cycle within a span of 5-6 months, later withering off leaving the tubers buried in soil till the advent of the next monsoon when the dormant tubers sprout. Though similar such habitats are common along the Sahyadris (North Western Ghats) especially the Panchagani plateau (also in Satara district), this species was never collected.

Cultivation : The tubers were raised in the experimental garden at Pune. They flowered profusely and set fruits as well but they failed to tide over the cold and dry seasons ; from Oct. - May, the tubers ultimately decayed before the onset of next monsoon. Efforts are made to cultivate them in the light of past experience gained.

Conservation status : This species is confined and growing luxuriently in shallow temporary pools or puddles of Mavashi plateau during the monsoon season. Due to its fragile habitat this species is likely to become extinct. Efforts were made to successfully raise this species in similar habitats along the Sahyadris as well as in the experimental garden at Pune. It has been proposed to fence the plateau enclosing a few puddles where this species grows gregariously.

Chr. No. : The haploid number is $n = 8$ which is a first report (unpublished), confirming the basic number as $x = 8$.

Notes : *Aponogeton satarensis* is the first record of a dioecious species from Asia. It is also the first report of an Indian *Aponogeton* with forked inflorescence, unusual in any Asiatic species. It is closely allied to *A. decaryi* Jumelle from Madagascar. However, the Indian species is unique in that both sexes are similar in shape and size but for the inflorescence. The male plants outnumber the female plants by 10 : 1. Germination of seeds is profuse and normal in nature.

Specimens cited : Maharashtra : Mavashi plateau in Satara dist., at 1200 m, June 1980, Yadav Y 15 (CAL, K, BSI) and Ram Narain Ruia College, Bombay ; 24.9. 1983, Sundara Raghavan 161738 (BSI).

7. *Aponogeton undulatus* Roxb., (Hort. Beng. 26. 1814, *nom. nud.*) Fl. Ind. 2 : 211. 1832 ('*undulatum*') ; Engler & Krause in Engler, Pflanzenr. IV. 13. heft 24 : 12. 1906, *pro nomen* : excl. descr. ; Bruggen in Blumea 18 : 465.f. 2. 1970 & in Steenis, Fl. Males. 1(7) : 213. f. 1 - 2, 1971. *A. microphyllum* Roxb., Fl. Ind. 2 : 210. 1832 ; Hook. f., Fl. Brit. India 6 : 564. 1893. *Spathium undulatum* Edgew. in Calc. J. Nat. Hist. 3 : 533, t 15. 1843. *Ouvirandra undulata* Edgew. in Hook., London J. Bot. Kew Gard. Misc. 3 : 405. t. 18. 1844. *Aponogeton stachyosporus* de Wit, Med. Bot. Tuinen Belm. Arb. Landb. Hogeschool Wagen. 2 : 96, f.1 - 3. 1958. *A. crispus auct. non* Thunb 1781 : Hook. f., Fl. Brit. India 6 : 564. 1893, *p.p.* ; Prain, Bengal Pl. 2 : 1122. 1903 (Repr. ed. 2 : 845. 1963) ; Haines, Bot. Bih. Or. 5 : 847. 1924 (Repr. ed. 3 : 888. 1961) ; Duthie, Fl. Upp. Gang. Pl. 3 : 313. 1929 (Repr. ed. 2 : 374. 1960) ; Nair in Rec. Bot. Surv. India 21 : 255. 1978. *Spathium microphyllum* (Roxb.) Voigt, Hort. Suburb. Calcutt. 694. 1845.

Rhizome stoloniferous, propagating by runners. Tubers 6 - 25 mm across, ovoid, elongate or globose, smooth. Leaves mostly submerged, rarely floating ; submerged leaves membranaceous, 10 - 33 × 0.6 - 3 cm, linear - oblong, lanceolate or strap - shaped, cuneate at base, acute or tapering at apex, parallel main nerves 2 - 3 pairs on either side ; petioles usually shorter than blades ; floating leaves, if present, ca 20 × 3 cm, oblong, rounded to cuneate at base, cuneate or blunt - tipped at apex, petioles longer than blade. Spathe ca 1.5 cm long, often persistent. Spikes 7 - 10 cm long, lax, elongating up to 16 cm in fruits. Flowers inodorous, white or rosy pink, turned all directions. Tepals 2, rarely 1 or 3, 3 - 6 × 1.3 - 5 mm, obovate or spatulate, 1 - nerved, caducous. Stamens 6 ; filaments pinkish, broadened at base ; anthers yellowish. Carpels 3, ca 1.5 mm long, 2 - ovuled. Follicles 5 - 6 × 3 - 4 mm, beak short, terminal, slightly curved. Seeds 2, ca 5 × 2 mm, subglobose ; testa simple.

Type : Roxburgh Icon. No. 936 CAL, *ined.* (K).

Fls. & Frts. : July - Nov.

Distrib. : INDIA : Assam, Bihar, Maharashtra, Orissa, Punjab, Uttar Pradesh, West Bengal. BANGLADESH, MALESIA, MYANMAR.

Habitat : In ponds and pools, fairly common in North and Eastern India.

Notes : 1. In fresh condition this species is readily distinguished by the irregular alternating pattern of opaque and transparent bands in the mesophyll,

a feature not observed in any other species of *Aponogeton*.

2. The type of *A. microphyllum* Roxb. (Roxburgh's *Icone* No. 1232 at K) showing white tepals and persistent spathe differs from his description of blue flowers and caducous spathe but van Bruggen views it as synonymous to *A. undulatus* in view of the large tepals, stoloniferous nature and persistent spathe. No specimen of *A. microphyllum* from Bhutan (the *type* locality) could be examined at K, BM or CAL.

3. This species can be propagated vegetatively by runners that superficially resemble peduncles and 5–9 plantlets can be produced from each plant.

Specimens cited : INDIA. Madhya Pradesh : Bastar, 6.9.1962, S.K. Jain 5174 (CAL). Maharashtra : Andheri, 27.4.1941, Santapau 204.1 (BLAT) ; Malad, 24.7.1955, Shah 4669, 4670 (BLAT) ; Malad, 19.10.1957, Shah 9322, 9324 (BLAT) ; Borivali, 24.7.1955, Fernandez 1944–1947 (BLAT), 26.10.1953, Fernandez 1600 (BLAT). Orissa : Without precise locality, 20.4.1965, Abraham 325 (CAL). Uttar Pradesh : Gorakhpur, Arora 1431 (CAL). West Bengal : Dindughat, 24.8.1877, G.King s.n. (CAL) ; Andul, Howrah dist., Bennet 892 (CAL).

Doubtful species :

In a cursory reference, Edgeworth (in *Calcutta J. Nat. Hist. Soc.* 3 : 533. 1843) mentions *A. pusillum* described in Roxburgh's *Flora Indica* and again repeats it under the genus *Ouvirandra* (in Hook., *Lond. J. Bot.* 3 : 405. 1844) as *O. pusilla* (species No. 5 under *spicae singulae*). There is no reference by Roxburgh in his *Flora Indica* to any such species. Possibly it may only be a manuscript name of Edgeworth or more likely a misprint for *A. microphyllum*.

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