FASCICLES OF FLORA OF INDIA

FASCICLE 22
Salvadoraceae Sonneratiaceae
Goodeniaceae Campanulaceae
Ellisophyllaceae Aponogetonaceae

Edited by
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and
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Plate 1. *Salvadora persica* L. fruiting twigs.
Plate 3. Aponogeton satarensis Sundararaghavan et al — grown in pot.
2. Habit.

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

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 Salvadoria), 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 carolla base; anthers round or ovate, dithecous, 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

1b. Trees and shrubs, not thorny, monoecious; flowers gamopetalous; ovary unilocular

1. AZIMA


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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.


**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 × 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. Staminodes 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 Orientatis, _Sonnerat s.n._ (P. Photo. !)


_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 Asthma, the decoction of bark as an expectorant. The white berries are edible.

2. SALVADORA


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 panicled 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 locale; 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 × 11 18 μ, 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.
SALVADORACEAE

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


   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 x 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 !)


   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.

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

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 intorse. 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 2 var. indica

2a. Leaves apices mucronate ; berries 2 2.5 mm across var. persica
   b. Leaves apices rounded ; berries 3 4.5 mm across var. tutilicornia

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.


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 subpetiolare 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, stigmate parum protrudenti, fructisque majoribus.


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 & Korusadi 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.

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 estipulate. Flowers large, bisexual, actinomorphic, pedicelled, solitary or 1 - 3 together in axillary or terminal cymes or corymb. 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; stigma 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 Malaysia, 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 fortuitous 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

\[\text{Duabanga } 1\]

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

\[\text{Sonneratia } 2\]

1. DUABANGA


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 connettive. 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.

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

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

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

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

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 exerted ; 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 !)


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.


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


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, asending on axile planenta; 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 duderkurense (Sonneratioxylon daksinense) (Rao & Ramamujam 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 μ; equatorial axis 40 - 60 μ; planoperturate. Pore elliptic or circular, annulus present or absent. Exine areolate to areoliodate 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

S. alba 1

b. Leaves with apical knobs. Flowers red; calyx tube not angular, lobes erect

S. caseolaris 3

3a. Leaves lanceolate elliptic. Calyx lobes 4, erect at fruit base. Fruits 2 - 3 cm across

S. apetala 2

b. Leaves obovate to suborbicular. Calyx lobes 7 - 8, reflexed at fruit - base. Fruits 5 - 9 cm across

S. griffithii 4

Local names: Ora (Or.); Pedata, Perepat, Pidatu (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 x 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 caseolarce album.


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 is saline littoral forests.

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


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

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 O. 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 exserted, 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 !).


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.


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 x 3 6 cm, oblong to narrowly obovate - elliptic, knobed 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 convolutely 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).


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, extipulate. 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, epipetalous or filaments free; anthers free or connate in a ring round the styles, dithecous, dehiscing with longitudinal slits. Intrapetalal 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 Goodeniaceae, very close to Campanulaceae (Vijayaraghavan & Malik in Bot. Notiser 125 : 241. 1972).

SCAEVOLA


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 54 × 34 44 μ, poles rounded, not quite reached by the colpae. Ora conspicuous, *ca* 5 × 24 μ. Exine 4 - 5 μ thick, punctate, spinulate between punctae, tectum thin and translucid.

**KEY TO THE SPECIES**

1a. Leaves 4 - 5 × 2 3 cm, leaf axils glabrous or sparsely hairy; flowers yellow; drupes without calyx segments, wrinkled, purple to black

..... **S. plumieri** 1

1b. Leaves 10 - 20 × 5 - 10 cm, leaf axils with tufts of sericeous hairs; flowers white; drupes with enlarged calyx segments, ribbed, white

..... **S. sericea** 2


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


Distrib.: INDIA : Karnataka (Surathkal 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 wrapers 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).


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

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

Evergreen shrubs or small trees, 2 - 4 m high. Branches decumbent with semilunar leaf - scars. Leaves alternate. ca 21 x 9 cm, spatulate to
obovate, fleshy, membranous and bluish on drying, entire or obscurely crenate, rounded or retuse at apex, sericeous or glabrescent, tufted in the axes. 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 x 3-6 mm long, much longer in fruits, unequal, clavate, erect to obscurely recurved. Corolla white, 2-3 cm long, wooly 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 !)


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 dischasial 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 Rheede 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. frutescense 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**


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, dehiscing longitudinally. Ovary inferior to semiinferior, rarely superior; ovules many or rarely few on axile or very rarely on basal or apical placentia, anatropus; style simple, cylindric, generally slightly dilated towards the apex, included or rarely exserted, rarely with a disc at the base; stigmatic lobes as many as carpels, very rarely capitiate. Fruits mostly capsular, dehiscing through apical valves or basal median or apical pores, sometimes circumscissile, rarely baccaeous 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
   
   .....  Sphenocleideae II


   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 dicerifolia); 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

1830 & in DC., Prodr. 7: 491. 1839; Benth. in Benth. & Hook. f., Gen.
Pl. 2: 557. 1876.

Leaves alternate or whorled, radical ones petiolate and cauline ones sessile
or rarely all petiolate. Flowers solitary or in racemes of 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 dehiscing 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
b. Disc tubular; stems branched
2a. Disc ca 4 x 1.5 mm, upper half pubescent; leaves petiolate
b. Disc 5 7 x 4 - 5 mm, pubescent throughout, leaves petiolate towards the
   base and sessile upwards
   ..... A. himalayana 2

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 x 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 x 1 mm. Corolla pale blue, broadly tubular - campanulate, 5 partite up to 1/4 of the length, glabrous; tube ca 11 x 14 mm; lobes ovate, obtuse, ca 4 x 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 x 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_: _Seize_- chuan bot.: Dongreng, 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.


_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 x 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 x 5 mm, obconic, glabrous. Calyx teeth erect, 5 - 7. 5 mm long, triangular, acuminate, entire, glabrous. Corolla broadly tubular - campanulate, 5-partite
Fig. 6: *Adenophora 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 x 1.8 2 cm at throat; lobes broadly triangular, acuminate, 6 -7 x 7 9 mm. Filaments 9 11 mm long, densely long ciliate, anther 5. 5 6 mm, linear oblong. Disc cylindric, pubescent, 5 -7 x 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.

Exsiccat: Known by type collections only.

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


Herbs, erect, 0. 3 - 1. 75 m high, branching, glabrous to hispid. Leaves sessile or lower ones short petiolate, 1 9 x 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 x 1. 5 6 mm, lanceolate to linear, sharply serrate; bracteoles 3 6 mm long, linear. Hypanthium 2. 5 - 3 x 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 x 15 19 mm at throat; lobes 5 - 8 x 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, exerted; stigmatic lobes ca 1.2 mm long, narrowly oblong. Capsules 7. 5 11 x 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.


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

Exsiccat.: 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


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 cylindrical, 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, t.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

1b. Stigmatic - lobes 2; panicles lax throughout; seeds ca 1.5 mm long

   A. thomsonii 2

*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 ob lanceolate, caudate or rarely attenuate at base, irregularly crenate - serrate to cuspidate - serrate, acute to acuminate, lower at time obtuse, glabrous or sparsely to densely sacbrid 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.


*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.


Perennial erect, herbs, 12 - 46 cm high, branching, glabrous, at times basally puberulous. Rootstocks 3 - 5 mm thick. Leaves 2.2 -7 x 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 x 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 x 1. 25 - 2.5 mm, linear - oblong, acute. Filaments much dialated 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 x 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