

FASCICLES
OF
FLORA OF INDIA

FASCICLE 20

Edited by
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BARCLAYACEAE

Li in Am. Midl. Nat. 54 : 40, 1955

R.L. Mitra*

Slender, perennial, rhizomatous, laticiferous, acaulescent, aquatic herbs with air-canals and scattered vascular bundles. Rhizomes short, erect, villous-pubescent, bearing flowers, leaves, vegetative buds and axillary runners. Leaves simple, stipulate, long petiolate, heterophyllous, submerged and erect, or floating, oblong to suborbicular, cordate or sub-sagittate at base; foliar sclereids present. Flowers small, solitary, usually long pedunculate, bisexual, with spirally arranged floral appendages. Sepals 5, free, hypogynous, persistent. Petals numerous, unequal, epigynous, free above, connate into a tube and adnate to ovary below, persistent; innermost ones transitional to stamens. Stamens numerous, free, arranged on corolla tube, pendulous, each differentiated into a short constricted filament (oval in cross section) and a dorsiventrally flattened broad anther with microsporangia arranged laterally or sublaterally. Ovary 6–14-loculate with a cup-like depression above formed by radiating, curvate stigmas; stigmatic appendages incurved, conniving into a cone. Ovules numerous in each locule, orthotropous, bitegmic, crassinucleate; placentation laminar. Fruit ripening under water, an irregularly dehiscent many-seeded berry, enclosed by and crowned with persistent calyx and corolla. Seeds spinulate, exarillate, operculate, with minute embryo, scanty endosperm and copious perisperm.

Distrib. : Monotypic, 4 species in pools and slow streams in tropical rain forests from S. E. Asia to East Indies; 1 in India (Andamans).

BARCLAYA

Wall. in Trans. Linn. Soc. Lond. 15 : 442. t. 18. Dec. 1827, *nom. cons.*; Benth. in Benth. & Hook. f., Gen. Pl. 1 : 47. 1862; Hook. f. & Thoms., Fl. Ind. 1 : 245. 1855 & in Hook. f., Fl. Brit. India 1 : 115. 1872; Caspary in Engl. & Prantl, Nat. Pflanzenfam. 3, 2 : 10. 1888; Hu in Dansk Bot. Arkiv 23 : 535. 1968. *Hydrostemma* Wall. in Taylor & Phillips ed. Phil. Mag. n. s. 1 : 454. June 1827, *nom. rej.*; Mabberley in Taxon 31 : 68. 1982.

Characters and distribution same as family.

Type : *Barclaya longifolia* Wall.

Notes : The name *Hydrostemma* Wall. originally proposed for the genus predates *Barclaya* Wall. by six months. However, *Barclaya* Wall. has

*Botanical Survey of India, Industrial Section, Indian Museum, Calcutta-700 016.

been appoved for conservation against *Hydrostemma* Wall. (Taxon 36 : 737. 1987 & 37 : 440. 1988).

Barclaya longifolia Wall. in Trans. Linn. Soc. Lond. 15 : 443. t. 18. 1827, Hook., Ic. Pl. t. 809--810. 1852; Hook. f. & Thoms., Fl. Ind. 1 : 246. 1855 & in Hook. f., Fl. Brit. India 1 : 115. 1872; Ridley, Fl. Mal. Pen. 1 : 116. 1922. *Hydrostemma longifolium* (Wall.) Mabberley in Taxon 31 : 68. 1982.

Leaves 12--28 × 2--6 cm, linear-oblong, membranous, undulate-crispate along margins, puberulous or glabrate beneath, obtuse at apex, cordate-subsagittate at base; petioles 6--25 cm long, puberulous or glabrescent. Flowers 1.5--2.5 cm long, purplish, hardly expanding and emerging above water; peduncles 10--35 cm long. Sepals 1.5--2.5 × 0.5--0.6 cm, linear-elliptic, concave, obtuse, with midrib distinct near to apex and produced into a tail 3--5 mm long, greenish-purple without, purplish within. Corolla shorter than sepals, sap-green without, purplish within; lobes broadly or narrowly oblong. Inner stamens 2.0--2.5 mm long, fertile, curved inwardly. Berries 1.0--1.5 cm across. Seeds c. 1 mm across, brown, globose, spinulose; spines radiating, tufted at micropylar region.

Type : Burma : Pegu near Rangoon, August, 1826. *Wallich*, Num. List, 7260 (CAL !, K-W, Microf.).

Fls. & Frts. : Jul.--Dec.

Distrib. : INDIA : South Andaman; BURMA, THAILAND, MALAYSIA, INDO-CHINA.

Uses : Popularly grown in aquaria in continental Europe and North America (Taxon 33 : 517. 1984).

Chr. No. : 2n = 36 (Sokolovskaya & Melikian in Bot. Zhur. 49 : 585-586. 1964).

Notes : Prain (*Journ. Asiatic. Soc. Beng.* 59 : 252. 1890) considers the plant doubtfully indigenous to Andaman flora. It appears to be very sporadic and localised in distribution, for the plant was collected only thrice (Caddelgunj Jungle, 1893, King's Coll. s.n.; Anikhet valley, 1904, Rogers 369 & Poona nallah, on way to Poochang forest post, 6.9.1982, Mehrotra 136) since its first record (King in *Journ. Asiatic. Soc. Beng.* 58 : 390. 1889), from a ditch near Haddo (King's Coll. s. n.) in 1884.

CABOMBACEAE

A. Rich., Nouv. Elem. Bot. ed. 4. 420. 1828 ('*Cabombeae*')

R.L. Mitra*

Aquatic, caulescent, rhizomatous laticiferous, mucilaginous herbs, usually stoloniform with air-canals and scattered vascular bundles devoid of cambium. Roots adventitious in groups at the base of rhizomes and nodes of stolons. Leaves simple, stipulate, usually long petiolate, heterophyllous, submerged and floating, spirally arranged on rhizome, on one side on stolons and distichous or tristichous, or even opposite or ternate on floating shoots; foliar selereids absent. Flowers small, solitary at nodes on floating shoots, usually long pedunculate, bisexual, hypogynous, with floral appendages arranged in low spirals. Sepals (2—) 3 (—4), free or slightly connate at base. Petals (2—) 3 (—4), free or slightly connate at base. Stamens 3—36, free, more or less flattened with paired microsporangia arranged laterally or abaxially; dehiscence longitudinal; pollen uniaperturate; staminodes absent. Carpels (1—) 2—18, free. Ovules 1—4 in each carpel. anatropous, bitegmic, crassinucleate; placentation laminar to submarginal. Fruit ripening above water, indehiscent, 1—4-seeded pod. Seeds exarillate, operculate with minute embryo, scanty endosperm and copious perisperm.

Distrib. : 2 genera and 8 species in the tropical and temperate regions of the world except Europe; 2 genera and 2 species (including 1 introduced) in India.

KEY TO THE GENERA

- 1a. Adult leaves monomorphic, floating, entire.....*Brasenia* 1
- 1b. Adult leaves dimorphic, submerged and floating;
submerged leaves deeply and finely dissected.....*Cabomba* 2

1. BRASENIA

Schreb., Gen. Pl. ed. 8, 1 : 372. 1789; Benth. in Benth. & Hook. f., Gen. Pl. 1 : 46. 1862; Hook. f. & Thoms., Fl. Ind. 1 : 246. 1855 & in Hook. f., Fl. Brit. India 1 : 113. 1872; Caspary in Engl. & Prantl, Nat. Pflanzenfam. 3, 2 : 6. 1888; Wood in Journ. Arnold Arb. 40 : 103. 1959. *Hydropeltis* Michx., Fl. Bot.—Am. 1 : 323. t. 29. 1803.

Slender, perennial herbs. Rhizomes small, erect with submerged and floating leaves and axillary runners producing at nodes adventitious roots,

*Botanical Survey of India, Industrial Section, Indian Museum, Calcutta-700 016.

floating leaves and floating shoots. Juvenile leaves subulate to eccentrically peltate, submerged; adult leaves centrally peltate, floating. Flowers reddish, inconspicuous, on peduncles of unequal length, emersed at anthesis. Sepals (2—)3 (—4). Petals (2—)3 (—4). Stamens (12—) 18—36, with or without short apiculate sterile appendages; microsporangia lateral; pollen 1-sulcate. Carpels (4—)7—18, each with (1—)2 (—4) pendulous ovules in laminar or dorsal position. Ovules atropous, anatropous at maturity. Pods coriaceous, 1—4 seeded.

Distrib. : Monotypic; sporadically distributed in all the continents except Europe; but seeds reported from pleistocene and interglacial deposits in Europe.

Notes : The floating shoots bear floating leaves and flowers at nodes which are the products of axillary buds of runners. Though it appears as a continuous axis, it represents a sympodial branch system (Richardson, *Univ. Calif. Publ. Bot.* 47 : 4. 1969). In gregarious populations, the floating shoots form a dense interoven mass.

Brasenia schreberi J. F. Gmel., *Syst. Nat.* 2 : 853. 1791; Komarov in Komarov *et al.*, *Fl. URSS* 7 : 5. pl. 1. f. I. 1937; Li, *Fl. Taiwan* 2 : 546. 1976. Verdc. in Milne-Redhead & Polhill, *Fl. Trop. E. Afr. Cabombaceae* : 1. f. 1-6. 1971. *B. peltata* Pursh, *Fl. Am. Sept.* 2 : 389. 1814, *nom. illegit.* (based on *Hydropeltis purpurea* Michx. 1803); Hook. f. & Thoms., *Fl. Ind.* 1 : 246. 1855 & in Hook. f., *Fl. Brit. India* 1 : 113. 1872; Kanjilal *et al.*, *Fl. Assam* 1 : 63. 1934. *Hydropeltis purpurea* Michx., *Fl. Bor.-Am.* 1 : 324. t. 29. 1803; Sims in Curtis, *Bot. Mag.* t. 1147. 1808. *B. purpurea* (Michx.) Casp. in *Journ. Sci. Acad. Lisb.* 4 : 312. 1873.

Fig. 1

Local name : Water-shield (Eng.); Sohpyllain phuhsaw (Kh.).

Floating shoots rising almost to water surface, 1 m or more long, with floating leaves and flowers at nodes; young submerged parts including petioles, peduncles, and under surface of leaves coated with thick transparent mucilage. Floating leaves 4—10 (—13.5) × 2.5—6.0 (—8) cm, distichous or tristichous (when flowers are absent), suborbicular or broadly elliptic, entire, green above, purplish beneath; petioles usually 0.5—1.0 m long. Sepals 1—1.5 × 0.3—0.5 cm, lanceolate, obtuse at apex, reddish within, puberulous, persistent. Petals 1.5—1.8 × 0.3—0.6 cm, lanceolate to linear-oblong, obtuse and cucullate at apex, puberulous, persistent. Anthers c. 3 mm long. Filaments 8—12 mm long, puberulous. Ovary 5—6 mm long, c. 1 cm in fruit, fusiform, appressed puberulous. Styles 3—4 mm long with densely papillose-hairy stigmatic region along adaxial face, persistent and incurved in fruit. Seeds 3—4 × 2.5—3.0 mm, ellipsoid, minutely beaked at hilum, sparsely papillate, dark brown.

Type : United States of America, New Jersey, *Hope s. n.* (Holo, M).

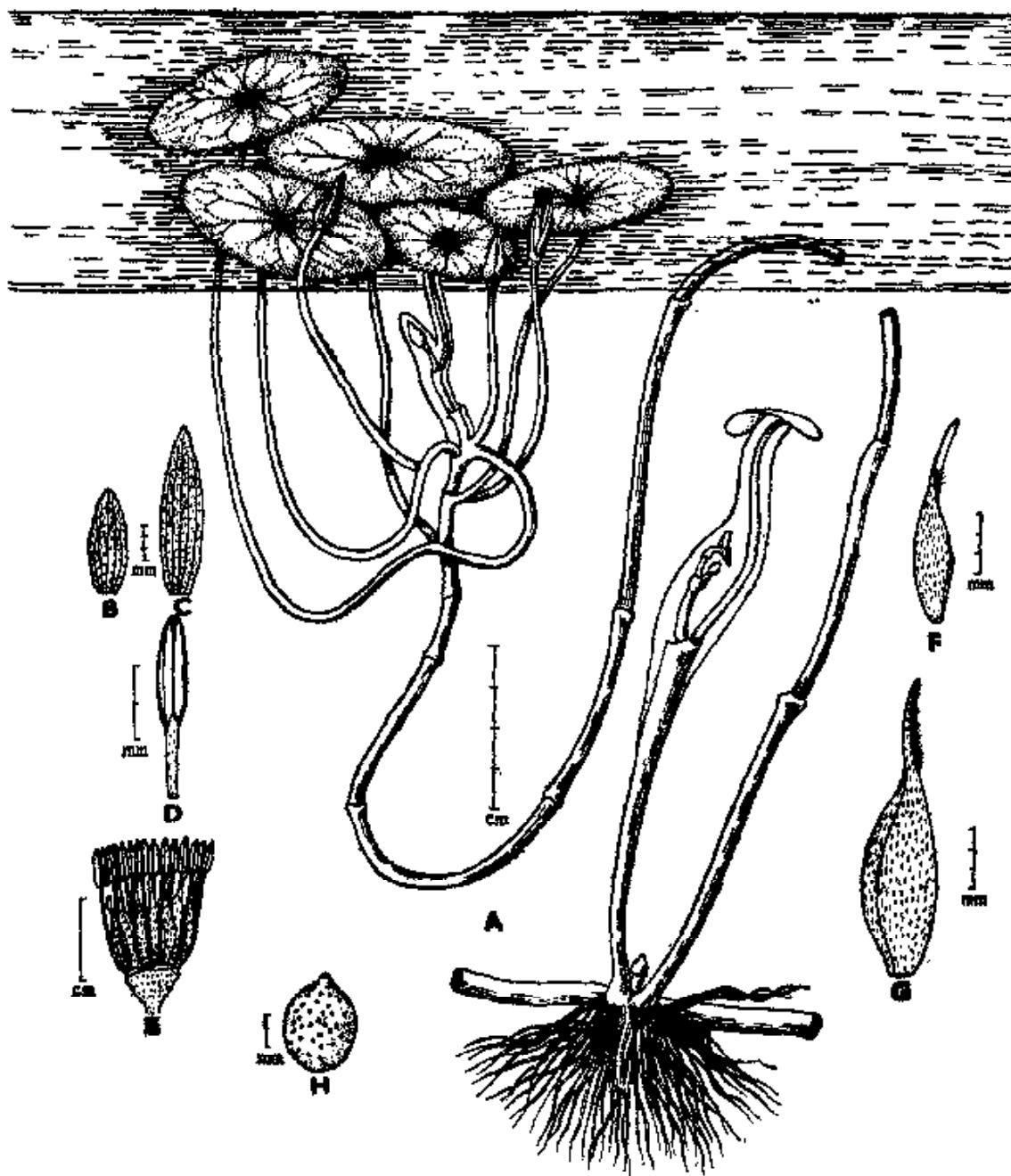


Fig. 1 *Brasenia schreberi* Gmel. (R. L. Mitra 1475). A. Habit. B. Sepal.
C. Petal. D. Stamen. E. Flower without sepals and petals. F. Carpel.
G. Fruit. H. Seed.

Fls. & Frts. : Aug.—Nov.

Distrib. : INDIA : Meghalaya, Nongkreem in Khasia Hills and Nartiang and Jowai in Jaintia Hills (1200–1800 m); BHUTAN, JAPAN, TAIWAN, CHINA, ASIATIC USSR, N. AMERICA, MEXICO, CUBA, GUATEMALA, GUYANA TROPICAL E. AFRICA and AUSTRALIA.

Exsicc. : Meghalaya : Khasia Hills, Lewpomtia Village near Nongkreem (1500 m), 29.9.1975, R. L. Mitra 1475 (CAL); Jaintia Hills, Nartiang (1300 m), 27.8.1968, N. P. Balakrishnan 47164 (sterile—CAL).

Chr. No. : 2a = 80 (Löve & Löve in Taxon 13 : 106. 1964).

Notes : The thick coat of transparent mucilage on young plant parts is secreted by densely packed glandular trichomes which, however, swell, rupture and disintegrate with age leaving the older parts free of mucilage (Richardson, *op cit.* 7). Specimens, unless pressed between wax-paper, stick to drying sheets (Wood, *l.c.* 104).

2. CABOMBA

Aubl., Hist. Pl. Guiane Franc. 1 : 321. 1775; Fassett in Castanea 18 : 116. 1953; Wood in Journ. Arnold Arb. 40 : 102. 1959.

Slender, perennial herbs, completely submerged except during flowering. Roots adventitious in groups at lower nodes of stems trailing through mud. Leaves dimorphic, petiolate; submerged leaves opposite or ternate, palmately divided at the summit of petiole into 3—9 parts, each part dividing 2—3-chotomously several times into many long, narrow segments forming a dissected blade flabellate in outline; floating leaves when present alternate, peltate. Flowers white to yellow or purple, emersed on peduncles of unequal length. Sepals 3, slightly connate at base. Petals 3, clawed and often auriculate, slightly connate at base. Stamens 3—6, without distal sterile appendages; microsporangia lateral to abaxial. Carpels 1—4, each with 3 pendulous ovules in laminar position. Pods coriaceous, usually 3-seeded; seeds covered with hygroscopic hairs.

Type : *C. aquatica* Aubl.

Distrib. : About 7 species in tropical and temperate regions of Americas, elsewhere introduced; 1 introduced in India.

Cabomba caroliniana Gray in Ann. Lyc. N. Y. 4 : 46. 1837; Gardner in Hook. Sc. Pl. 7 : t. 642. 1844; Fassett in Castanea 18 : 120. 1953. *C. aquatica* auct. non Aubl. (1775) : Aleykutty & Inamdar in Curr. Sci. 47 : 136. f. 1—5. 1978.

Stems up to 2 m long, branched, thinly mucilaginous. Leaves dimorphic; petioles 1—3 cm long, pubescent. Submerged leaves finely dissected, flabellate in outline, 2—5 cm wide; terminal segments slightly spatulate, 0.3—0.8 mm broad with an obscure midrib. Floating leaves peltate, linear-oblong-elliptic, 5—20 × 1.5—3.0 mm, often emarginate at one end, usually pubescent beneath. Flowers 1.0—1.5 cm across, creamy white with a pair of yellow spots at base of each petal, rising above water on peduncles from upper axils; peduncles 1.5—8.0 cm long, pubescent. Sepals and petals 3, the latter obovate, rounded at apex and auriculate near base. Stamens 3—6. Carpels 2—4, elongate, puberulous. Seeds ovoid, covered with hygroscopic hairs.

Fls. & Frts. : May—Aug.

Distrib. : INDIA : Kerala (around Cochin in fresh water ponds and ditches; introduced); U.S.A.

Chr. No. : 2n = 34 (Sen & Bhaduri in Journ. Cytol. Genet. 6 : 70. 1971).

Notes : Aleykutty and Inamdar (*I.c.*) reported the plant from fresh water ponds and ditches around Cochin as *C. aquatica* Aubl. Except for the creamy white colour of the flower and an enlarged drawing showing clearly the emarginate nature of the linear-oblong floating peltate leaf, all the other characters mentioned by them are generalised in nature and both of these two characters are applicable only to *C. caroliniana* Gray (Gardner, *I.c.*) On the other hand, in *C. aquatica* Aubl. the flowers are yellow and the floating peltate leaves are broadly elliptic to orbicular ((1—) 1.5—2.5 (—5) cm wide) and entire in outline.

The plant is commonly grown in fresh water aquaria for their decorative dark-green fan-shaped submerged leaves and got introduced probably from discarded aquarium plantlings. Under indoor aquarium conditions this plant never produce floating leaves and flowers and remain completely submerged, and are thus often mistaken for *Limnophila* sp. The plant can however, be easily recognised by its submerged leaves being long petiolate and leaf-segments 2—3-chotomously branched, while in *Limnophila* these are sessile and pinnately divided.

NELUMBONACEAE

Dum., Anal. Fam. Pl. 53. 1829 ('*Nelumboneae*')

R. L. Mitra*

Large, perennial, rhizomatous, milky laticiferous, acaulescent, aquatic herbs with air-canals and scattered vascular bundles devoid of cambium. Rhizomes stoloniform, branched, creeping, slender or tuberous, producing at nodes adventitious roots, solitary leaf, flower and axillary bud. Leaves simple, stipulate, long petiolate, orbicular with radiating veins branched dichotomously except the midrib; juvenile ones eccentrically peltate, floating; adult ones centrally peltate, floating or emersed; foliar sclereids absent. Flower solitary on long peduncles, raised well above water, large, showy, rose-pink, white or yellow, bisexual, hypogynous with spirally arranged floral appendages. Sepals 4—5, free, subequal, petaloid, persistent. Petals often numerous, free, intermediate ones largest, caducous; innermost ones sometimes transitional to stamens. Stamens numerous, free, long and linear, each differentiated into a subterete filament, an anther with adaxial to sublateral microsporangia, and a distal, clavate, incurved sterile appendage; pollen tricolporate. Carpels (9—) 12—28(—39), distinct, embedded singly in cavities on turbinate, accrescent receptacles. Ovules solitary in each carpel, pendulous, orthotropous, anatropous at maturity, bitegmic, crassinucellate; placentation laminar. Nuts ripening above water; pericarp smooth, bony. Seed filling the carpel, exarillate, inoperculate; cotyledons large, fleshy; plumule folded, enclosed in a stipule-like sheath.

Distrib. : Monotypic, 2 species in tropical and subtropical regions, such as West Indies, Columbia, Central America, South-Eastern United States, Eastern Asia to North-Eastern Australia; 1 in India.

NELUMBO

Adans., Fam. 2 : 76. 1763; Wood in Journ. Arnold Arb. 40 : 105. 1959.
Nelumbium Juss., Gen. Pl. 68. 1789 'orth. var.'; Benth. in Benth. & Hook. f., Gen. Pl. 1 : 47. 1862; Hook. f. & Thoms., Fl. Ind. 1 : 248. 1855 & in Hook. f., Fl. Brit. India 1 : 115. 1872; Caspary in Engl. & Prantl, Nat. Pflanzenfam. 3, 2 : 5. 1888.

Characters and distribution same as family.

Type : *N. nucifera* Gaertn.

Nelumbo nucifera Gaertn., Fruct. 1 : 73. t. 19. f. 2. 1788; Biswas & Calder, Handb. Wat. Mar. Pl. Ind. Burma ed. 2, 23. 1954; Subra-

*Botanical Survey of India, Industrial Section, Indian Museum, Calcutta-700 016.

manyam, Aquat. Ang. 8, f. 4, 1962. *Nymphaea nelumbo* Linn., Sp. Pl. 511, 1753. *Nelumbo indica* Poir. in Lam., Encycl. 4 : 543, 1798. *Nelumbium speciosum* Willd., Sp. Pl. 2 : 1258, 1799; Wight, Ill. 1 : t. 9, 1840; Hook. f. & Thoms., Fl. Ind. 1 : 247, 1855 & in Hook. f., Fl. Brit. India 1 : 116, 1872; Sims in Curtis, Bot. Mag. t. 903, 1806; Hook. f. in Curtis, Bot. Mag. 68 : t. 3916 & 3917, 1842; Cooke, Fl. Pres. Bombay 1 : 26, 1901 (Repr. ed. 1 : 28, 1958); Prain, Beng. Pl. 1 : 214, 1903 (Repr. ed. 1 : 141, 1963); Duthie, Fl. Upp. Gang. Pl. 1 : 35, 1903 (Repr. ed. 1 : 35, 1960); Gamble, Fl. Pres. Madras 1 : 34, 1915 (Repr. ed. 1 : 24, 1957); Haines, Bot. Bih. Or. 1 : 22, 1921 (Repr. ed. 1 : 23, 1961); Kanjilal *et al.*, Fl. Assam 1 : 65, 1934. *N. nelumbo* (Linn.) Druce in Rep. Bot. Exch. Cl. 3 : 421, 1914.

Local name : Podam (Asm.); Padma (Beng., Or., Sans.); Kanwal, Kamal (Hind.); Pampus (Kash., Punj.); Kamala, Tavaregida (Kan.); Sohlapudong (Kh.); Tamara, Chentamara (Mal.); Kamal (Mar.); Tamari (Tam.); Kalung, Erra-tamara (Tel.).

Leaves 20—80 cm across, flat when floating, somewhat cupped when emersed, suborbicular, shallowly notched and apiculate at one side terminating a simple vein, with a minute apicula at opposite side, glabrous and glaucous on both surfaces, dark-green above, paler beneath, coriaceous, membranous when dry; petioles up to 2m long, beset with scattered hard, minute papillae. Flowers 8—25 cm across, rose-pink or white, fragrant; peduncles up to 2m long, beset with scattered, hard, minute papillae. Sepals 1.5—5.0 × 0.8—3.5 cm, ovate or elliptic, concave, green (in white flowers) or pinkish-green (in rose-pink flowers). Petals c. 20 (single form) or c. 110 (double form), each 4—15 × 2—8 cm, elliptic, obtuse or subacute, concave, gradually becoming obovate to spatulate. Stamens up to 225, each 2.2—4.5 cm long; outermost ones in double form staminodial. Receptacles 2—4 cm across, spongy, yellow during anthesis, turn green, finally become dark brown and 5—10 cm across in fruit. Carpels 8—10 × 2—3 mm, becoming c. 2 × 1 cm in fruit, each differentiated into an oblong-cylindric ovary, a short exserted stylodium with peltate, centrally depressed and papillose stigma.

Type : India, Herb. Linn. 673.7 (LINN, Microf.!).

Fls. & Frts. : March—Dec. (Jan.).

Distrib. : India : Throughout in fresh water ponds and lakes, also grown as an ornamental; South east and eastern Asia to Far eastern USSR and to North Australia.

Exsicc. : Kashmir : Srinagar, Dal Lake, 20.9, 1961, B. M. Wadhwa & J. N. Vohra 131 (CAL). Uttar Pradesh : Mirzapur, Patharah Village, 11.10, 1969, G. Panigrahi 12427 (CAL). West Bengal : Malda, Gour, 23.4. 1966, R. M. Dutta 152 (CAL). Rajasthan : Bhilwara, Banera, 27.9.

1978, A. N. Singh 6020(CAL). Tamil Nadu : Madurai, Perumalkoil tank, 16. 6. 1957, K. Subramanyam 3507 (CAL).

Uses : The sacred lotus of Hindus, used for religious and decorative purposes, and also in indigenous system of medicine. Tuberous rhizomes and ripe carpels are edible, sold in market; cultivated in a small scale in Punjab and extensively in China and Japan.

Chr. No. : $n = 8$ (Subramanyam & Kamble in Taxon 15 : 159. 1964); sub. *Nelumbium speciosum* Willd. (Bir & Thakur in Taxon 30 : 843. 1981). $2n = 16$ (Sen & Bhaduri in Journ. Cytol. Genet. 6 : 70. 1971).

Notes : The seeds of *Nelumbo nucifera* are perhaps the longest viable; seeds recovered from the moist peat of a drained lake in Southern Manchuria, variously claimed between 100 and 1000 years old, germinated consistently (Sculthorpe, Biol. Aquatic Vas. Pl. 325. 1967).

NYMPHAEACEAE

Salisb. in König & Sims ed., Ann. Bot. 2 : 70. 1805 ('Nymphaeaceae')

R. L. Mitra*

Aquatic, acaulescent, rhizomatous, laticiferous herbs, usually stoloniform with air-canals and scattered vascular bundles devoid of cambium. Roots adventitious in groups at base of petioles. Leaves simple, stipulate, usually long petiolate, heterophyllus, submerged (usually juvenile ones) and floating, spirally arranged on rhizome; venation palmate; all but one (pinnately branched midrib) dichotomously branched; vernation involute; foliar sclereids present. Flowers solitary in leaf-site or anodic side of leaf-axil, usually long pedunculate, bisexual, with spirally arranged floral appendages. Sepals 4, free, hypogynous or epigynous. Petals usually numerous, subequal, free, innermost ones staminodial, hypogynous to epigynous. Stamens usually numerous, free, hypogynous to epigynous, with or without sterile appendages, dorsiventrally flattened, with paired microsporangia arranged adaxially; dehiscence longitudinal; pollen unaperturate. Carpels 5—many, partially or fully coherent and fused peripherally with receptacular tissue forming a multilocular ovary. Ovules 2—many in each carpel, anatropous, bitegmic, crassinucellate; placentation laminar. Fruit ripening under water, an irregularly dehiscent, many-seeded berry. Seeds usually arillate, operculate, with minute embryo, scanty endosperm and copious perisperm.

Distrib. : 5 genera and c. 70 species in tropical and temperate regions of the world. 2 genera and 7 species in India, besides a number of exotic species and cultivars belonging to *Nymphaea*, *Nuphar* and *Victoria* are grown in ponds, lakes and water gardens.

Notes : Nymphaeaceae (*sensu lato*) is often considered a heterogenous assemblage primarily on the basis of gynoecial characters. The three subfamilies originally recognised by Caspary (in Engl. & Prantl, Nat. Pflanzenfam. 3, 2 : 4. 1888) have been accorded distinct familial status by Bessey (*Ann. Mo. Bot. Gard.* 2 : 130 & 137. 1915), but segregated further into 5 families by Li (*Am. Mid. Nat.* 54 : 33—40. 1955). Hutchinson (*Fam. Fl. Pl.* ed. 3, 1 : 497 & 501. 1973), however, recognised only Cabombaceae and retained the other two subfamilies in the Nymphaeaceae, while Thakhtajan (*Bot. Rev.* 46 : 261. 1980) in partial modification of his earlier views (*Fl. Pl. Origin & Disp.* 207. 1969) accepted only three families like Bessey (*I.c.*). Cronquist on the other hand, though originally (Evol.

*Botanical Survey of India, Industrial Section, Indian Museum, Calcutta-700 016.

Class. Fl. Pl. 147-150, 1968) maintained only Nelumbonaceae and regrouped the remaining two subfamilies into Nymphaeaceae, changed his opinion (An Integrated Syst. Class. Fl. Pl. 105—105, 1981) and maintained four families, a view favoured by Thakatajan (*l.c.* 1969) earlier. These segregated families have even been placed in different orders or given new ordinal ranks.

In view of the conflicting morphological evidences, some of which are fragmentary, many authors still follow Wood (*Journ. Arnold Arb.* 40 : 95, 1959) in retaining Nymphaeaceae *sensu lato* as a single family, while considering a few genera, particularly *Nelumbo* as most specialised in the whole family. Though there are growing evidences in recent times in favour of the familial concept proposed by Bessey (*l.c.*), in the present work families have been delimited following Cronquist (*l.c.* 1981).

KEY TO THE GENERA

- 1a. Plants densely prickly. Sepals, petals and stamens epigynous
... *Euryale* 1
- 1b. Plants without prickles. Sepals, petals and stamens hypogynous to perigynous... *Nymphaea* 2

1. EURYALE

Salisb. in König & Sims ed., Ann. Bot. 2 : 73, 1805; Benth. in Benth. & Hook. f., Gen. Pl. 1: 47, 1862; Hook. f. & Thoms., Fl. Ind. 1 : 244, 1855 & in Hook. f., Fl. Brit. India 1 : 115, 1872; Caspary in Engl. & Prantl, Nat. Pflanzenfam. 3, 2 : 7, 1888. *Anneslea* Roxb. ex Andrews, Bot. Rep. 10 : t. 618, 1811.

Annual or short-lived perennial herbs with submerged and floating juvenile leaves, and densely prickly and strongly venose adult floating leaves. Rhizomes short, thick, erect with leaves and flowers arranged in distinct spirals; vegetative buds absent. Flowers on densely prickly peduncles, partially submerged; sepals, petals and stamens epigynous, arranged on a broad rim along distal outer margin of cup-like depression of ovary. Sepals 4. Petals c. 25, innermost few transitional to stamens. Stamens numerous in fascicles, inflexed, dorsiventrally flattened; outer ones spatulate with broader filaments and reduced anthers, inner ones spatulate with narrower filaments and longer anthers; anther sacs partially sunken in outer stamens. Ovary 7—12-loculate, with a cup-like depression above formed by radiating curvate stigmas; stigmatic appendages absent. Ovules 2—3 in each locule, at length usually one by abortion; placentation parietal. Berries 8—20-seeded.

Distrib. : Monotypic; in fresh water tanks and jheels in India, Bangladesh, Japan, Taiwan, China and Ussuri in USSR. Also reported from Pliocene and later deposits in Europe.

Euryale ferox Salisb. in König & Sims ed., Ann. Bot. 2 : 74. 1805; Roxb., Pl. Corom. 3 : t. 244. 1815; Sims in Curtis, Bot. Mag. t. 1447. 1812; Hook. f. & Thoms., Fl. Ind. 1 : 245. 1855 & in Hook. f., Fl. Brit. India 1 : 115. 1872; Prain, Beng. Pl. 1 : 214. 1903 (Repr. ed. 1 : 140. 1963); Duthie, Fl. Upp. Gang. Pl. 1 : 34. 1903 (Repr. ed. 1 : 35. 1960); Haines, Bot. Bih. Or. 1 : 22. 1921 (Repr. ed. 1 : 22. 1961); Kanjilal et al., Fl. Assam 1 : 65. 1934; Biswas & Calder, Handb. Wat. Mar. Pl. Ind. & Burma ed. 2, 22. 1955; Subramanyam, Aquat. Ang. 6. f. 3. 1962. *E. indica* Planch., Ann. Sci. Nat. Bot. 3, 19 : 29. 1853. *Anneslia spinosa* Roxb. ex Andrews, Bot. Rep. 10 : t. 618. 1811.

Local name : Makhana, Makhna, (Asm., Beng., Hind.); Jubar, Jewar (Kash., Punj.); Shriew-u-puhan (Kh.); Kunta padma (Or.).

Leaves 30—120 × 25—110 cm, centrally peltate, coriaceous, orbicular, acute at one side terminating a pinnately branched vein, shallowly notched at opposite side, green, bullate (also corrugated along margins when young) and prickly along veins above, violet, strongly venose (with interlacing nerves) and prickly along veins beneath; petioles 4—8 mm across, pinkish, densely prickly. Flowers 3—5 cm long, beset with prickles up to 12 mm long. Sepals 2—3 × 1.2—1.8 cm, fleshy, triangular-ovate, concave, obtuse and cucullate at apex, violet or pinkish-violet within, green and armed with scattered recurved prickles without. Outer petals 1.8—2.5 × 0.8—1.2 cm, concave, oblong, obtuse and cucullate at apex, dark violet (fading near to base), gradually smaller in size and fading to white towards centre (innermost ones c. 1.3 × 0.4 cm. linear-oblong). Outer stamens 8—10 mm long; inner stamens 4—6 mm long. Berries 4—10 cm across, globular-ovoid, tuberculate and densely prickly, with a conical crown of persistent floral appendages. Seeds 7—12 mm across, with thick and hard testa, subglobose, wrinkled, dark brown, enclosed in pulpy white aril marked with scattered reddish streaks.

Type : China, Banks herbarium (BM).

Fls. : April—July; *Fris.* : June—Oct.

Distrib. : INDIA : Rajasthan, Kashmir, Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Manipur, Tripura; also cultivated for its starchy edible seeds.

Exsicc. : Kashmir : Srinagar, Nagin lake, 10.10.1961, B.M. Wadhwa & J.N. Vohra 351 (CAL). West Bengal : Bamonghat Road near Howrah, M.S. Ramaswamy 139 (CAL). Assam : 3 miles before Sibsagar, 7.7. 1959,

G. Panigrahi 18704 (CAL, ASSAM). Manipur : Logtak (3000'), Nov. 1907,
A. Meebold 6378 (CAL). Tripura : Agartala, 9.6. 1915, *P.M. Debbarman* 675 (CAL).

Uses : Extensively cultivated in North Bihar for its starchy edible seeds; sold in market.

Chr. No. : $2n = 58$ (*Gupta & Ray* in *Curr. Sci.* 42 : 106. 1973).

Notes : In *Euryale ferox*, the floating leaves are highly polymorphic. The early floating leaves, which are sometimes preserved in the herbarium, are quite different in appearance from adult leaves. These are membranous, broadly elliptic to elliptic-orbicular, at first non-peltate with a deep sinus up to petiole base, deep violet on both surfaces with a few or no prickles, afterwards peltate with a shallow sinus, green above, deep violet beneath, with prickles on both surface and petioles.

2. NYMPHAEA

Linn., Sp. Pl. 510. 1753 & Gen. Pl. 227. 1754, *nom. cons.*; Benth. in Benth. & Hook. f., Gen. Pl. 1 : 46. 1862; Hook. f. & Thoms., Fl. Ind. 1 : 239. 1855 & in Hook. f., Fl. Brit. India 1 : 114. 1872; Caspary in Engl. & Prantl, Nat. Pflanzenfam. 3, 2 : 7. 1888; Conard in Carnegie Inst. Wash. Publ. 4 : 125. 1905; Wood in Journ. Arnold Arb. 40 : 97. 1959. *Castalia* Salisb. in König & Sims ed., Ann. Bot. 2 : 71. 1805.

Perennial herbs. Rhizomes usually stoloniferous, tuberous, erect or creeping, sometimes branched, hairy in interfoliar region, with leaves, vegetative buds and flowers arranged in spirals. Leaves polymorphic, long petiolate; juvenile leaves membranous, at first subulate, hastate, sagittate, deltoid or cordate-ovate and submerged, afterwards elliptic and cleft up to petiole-base and floating; adult leaves coriaceous, prominently venose beneath, broadly elliptic to orbicular and deeply cleft near or up to petiole-base, floating or rarely emersed. Flowers on long peduncles, floating or emersed, showy. Sepals 4, free, hypogynous. Petals numerous, hypogynous to perigynous, outermost a few sometimes sepaloid, innermost ones often transitional to stamens. Stamens numerous, inflexed, perigynous, dorsiventrally flattened with or without distal sterile appendages, outer stamens with broad, petaloid filaments and reduced anthers, the inner with narrower filaments and longer anthers; anther-sacs partially sunken. Carpels 5—35, partially (septa double) or fully (septa single) coherent, fused peripherally, arranged radially around and adnate below to central core of receptacular tissue to about half their length, with a cup-shaped depression above formed by radiating, curvate, bilobed stigmas with or without an appendage. Ovules numerous, anatropous and laminar, arising all over septa. Berries globose, often crowned with

persistent, green filaments, retracted to and ripening under water. Seeds enclosed in bell-shaped aril, indurate.

Type : *N. alba* Linn.

Distrib. : c. 50 species in tropical and temperate regions inhabiting stagnant fresh water ponds, lakes and swamps; 6 species in India. Besides, a few exotics cultivated in ponds and lakes.

KEY TO THE SPECIES

- 1a. Leaves distinctly subpeltate; primary veins prominently raised beneath ... 2

1b. Leaves cleft to petiole-base, non-peltate; primary veins impressed beneath... 4

2a. Leaves glabrous. Sepals obscurely veined, persistent in fruit. Stamens with distal sterile appendages... *N. nouchali* 3

2b. Leaves velutinous pubescent beneath. Sepals conspicuously veined, decaying after flowering. Stamens without sterile appendage ... 3

3a. Flowers white or a few sepals and outer petals with tinge of purple towards apex without. Anthers yellow; filaments of inner stamens without purplish band... *N. pubescens* 4

3b. Flowers crimson red. Anthers red; filaments of inner stamens with a purplish band without... *N. rubra* 5

4a. Rhizomes 2.5—7 cm long, erect, densely clothed with black hairs. Leaves 3—7 cm across; petioles c. 1.5 mm across, filiform. Sepals accrescent in fruit... *N. tetragona* 6

4b. Rhizomes much longer than 7 cm, horizontally creeping; interfoliar hairs not black. Leaves 10—28 cm across; petioles 3—10 mm across. Sepals decaying after flowering... 5

5a. Flower buds obtuse at apex; receptacle cylindrical. Sepals as long as or shorter than petals. Filaments of innermost stamens filiform, narrower than anther. Stigma almost flat... *N. alba* 1

5b. Flower buds acute at apex; receptacle weakly tetragonous. Sepals longer than petals. Filaments of innermost stamens lanceolate, never narrower than anther. Stigma strongly concave ... *N. candida* 2

1. *Nymphaea alba* Linn., Sp. Pl. 510. 1753; Hook. f. & Thoms., Fl. Ind. 1: 241. 1855 & in Hook. f., Fl. Brit. India 1: 114. 1872; Conard in Carnegie Inst. Wash. Publ. 4: 175. 1905; Komarov in Komarov et al., Fl. URSS 7: 7. 1937; Tutin in Tutin et al., Fl. Europaea 1: 205. 1964.

Local name : Brimposh (Kash.).

Leaves 10—28 × 9.5—26.0 cm, suborbicular, rounded or retuse at apex, with lowest pair of veins straight and divergently produced into basal lobes at least in the first one-third; basal lobes unequal, nearly straight along inner margin and obtuse at apex. Flowers 10—15 cm across, white. Sepals 5.5—8.0 × 1.5—1.8 cm, green without, ovate-oblong, obtusely cucullate at apex. Petals c. 20, outer ones as long as or longer than sepals, oblong-lanceolate, obtusely cucullate at apex, attenuate at base. Stamens numerous, distributed up to summit of ovary; outer ones 2.5—3.4 cm long with lanceolate filaments. Ovary 14—20-loculate. Stigma flat with a hemispheric central projection, yellow; stigmatic appendages 3—4 mm long, incurved, triangular-ovate, sulcate within. Berries 3—4 cm across. Seeds 2—3 × 1.7 mm, ellipsoid.

Type : Europe, Herb. Linn. 673.4 (LINN, Microf. !).

Fls. & Frts. : Apr.—Oct.

Distrib. : INDIA : Kashmir; N. AFRICA, ASIA MINOR, EUROPE.

Exsicc. : Kashmir : Srinagar; 'Woolar' Lake, 10.5. 1892, J. F. Duthie 10858 (CAL); Dal Lake, 20.9. 1961, B. M. Wadhwa & J. N. Vohra 135 (CAL).

Chr. no. : 2n = 56 (Sen & Bhaduri in Journ. Cytol. Genet. 6 : 75. 1971).

2. *Nymphaea candida* C. Presl in J. & C. Presl, Del. Prag. 224. 1822; Conard in Carnegie Inst. Wash. Publ. 4 : 172. 1905; Komarov in Komarov *et al.*, Fl. URSS 7 : 8. 1937; Tutin in Tutin *et al.*, Fl. Europaea 1 : 205 1964. *N. cachemiriana* Camb. in Jacq. Voy. 4 : 11. 1844. *N. alba* Linn. var. *cachemiriana* (Camb.) Hook. f. & Thoms., Fl. Ind. 1 : 241. 1855 & in Hook. f., Fl. Brit. India 1 : 114. 1872 '*Kashmiriana*'.

Leaves 10—20 × 9—19 cm, elliptic-suborbicular, rounded or retuse at apex, with lowest pair of veins arcuately converging into basal lobes; basal lobes subequal, usually concave along inner margin and acute at apex. Flowers 6—8 cm across, white. Sepals 3.5—4.5 × 1.3—1.5 cm, green without, ovate-lanceolate to ovate-oblong, obtusely cucullate at apex. Petals c. 12, outer ones 3.0—4.2 × 1.0—1.3 cm, oblong-lanceolate, obtuse at apex. Stamens c. 40, absent from summit of ovary, outer ones 1.8—2.2 cm long with lanceolate filmaments. Ovary 6—10-loculate. Stigmas strongly concave with a conical central projection, purple; stigmatic appendages 2—3 cm long, incurved, flattened, oblong. Berries 3.0—3.5 cm across. Seeds 3—4 × 2 mm, ellipsoid-oblong.

Type : Czechoslovakia, Bohemia in ponds and ditches (PR).

Fls. & Frts. : Apr.—Dec.

Distrib. : INDIA : Kashmir (1200—1800 m); SCANDINAVIA, CENTRAL EUROPE, SIBERIA, SOVIET CENTRAL ASIA.

Exsicc. : Kashmir : Srinagar, Wular Lake, 16.6.1959, T. A. Rao 9489 (CAL), Dal Lake, 7.9. 1962, J.N. Vohra & B.M. Wadhwa 316 (CAL).

Chr. No. : $2n = 112$ (Skalinska, M. et al. in Acta Biol. Cracov. ser. Bot. 11 : 199–224. 1968).

Notes : The small form usually referred to as *N. candida* var. *minor* Wainio in *Acta Soc. Fauna & Fl. Fenn.* 8 : 58. 1891 is also recorded from Kashmir—H. Falconer s.n. (CAL Acc. no. 17783); *J. E. T. Aitchison* 6 (CAL).

3. *Nymphaea nouchali* Burm. f., Fl. Ind. 120. 1768; van Royen in Nova Guinea 8 : 110. f. 2. 1962, p. p. *N. stellata* Willd., Sp. Pl. 2 : 1153. 1799; Andrews, Bot. Rep. 5 : t. 330. 1803; Wight, Ic. t. 178. 1839; Hook. f. & Thoms., Fl. Ind. 1 : 243. 1855 & in Hook. f., Fl. Brit. India 1 : 114. 1872 incl. var.; Cooke, Fl. Pres. Bombay 1 : 25. 1901 incl. var. (Repr. ed. 1 : 27. 1958); Prain, Beng. Pl. 1 : 213. 1903 incl. var. (Repr. ed. 1 : 140. 1963); Duthie, Fl. Upp. Gang. Pl. 1 : 34. 1903 incl. var. (Repr. ed. 1 : 34. 1960); Gamble, Fl. Pres. Madras 1 : 33. 1915 (Repr. ed. 1 : 24. 1957); Haines, Bot. Bih. Or. 1 : 21. 1921 incl. var. (Repr. ed. 1 : 22. 1961); Kanjilal et al., Fl. Assam 1 : 64. 1934; Conard in Carnegie Inst. Wash. Publ. 4 : 140. 1905 incl. var.; Biswas & Calder, Handb. Wat. & Mar. Pl. Ind. & Burma ed. 2, 21. 1954. Subramanyam, Aquat. Ang. 6. 1962. *N. malabarica* Poir. in Lam., Encycl. Bot. 4 : 457. 1798. *N. versicolor* Roxb. ex Sims in Curtis, Bot. Mag. 29 : t. 1189. 1809. *N. cyanea* Roxb., [Hort. Beng. 41. 1814, nom. nud.] Fl. Ind. 2 : 577. 1832; Biswas & Calder, I. c. 21. *N. punctata* Edgew. in Trans. Linn. Soc. 20 : 29. 1851. *N. stellata* Willd. var. *parviflora* Hook. f. & Thoms., Fl. Ind. 1 : 243. 1855.

Local name : Sundi, Nil-sapla (Beng.); Nilkamal (Hind.); Sitambel (Mal.); Subdi Kain (Or.); Nilotpalam (Tam.).

Leaves 6—45 × 5—41 cm, elliptic-orbicular to subrotund, repand to irregularly sinuate-dentate with broad obtuse teeth, or subentire, glabrous and often punctulate on both surfaces, green and sometimes also blotched purple above, reddish purple beneath. Flowers 4—17 cm across, bluish-purple, blue, or pale bluish-white, fragrant. Sepals 2.5—9.0 × 0.7—2.6 cm, triangular-ovate and obtusely cucullate at apex, green, often with dark purplish streaks without. Petals 8—15, outer ones 2.5—7.5 × 0.8—17.0 cm,

lanceolate to oblong-lanceolate, subacute at apex. Stamens 25–40, outer ones 1.5–3.0 cm long, yellow with blue appendage. Ovary 8–16 loculate. Stigmatic appendages 1.0–3.5 mm long, incurved. Berries 1.5–4.0 cm across. Seeds c. 1.5 mm long, ellipsoid, reticulate, longitudinally ribbed, conspicuously ciliate along ribs when immature, become glabrate with growth of aril.

Type : India, Coromandel, *Burm. f. s. n.* in herb. Delessert (G).

Fls. & Frts. : All round the year; profusely during Aug.–Jan.

Distrib. : INDIA: Throughout the plains; SRI LANKA, BURMA, MALAYSIA, THAILAND, LAOS, CAMBODIA, VIETNAM, INDONESIA, PHILIPPINES, NEW GUINEA, TAIWAN.

Exsicc. : Uttar Pradesh : Dehra Dun, 15.8. 1898, *P. W. Mackinnon s. n.* (CAL Acc. no. 17734). West Bengal : 24-Parganas dt., Port Canning, 2.8.1907, *Kalka Prosad* 28888 (CAL). Assam : Goalpara dt., Dhubri, Balajan, 4.9.1906, *I. H. Burkitt* 27474 (CAL). Orissa : Brack water near Ganjam, 17.3. 1889, *W. Alcock s. n.* (CAL Acc. no. 17922). Madhya Pradesh : Saugor dt., Mohli Tank, 7.11.1960, *N. P. Balakrishnan* 11518 (CAL). Rajasthan : Bhilwara dt., Jahajpur, 4.10.1978, *A.N. Singh* 5725 (CAL). Andhra Pradesh : West Godavari dt., Kolleru Lake, 22.1.1958, *K. Subramanyam* 5071 (CAL). Tamil Nadu : Madurai dt., Chenkolam, 19.9.1961, *K.M. Sebastine* 12987 (CAL). Kerala : South Malabar, Nedemgayaer, *C.E.C. Fischer* 4021 (CAL). Little Andaman : Near Hut Bay, 13.1.1976, *N. Bhargava* 3429 (CAL).

Uses : The tuberous rhizomes and peduncles are eaten as vegetable; seeds on frying are eaten as puffed grain.

Chr. No. : $n = 42$ and $2n = 84$ sub. *N. stellata* var. *versicolor* (Roxb. ex Sims) Hook. f. & Thoms. (Raghavan & Arora in Proc. Ind. Acad. Sci. B47 : 356. 1958), $n = 14$ sub. *N. stellata* Willd. (Mitra & Datta in Taxon 16 : 455. 1967); $2n = 84$ sub. *N. stellata* var. 1 (Sen & Bhaduri in Journ. Cytol. Genet. 6 : 77. 1971); $2n = 56$ sub. *N. stellata* var. 2* (Sen & Bhaduri *l. c.* 73).

Notes : Reports of *N. nochiali* Burm. f. from other than plains usually belong to *N. caerulea* Savigny.

4. *Nymphaea pubescens* Willd., Sp. Pl. 2 : 1154. 1799; DC., Syst. Nat. 2 : 52. 1821 & Prodr. 1 : 115. 1824; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 1 : 17. 1834; Conard, in Carnegie Inst. Wash. Publ. 4 : 198. pl. 17. 1905; Gamble, Fl. Pres. Madras 1 : 34. 1915 (Repr. ed. 1 : 24. 1957),

*Materials studied belong to *N. micrantha* Guill. & Perr. as is evident from the bulbose nature of leaf mentioned by the authors (*l. c.*).

p. p. N. lotus var. *pubescens* (Willd.) Hook. f. & Thoms., Fl. Ind. 1 : 241. 1855 & in Hook. f., Fl. Brit. India 1 : 114. 1872; Cooke, Fl. Pres. Bombay 1 : 25. 1901 (Repr. ed. 1 : 27. 1958); Duthie, Fl. Upp. Gang. Pl. 1 : 34. 1903 (Repr. ed. 1 : 34. 1960). *Castalia edulis* Salisb. in König & Sims ed., Ann. Bot. 2 : 73. 1805. *Nymphaea esculenta* Roxb., [Hort. Beng. 41. 1814, nom. nud.] Fl. Ind. 2 : 578. 1832; Haines, Bot. Bih. Or. 1 : 21. 1921 (Repr. ed. 1 : 22. 1961). Biswas & Calder, Handb. Wat. & Mar. Pl. Ind. & Burma, ed. 2, 20 : 1954. *N. lotus* auct. non Linn. (1753) : Roxb., Fl. Ind. 2 : 577. 1832; Hook. f. & Thoms., Fl. Ind. 1 : 241. 1855 & in Hook. f., Fl. Brit. India 1 : 114. 1872, uterque *p. p.*; Cooke, l.c. (Repr. ed. 1 : 26. 1958), *p. p.*; Prain, Beng. Pl. 1 : 213. 1903 (Repr. ed. 1 : 140. 1963); Duthie, l. c. 33 (Repr. ed. l. c.) *p. p.*; Haines, l. c. (Repr. ed. l. c. 21), *p. p.*; Kanjilal et al., Fl. Assam 1 : 64. 1934, *p. p.*; Biswas & Calder l. c. *N. nouchali* auct. non Burm. f. (1768) : Subramanyam, Aquat. Ang. 6. 1962, *p. p.*

Local name : Mokuwa, Nal (Asm.); Shaluk, Shapla (Beng.); Koka (Hindi.); Dhabala Kain (Or.); Kumuda (Sans.); Allitamari, Vellambal (Tam.).

Leaves 15–50 × 12–45 cm, broadly ovate-elliptic, or reniform to orbicular, repand to sinuately spinous-dentate and somewhat crispat along margin, dark-green, glabrous and often pustulate above, green or dull purplish-green and velutinous pubescent beneath; petioles to 1.70 m or more long, up to 8 mm across, green or reddish-brown, puberulous. Flowers 4–15 cm across; peduncles similar to petioles, up to 1.5 cm across. Sepals 2.5–8.0 × 1.0–3.2 cm, usually ovate-lanceolate, elliptic-oblong and obovate-oblong respectively, subacute or obtuse at apex, puberulous and green with 5–9 prominent white veins without. Petals 10–25; outer ones 2–7 × 1.0–2.8 cm, oblanceolate, obtuse or subacute at apex. Stamens 25–70; outer ones 1.5–3.5 cm long, yellow. Ovary 13–22-loculate. Stigmatic appendages 0.5–1.0 cm long, oblong, inflexed, yellow. Berries 2.5–4.0 cm across. Seeds c. 1.5 × 1.0 mm, ellipsoid, longitudinally marked with rows of irregular papillae.

Type : India, Herb. Willd. 10100 (B, Microf.!).

Fls. & Frts. : All round the year; profusely during Aug.–Jan.

Distrib. : INDIA : Throughout the plain regions; SRI LANKA, BURMA, MALAYSIA, INDONESIA, NEW GUINEA, PHILIPPINES, THAILAND, LAOS, CAMBODIA, VIETNAM.

Exsicc. : Uttar Pradesh : Dehra Dun, Oct. 1895, P. W. Mackinnon s.n. (CAL Acc. no. 17840). Bihar : Champaran dt., Udaipur Lake, 11.11. 1963, B. V. Shetty 210 (CAL). West Bengal : 24-Parganas dt., Port Canning, 2.8. 1907, Kalka Prosad 28887 (CAL). Assam : Amlighat near Madhola,

19.8. 1964, *N.P. Balakrishnan* 39277 (CAL). Orissa : Shishma, east of Cuttack, 24.8. 1906, *I.H. Burkitt* 27423 (CAL). Madhya Pradesh : Bastar dt., Dangadamunda Lake, Kondagaon, 19.11. 1958, *K. Subramanyam* 7205 (CAL). Rajasthan : Banswara dt., Kushalgarh Rd., 24.8. 1978, *V. Singh* 3027 (CAL). Maharashtra : Thana dt., Vada Talao, W. Vada range, 10.9. 1968, *K. V. Billore* 116622 (CAL). Andhra Pradesh : West Godavari dt., Kolleru Lake, 22.1. 1958, *K. Subramanyam* 5065 (CAL). Karnataka : Ananthapura, Oct. 1908, *A. Meebold* 10096 (CAL). Tamil Nadu : North Arcot dt., Somasi padi, T.V. Malai, 27.11. 1977, *E. Vajravelu* 52095 (CAL). Kerala : Palghat dt., Olavakkot 17.10. 1963, *J. Joseph* 17790. (CAL). Andaman Islands : Great Cocos Island, Dec. 1889, *D. Prain* s.n. (CAL Acc. no. 17836).

Uses : Similar to *N. nouchali* Burm. f.

Chr. No. : $n = 42$ & $2n = 84$ sub. *N. lotus* Linn. (Raghavan & Arora in Proc. Ind. Acad. Sci. B47 : 356. 1958); $2n = 84$ (Sen & Bhaduri in Journ. Cytol. Genet. 6 : 78. 1971).

5. *Nymphaea rubra* Roxb. ex Andrews, Bot. Rep. 8 (104) : t. 503. 1808; Sims in Curtis, Bot. Mag. 31 : t. 1280. 1810; Roxb., Fl. Ind. 2 : 576. 1832; DC. Syst. Nat. 2 : 52. 1821 & Prodr. 1 : 115. 1824; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 1 : 17. 1834; Wight, Ill. t. 10. 1840; Conard in Carnegie Inst. Wash. Publ. 4 : 199. pl. 1—8. 1905; Prain, Beng. Pl. 1 : 213. 1903 (Repr. ed. 1 : 140. 1969); Biswas & Calder, Handb. Wat. & Mar. Pl. Ind. & Burma ed. 2, 20. 1954. Mitra & Subramanyam in Bull. Bot. Surv. India 24 : 83. 1983. *Castalia magnifica* Salisb. in Hook., Parad. Lond. 1:t. 14. 1805. *N. magnifica* (Salisb.) Conard in Rhodora 18 : 120. 1916, non Gilg (1908); *N. lotus* auct. non Linn. (1753) : Hook. f. & Thoms., Fl. Ind. 1 : 241. 1855 & in Hook. f., Fl. Brit. India 114. 1872, *uterque p. p. quoad syn. N. rubra*; Cooke, Fl. Pres. Bombay 1 : 25. 1903 (Repr. ed. 1 : 26. 1958), *p. p.*, Duthie, Fl. Upp. Gang. Pl. 1 : 33. 1903 (Repr. ed. 1 : 34. 1960), *p. p.*; Haines, Bot. Bih. Or. 1 : 21. 1921 (Repr. ed. 1 : 21. 1961), *p. p.* incl. var. β *rubra*; Kanjilal et al., Fl. Assam 1 : 64. 1934, *p. p.* *N. pubescens* auct. non Willd. (1798) : Gamble, Fl. Pres. Madras 1 : 34. 1915 (Repr. ed. 1 : 24. 1957), *p. p.* *N. nouchali* auct. non Burm. f. (1968) : Subramanyam, Aquat. Ang. 6. 1962, *p. p.*

Local name : Lal Shapla (Beng.); Rang Kai (Or.).

Very similar to *N. pubescens* Willd. but differs chiefly in colour of leaves, flowers, and in being completely sterile. Leaves at first dark-red both above and beneath, turning greenish above with age. Flowers usually 5—15 cm across, crimson red. Petals 16—25. Stamens 55—80; filaments of nearly inner two-third stamens with a dark purplish band near base. Ovary 17—27, usually 19—21-loculate.

Type : Andrews, Bot. Rep. 8 : t. 503. 1808 [drawn from a plant cultivated in Mr. Vere's Kingston Gore, in the vicinity of London].

Fls. : All round the year: profusely during Aug.—Jan.

Distrib. : INDIA : Throughout in Plains; SRI LANKA, BURMA, MALAYSIA, THAILAND, LAOS, CAMBODIA, VIETNAM, INDONESIA, PHILIPPINES.

Exsicc. : West Bengal : 24-Parganas dt., Majilpur, Nandipara, 28.10. 1906, *Kalka Prosad et al.* 27288 (CAL). Tripura : Agartala, 1.10.1914, *P.M. Debbarmen* 158 (CAL). Madhya Pradesh : Bastar dt. Dangadamunda Lake, Kondagaon, 19.11.1958, *K. Subramanyam* 7209 (CAL). Maharashtra : Chanda, 4.12.1889, *J. F. Duthie* 9271 (CAL). Karnataka : Sagar, Oct. 1908, *A. Meebold* 10095 (CAL). Tamil Nadu : Madurai dt., Alagar hills near Poyakari, 20.9.1957, *K. Subramanyan* 4291 (CAL).

Uses : Similar to *N. nouchali* Burm. f.

Chr. No. : $2n = 56$ (Janaki Ammal in Bull. Bot. Surv. India 1 : 25. 1959); $2n = 70$ (Sen & Bhaduri in Journ. Cytol. Genet. 6 : 77. 1971).

Notes : *N. rubra* Roxb. ex Andrews, originally claimed to be a native of Bengal, never sets fruit in nature and appears to be an obligate apomictic species. It propagates mainly through stolons and vegetative buds, and in exceptional cases by proliferation of flowers. Unlike the two common species of Indian plains, viz., *N. nouchali* Burm f. and *N. pubescens* Willd., *N. rubra* is not met with in temporary habitats like seasonally inundated fields, rice swamps, shallow ditches along roadsides and railway tracks, but is restricted only to the permanent ponds, lakes, etc.

In cultivation there is a rose-coloured variety known as *N. omarana* Hort. — Conard *I.c.* pl. 30 (*N. rubra* var. *rosea* Sims in Curtis, Bot. Mag. t. 1364. 1811) with leaves bronze-green and blotched brown above and yellowish-brown beneath. Stamens are yellow with reddish-brown tips and without any purplish bands on their filaments. It is claimed to be a third generation hybrid between *N. lotus* Linn. and *N. rubra* Roxb. ex Andrews, or their derivatives, and occasionally sets fruits. The chromosome number report $2n = 56$ (Langlet & Söderberg in Acta Hort. Berg. 9 : 85. 1927; Janaki Ammal, *I. c.*) probably belongs to this cultivated variety.

6. *Nymphaea tetragona* Georgi in Reise Russ. Reich 1 : 220. 1775; Conard in Carnegie Inst. Wash. Publ. 4 : 167, pl. 14, f. 65. 1905; Komarov in Komarov *et al.*, Fl. URSS 7 : 11, pl. 1, f. 1. 1937; Tutin in Tutin *et al.*, Fl. Europaea 1 : 205. 1964; Li, Fl. Taiwan 2 : 545. 1976. *N. pygmaea* Ait., Hort. Kew. ed. 2, 3 : 293. 1811; Hook. f. & Thoms., Fl. Ind. 1 : 244. 1855 & Hook. f., Fl. Brit. India 1 : 115. 1872; Sims in

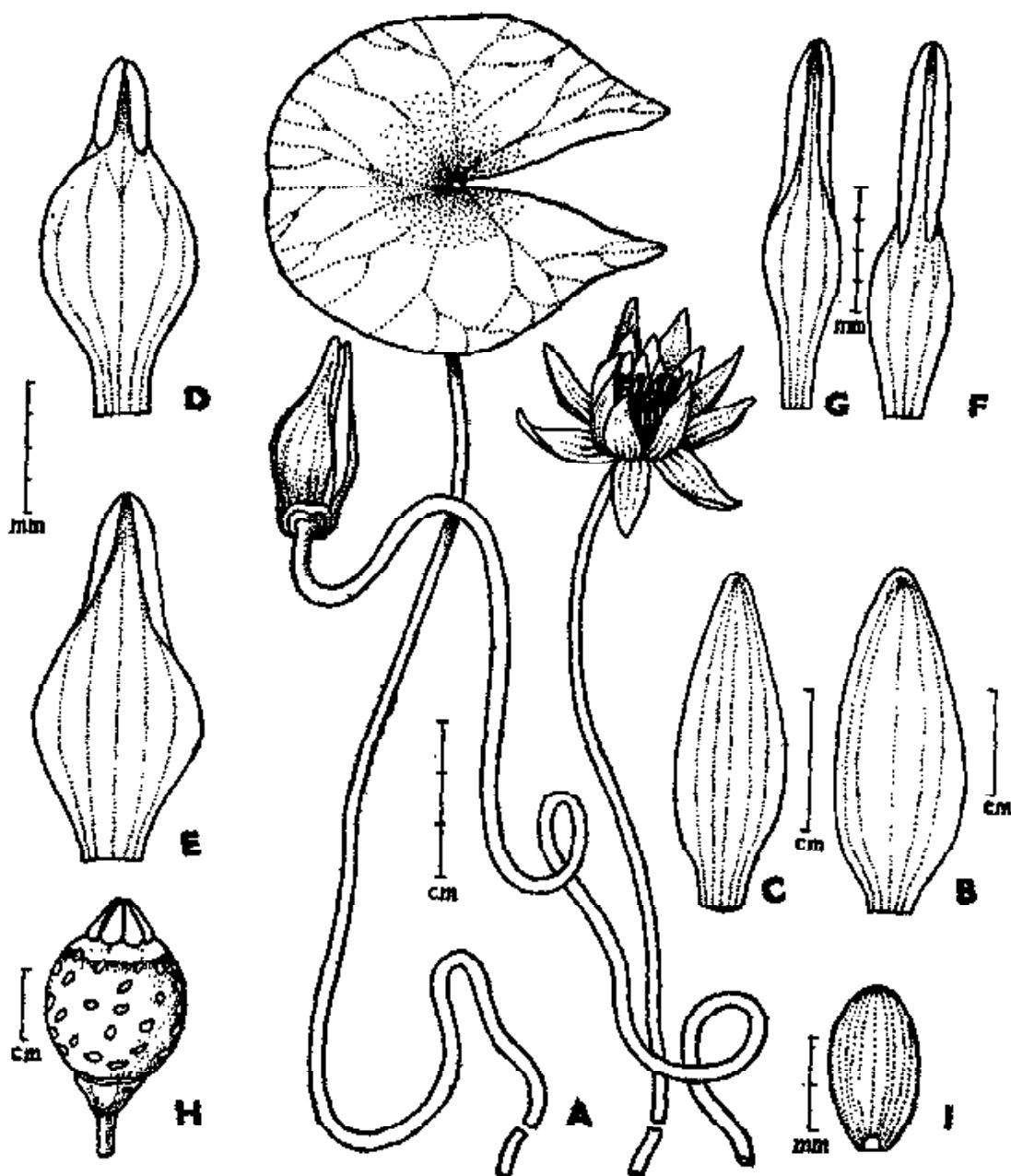


Fig. 2 *Nymphaea tetragona* Georgi (*R. L. Mitra* 1476). A. Habit. B. Sepal.
C. Petal. D.—G. Outer and inner stamens, dorsal and ventral views.
H. Fruit. I. Seed.

Curtis, Bot. Mag. t. 1525. 1813; Kanjilal et al., Fl. Assam 1 : 64.
1934.

Fig. 2

Local name : Pigmy Water Lily (Eng.); Sohpyllain phuhlieh (Kh.).

Leaves 3—7 × 2.2—5.8 cm, orbicular-obovate or horse-shoe shaped, rounded or retuse at apex, reddish-brown with patches of green above (green above and pale puplish beneath when submerged), turn scarlet with age, green with tinge of purple along margin beneath; basal lobes subequal, acuminate, more or less straight and divergent. Flowers 2.5—5.0 cm across, white; receptacle sharply tetragonal; peduncles c. 2 mm across, spirally twisted in fruit. Sepals 1.4—3.2 × 0.5—1.2 cm, ovate-lanceolate to oblong-lanceolate, obtusely cucullate at apex. Petals c. 12; outer ones 1.3—2.5 × 0.5—0.8 cm, obovate-oblong or oblong-lanceolate; innermost ones abruptly much reduced and transitional to stamens. Stamens c. 50; outer ones 7—12 mm long with spatulate or obovate-oblong filaments. Ovary 6—8-loculate. Stigmas raised, convex; stigmatic appendages 2—3 mm long, ovate-lanceolate with involute sulcate margin. Berries 1.5—2.0 cm across, enclosed by coriaceous sepals and remnants of other floral appendages. Seeds 3—4 × 2 mm, oblong, black.

Type : Siberia, banks of Lena river, *Gmelin* in herb. Pallas (BM).

Fls. & Frts. : July—Sept. (Dec.).

Distrib. : INDIA : Kashmir and Meghalaya (1200—1800 m); FINLAND, E. SIBERIA, JAPAN, N. AMERICA.

Exsicc. : Kashmir : Gulmarg, in water holes, 4.7.1893, *J. F. Duthie* 13057 (CAL). Meghalaya : Khasia Hills, *J. D. Hooker & T. Thomson* 2290 (CAL) ; Umjapung village, near Nongkreem, Khasia Hills, 29.9.1975, *R. L. Mitra* 1476 (CAL).

Chr. No. : 2n = 112 (Langlet & Söderberg in Acta Hort. Bot. 9 : 85 1927).

CULTIVATED SPECIES

I. A. Flowers blue or bluish-purple. Stamens 50—80, appendaged :

1. *Nymphaea caerulea* Savigny in Dec. Egypt. 3 : 74. 1798; Conard, I. c. 141, pl. 8.

Leaves green beneath with dark purple spots and pale purplish along margin. The Blue Lotus of Egypt, grown in Ward Lake, Shillong, and elsewhere; often indistinguishable from *N. nouchali* Burm. f. in herbarium.

2. *Nymphaea micrantha* Guill. & Perr., Fl. Seneg. Tent. 1 : 16. 1830; Conard, I. c. 146, pl. 9.

Leaves reddish beneath with dark violet spots, green above with a woolly umbo at the summit of petiole when young, become characteristically bulbiferous afterwards. A native of Africa, introduced in ponds and lakes in Tripura, Manipur, and elsewhere. The viviparous habit is reported to develop only during second year of plant's growth; till then the plant is liable to be mistaken for *N. caerulea* Savigny and *N. nouchali* Burm. f.

B. Flowers yellow. Stamens c. 75, without appendages :

3. *Nymphaea alba* X *N. mexicana* = *Nymphaea marliacea* Latour-Marliac in Gard. Chron. 1 : 564. 1888; Conard, l. c. 230.

Leaves blotched with brown when floating, raised well above water when crowded and become somewhat cupped and dark-green above, paler beneath with reddish-brown blotches towards margin; petioles and peduncles inconspicuously ribbed and slightly flattened. Contrary to the claim by Marliac (*l. c.*), often believed to be a hybrid between *N. tuberosa* and *N. mexicana*.

C. Flowers carmine red. Stamens c. 75, without appendages :

4. *Nymphaea alba* var. *rubra* Lönnroth in Bot. Notis. 124. 1856; Conard, l. c. 179. pl. 15. f. 1—19.

Leaves reddish both above and beneath when young, turn dark green above and pale green beneath except along margin with age, and rise well above water when crowded. Flowers deep red in the centre, paler towards periphery.

Grown in Ward Lake, Shillong and elsewhere; often misidentified as *N. alba* Linn.

II. 1. *Victoria amazonica* (Poepp.) Sowerby in Ann. & Mag. Nat. Hist. Ser. 2, 6 : 310. 1850; Bailey, Man. Cult. Pl. 384. 1958. *Euryale amazonica* Poepp. in Froriep. Notiz. 35 : 131. 1832. *V. regia* Lindl., Victoria Regia 3. 1837.

The Gaint Water Lily of Amazon, occasionally grown in Water Gardens for its enormous, orbicular floating leaves upturned at margins. Grown in ponds of Indian Botanic Garden, Howrah.

2. *Victoria cruziana* Orbigny in Ann. Sci. Nat. Ser. 2, 13 : 57. 1840; Bailey, l.c.

Similar to *V. amazonica*, sometimes considered a variety of it; easily recognised by its green upturned leafmargins which are purplish in *V. amazonica*. Also grown in Indian Botanic Garden, Howrah.

EXCLUDED SPECIES

Nymphaea sioux — a tradesman name for ornamental *Nymphoides peltata* (Gmel.) Kuntze (Gentianaceae) with bright yellow flowers and 'nymphaea-like' leaves. Evidently, Sen & Bhaduri (Journ. Cytol. Genet. 6 : 84. 1971) while reporting its chromosome number as $2n = 70$, had difficulty in explaining its chromosome morphology in relation to other species of *Nymphaea*.

RHAMNACEAE

DC., Prod. 2 : 19. 1825

M.M. Bhandari* and A.K. Bhansal**

Trees, shrubs or lianas; unarmed or thorny, branches spinous or aculeate, rarely cirrhose or tendrillar. Leaves simple, alternate or opposite or subopposite, penninerved or 3-5-nerved from the base; stipules deciduous or modified into persistent prickles, free or interpetiolar or intra-axillary. Inflorescence axillary or terminal cyme, rarely raceme or panicle or spicate. Flowers minute, regular, bisexual or less commonly polygamous, hypogynous, perigynous or epigynous, intrastaminal disc cup-like, nectariferous, sometimes thickened near and/or produced beyond the rim of the cup. Calyx 4 or 5-lobed, rarely 6, usually carinate whithin down the middle or with a raised line within, the tube generally more or less united with the ovary or disc and usually persistent. Petals 4—5, sometimes 6, rarely absent narrowed or clawed at base, cucullate or involute at tip. Stamens 4—5, antipetalous, inserted with petals on edge of disc; filaments filiform, rarely flattened; anthers small, 2-celled or rarely the 2-cells confluent. Ovary 2—3-loculed, rarely 4 or 1-loculed, ovules solitary in each cell, anatropous, placentation basal; style simple or divided into as many lobes as ovary locules; stigmas capitate or club-shaped. Fruits capsules, sometimes winged. Seeds solitary, erect, ovoid, angular or compressed, often arillate; testa coriaceous, crustaceous or membranous, often shining; albumen fleshy or horny, rarely exalbuminous; embryos large, straight.

Distrib. : 70 genera and c. 1500 species, rather extensively represented throughout the temperate and tropical regions of the world. 12 genera with 57 species in India.

Notes : Several species have been introduced in India. These include *Colletia cruciata* Gill. ex Hook., a curious South American plant, which is nearly a leafless shrub with decussate branches and flattened spines; *Pomaderris lanigera* Sims., a conspicuous unarmed shrub of Australia and New Zealand with dense rusty tomentose tender parts and *Noltea africana* (Linn.) Reichb. ex Harv. & Sond., an upright glabrous shrub with virgate branches and polygamodioecious flowers and 2-lobed fruits covered with persistent calyx tube.

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KEY TO THE GENERA

1. BERCHEMIA

Neck. [Elem. Bot. 2 : 122. 1790] ex DC., Prodr. 2 : 22. 1825 *nom cons.*
 Benth. & Hook. f., Gen. Pl. 1 : 377. 1862; Brandis, For. Fl. 90. 1874;
 Lawson in Hook. f., Fl. Brit. India 1 : 637. 1875; Kanjilal, For. Fl. (Repr.
 ed.) 126. 1969.

Trees or shrubs, erect or climbing. Leaves opposite, subopposite, or alternate, coriaceous, penninerved, nerves parallel, nervules transverse; stipules small, deciduous, often intraaxillary or free. Inflorescence axillary, spicate, paniculate or clustered at ends of branches. Flowers sessile or pedicellate, polygamous. Calyx 5-lobed, rarely 6; tube short, hemispherical or turbinate. Petals 5, rarely 6, obovate, unguiculate, cucullate. Stamens 5, rarely 6; anthers large, ovate, 2-celled; filaments filiform, often flattened. Disc fleshy, annular, margin free, swollen. Ovary superior, sunk in the disc but free from it, ovoid, 2-loculed; style 2-fid or notched; stigma terminal, obtuse, convex. Drupes girt at base with calyx tube, ellipsoid, ripening black, purple or yellow, putamen crustaceous or woody, exocarp fleshy. Seeds 2, linear-oblong, testa membranous, raphe lateral; albumen fleshy, cotyledons narrowly oblong, radicle short.

Distrib. : 22 species in the world (in 1 N. America, 2 in Africa and 19 in S. Asia). 3 in India, species of *Berchemia* are confined to subtropical N. W. Himalayas and tropical evergreen forests of E. Himalayas.

Pollen : 3-zonocolporate; grain size 22–24/18–22 μm prolate, spheroidal or circular; sexine is almost as thick as nexine, psilate (Parveen & Bhandari in Bir, Recent Res. Plant Sci. 687–697, 1979).

KEY TO THE SPECIES

- 1a. Flowers 6-merous... *B. edgeworthii* 1
- 1b. Flowers 5-merous :
 - 2a. Climbing shrubs; leaves more than 2.5 cm long, acute or subacuminate at apex; lateral nerves 9–15 pairs; fruits surrounded at base by the rim of calyx... *B. floribunda* 2
 - 2b. Undershrubs; leaves upto 2.5 cm long, obtuse at apex; lateral nerves 6–8 pairs; fruits surrounded at base by the 5-lobed calyx tube... *B. lineata* 3
- 1. *Berchemia edgeworthii* Lawson in Hook. f., Fl. Brit. India 1 : 638. 1875.

Shrubs; branches glabrous. Leaves 2.0—2.5 cm long, elliptic or ovate-lanceolate, scarious; petioles 3—6 mm long; stipules 6 mm long. Flowers 6-merous, shortly pediceled, 2 together in the axil of the leaves, the buds almost hidden by the stipules. Calyx lobes 6. Petals 6, broadly ovate. Stamens 6. Drupes 1.6 cm long, surrounded at the base by the persistent entire calyx.

Type : India : Western Himalayas, M. P. Edgeworth 376 (K!).

Distrib. : INDIA : Himalayas; NEPAL, PAKISTAN, AFGHANISTAN.

Notes : This is a distinct species due to the hexamerous nature of its flowers. Parker (1918) included *B. edgeworthii* under *B. lineata* in his flora of Punjab, but a critical study of the type material supports its distinct identity.

2. *Berchemia floribunda* (Wall.) Brongn., Mem. Fam. Rham. 50. 1826 & in Ann. Sci. Nat. Ser. 1, 10 : 357. 1827; Brandis, For. Fl. 91. 1874; Lawson in Hook. f., Fl. Brit. India. 1 : 637. 1875; Gamble, Man. Ind. Timb. 184. 1922 (Repr. ed.); Kanjilal, For. Fl. 126. 1969 (Repr. ed.); Brandis, Ind. Trees 169. 1971. (Repr. ed.) *Ziziphus floribunda* Wall. in Roxb., Fl. Ind. 2 : 368. 1824. *Berchemia laxa* Wall. Cat. 4257. 1828 *nomen nud.*

Fig. 3

Local names : Kouloi or Kauloi (Jaunsar); Amili Kalapag (Hindi); Rungycony rik (Lepcha); Chiaduk (Nepal).

Large climbing shrubs; branches glaucous when young; bark thin, whitish. Leaves alternate, spreading, 4.0—8.3 × 2.2—4.4 cm, ovate-oblong or elliptic, acute to ruminate at apex, obliquely furrowed, rounded or subcordate at base, subcoriaceous, shining, glabrous, margin entire, lateral nerves oblique; petioles 1.3—1.8 cm long, channelled; stipules intraaxillary 2—4 mm long, subulate, bifid, connate up to middle, early deciduous. Inflorescence 3—8-flowered clusters in terminal panicles. Flowers 5—6 mm across, sessile or shortly pedicellate; pedicels 1—2 mm long. Calyx lobes 5, 2—3 mm long, keeled up to the middle, glabrous. Petals 5, 1.5—2.2 mm long, spatulate. Stamens 5, longer than the petals; anthers dorsifixed; filaments flat. Disc massive, enveloping the ovary, margin notched above the insertion of filaments. Ovary glabrous; style long with 2 stigmata. Drupes 9—12 × 4—6 mm, ellipsoid or cylindrical. Seeds 2, 6—8 × 3—4 mm, compressed, black.

Type : Kumaon, Wall. Cat. no. 4256b (K-W).

Fls. : May—Aug.; *Frts.* : Feb.—Apr.

Distrib. : INDIA : Kashmir, Uttar Pradesh, Assam, W. Bengal.

Chr. No. : n = 12 (Mehra & Khosla in *Taxon* 18 : 213—221. 1969).

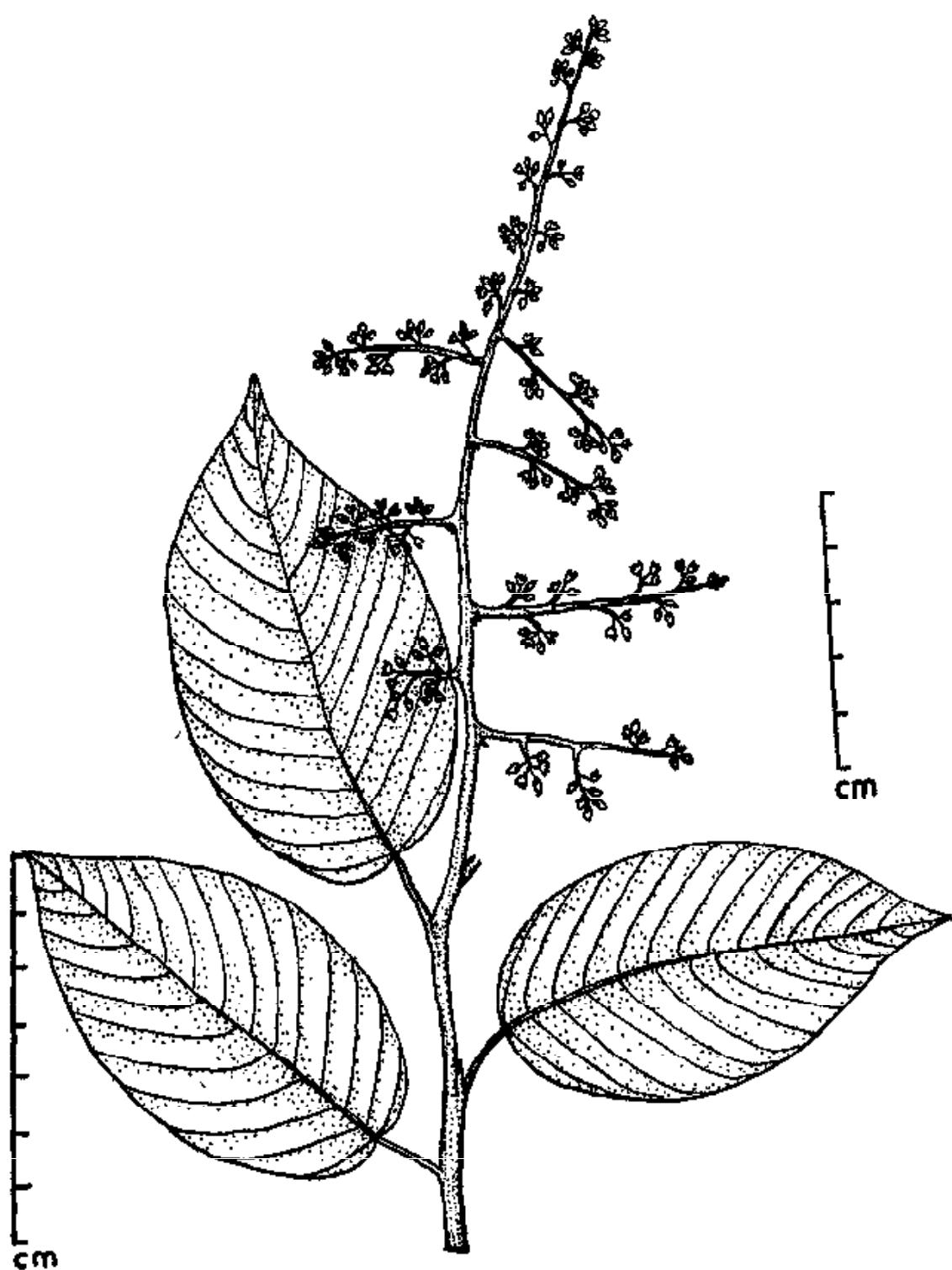


Fig. 3 *Berchemia floribunda* (Wall.) Brongn.

Notes : Wallich 4256 consists of 3 sheets, all preserved at Kew. 4256a from Nepal, 4256b from Kumaon and 4256c from Silhet. There are no fruits on the first sheet. The fruits on the specimen from Kumaon are smaller than those from Silhet. M. Johnston (1969) regards 4256a as the probable holotype (ex Nepal). *B. laxa* Wall. Cat. 4257 (K) has larger fruits compared to 4256b or 4256c.

3. *Berchemia lineata* (Linn.) DC., Prodr. 2 : 23. 1825; Brandis, For. Fl. 91. 1874 & Ind. Trees 169. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 638. 1875; Kanjilal, For. Fl. 126. 1969 (Repr. ed.) *Rhamnus lineata* Linn., Amoen. Acad. 5 : 308. 1760.

Diffuse undershrubs; bark smooth, shining; young branches puberulous. Leaves $0.7-2.5 \times 0.3-1.5$ cm, very variable, ovate-elliptic, glabrous, obtuse at apex, mucronate, rounded at base, entire, midribs depressed above, prominent beneath; petioles 3-4 mm long; stipules intra axillary, setaceous, 3-4 mm long. Inflorescence axillary or terminal fascicle, 2-4-flowered. Flowers 5 mm across, glabrous; pedicels 2-3 mm long. Calyx 2.0-2.5 mm long, keeled up to base; tube campanulate. Petals 5, 1.5-2.0 mm long, ensheathing the stamens. Stamens 5, 2-2.5 mm long, inserted below the disc; anthers dorsifixed; filaments flat. Disc massive, glabrous. Ovary glabrous, ovules 1 in each locule; style 2 mm long; stigma emarginate or notched. Drupes $6-10 \times 3-5$ mm, ellipsoid or cylindrical, bluish when ripe, glabrous. Seeds 2, 6-8 \times 2-3 mm, compressed, black.

Fls. : May—July. *Frt.s.* : Sept.—Nov.

Ecol. : Very common. A very pretty small shrub often found among rocks at about 2100 m, particularly in N. W. Himalayas.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Uttar Pradesh; CHINA.

2. COLUBRINA

Rich. ex Brongn., Mem. Fam. Rham. 61. 1826 & in Ann. Sci. Nat. Paris 10 : 362. 1827 *nom. cons.*; Benth. & Hook. f., Gen. Pl. 1 : 379. 1862; Lawson in Hook. f., Fl. Brit. India 1 : 642. 1875; Parkinson, For. Fl. Andaman 131. 1923; Gamble, Fl. Pres. Madras 1 : 223. 1918 (Repr. ed. 1 : 160. 1957); Cooke, Fl. Pres. Bombay 1 : 245. 1902 (Repr. ed. 1 : 261. 1958).

Scandent or erect shrubs or trees, unarmed or rarely armed. Leaves alternate or opposite, basally 3-nerved, or pinninerved, petiolate; stipules small, deciduous. Inflorescence axillary, thyrsoid or cymose fascicles. Flowers small, protandrous, 5-merous, calyx, corolla, and androecium

attached to the rim of hemispheric or shallow floral cup. Calyx lobes 5, spreading, valvate, deltoid, pubescent without, deciduous along the rim of the cup, tube hemispherical. Petals 5, euculate, obovate, convolute, clawed at base, inserted below the disc. Stamens 5; filaments filiform; anthers ovate. Disc fleshy, annular, flat, and nearly completely surrounding the ovary, accrescent along the cup and adnate to the lower fifth to half of capsule. Ovary inferior, 3-loculed; style 3-cleft; stigmas truncate or obtuse. Capsules nearly globular, slightly 3-lobed, dehiscing septicidally into 3 cocci; exocarp thin. Seeds obovoid, compressed, 3-gonous; albumen fleshy, thin; cotyledons flat or incurved; embryo flat.

Distrib. : 31 species in the world (21 in the warmer parts of America; 1 in Hawaii; 4 in Madagascar; 5 in S. E. Asia). 2 species in India.

Ecol. : In India the genus is characteristic to coastal areas, just above high tide level.

Pollen : 3-zonocolporate; P/E 26—33/24—26 μm ; prolate or subprolate spheroidal as slightly lalongate, sexine as thick as nexine, reticulate. (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 691. 1979).

KEY TO THE SPECIES

- 1a. Leaves ovate, basally 3-nerved, lateral nerves
2—3 pairs... *C. asiatica* 1
- 1b. Leaves elliptic to lanceolate, pinninerved,
lateral nerves 4—6 pairs... *C. travancorica* 2

1. *Colubrina asiatica* (Linn.) Brongn., Mem. Fam. Rham. 62, 1926 & in Ann. Sci. Nat. Ser. 1, 10 : 369. 1827; Dalz. & Gibbs., Bombay Fl. 50. 1861; Bedd., Fl. Syl. 69. 1871; Lawson in Hook. f., Fl. Brit. India 1 : 642. 1875; Parkinson, For. Fl. Andaman 131. 1923; Sant. in Rec. Bot. Surv. India 16 (1) : 51. 1953; Gamble, Fl. Pres. Madras 1 : 224. 1918 (Repr. ed. 1 : 161. 1957); Cooke, Fl. Pres. Bombay 1 : 246. 1902 (Repr. ed. 1 : 261. 1958). *Ceanothus asiaticus* Linn., Sp. Pl. 196. 1753.

Local name : Guti (Mar.)

Fig. 4

Glabrous, straggling, littoral, unarmed shrub, 1—3 m high; branchlets slender, often zig-zag, internodes 5—45 mm long. Leaves alternate, 3.0—10.2 \times 2.3—6.5 cm, ovate, broadly rounded to shallowly cordate at base, acuminate, membranous, crenate, crenatures gland-tipped; petioles 7—22 mm long, stipules 1 mm long, deltoid. Inflorescence a cyme. Flowers yellowish-green, 5—6 mm across, fragrant, lower fertile, the upper abortive or staminate; peduncles 2—6 mm long; pedicels 2—5 mm long, elongating. Calyx lobes 5, 2.5—3.0 mm long, glabrous; tube glabres-

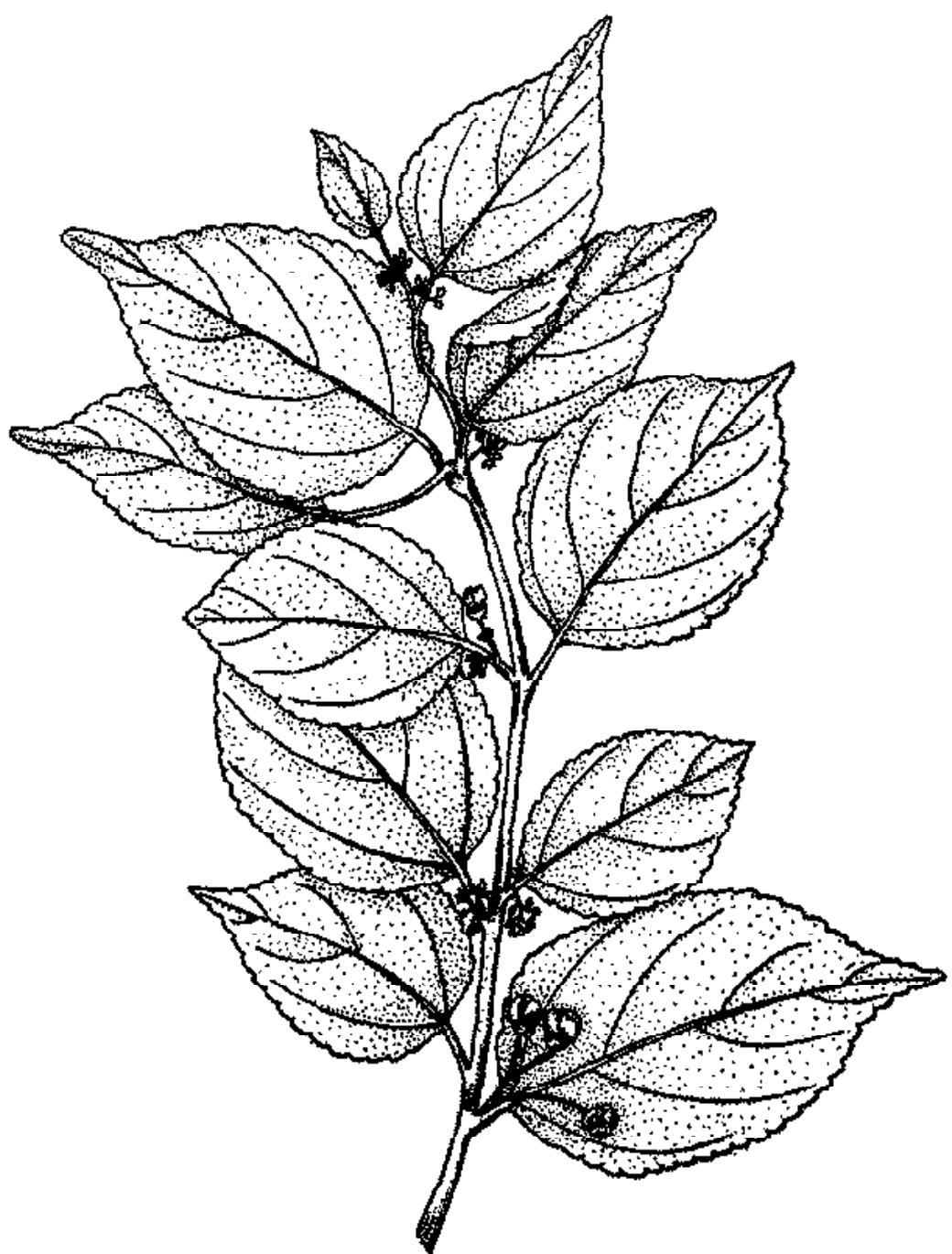


Fig. 4. *Colubrina asiatica* (Linn) Brongn.

cent. Petals yellow, 1.8 mm long, emarginate, glabrous, claw slender. Stamens 1.6 mm long, anthers dorsifixed. Disc 5-lobed, glabrous. Ovary globose; style 1.5 mm long; stigma truncate. Capsules globose, 8–10 mm long, slightly depressed at top, dehiscent, cocci thin-walled, radial walls membranous, occasionally adherent to the receptacle after dehiscence. Seeds 3, chocolate-brown, 4–7 × 4–5 mm, slightly emarginate at the base.

Type : Sri Lanka, Herb. Hermann, Vol. 2, f. 11 (Lecto, BM!).

Fls. & Frs. : Dec.—Mar.

Distrb. : INDIA : Andaman Nicobar Islands, Orissa, Karnataka, Maharashtra, Tamil Nadu; BURMA, SRI LANKA, INDONESIA, AUSTRALIA, S. AFRICA.

Ecol. Especially near the coasts and just above high tide level.

Uses : The bark contains saponin, and is reported to be used in Samoa for clearing mats.

Notes : Johnston (1971) recognises two varieties under this species; the Indian plant is *C. asiatica* var. *asiatica*.

2. *Colubrina travancorica* Bedd., Jc. Pl. Ind. Or. 1 : 43, t. 188. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 653. 1875; Gamble, Fl. Pres. Madras 1 : 224. 1918 (Repr. ed. 1 : 161. 1957); Brandis, Ind. Trees 174. 1971 (Repr. ed.). Fig. 5

Unarmed shrubs, young branches antorse, appressed golden silky hairy. Leaves membranous, alternate or subopposite towards the flowering region, 9.8–12.5 × 3.5–4.4 cm, elliptic to lanceolate, acuminate, apex mucronate, base rounded, crenate, crenatures black callous tipped, distal ones more conspicuous than the proximal ones, when young densely pubescent beneath and costa above, lateral nerves impressed above and raised below; petioles 5–9 mm long, pubescent; stipules 2–3 mm long, subulate, pubescent. Inflorescence thyrses or congested dichasia; peduncles 4–8 mm long, pubescent. Flowers pinkish, 5–6 mm across; pedicels 4–8 mm long, golden silky hairy. Calyx lobes 5, 2.0–2.5 mm long; tube campanulate, sparsely hispid. Petals 5, 1.5–2.0 mm long. Stamens shorter than petals; anthers dorsifixed; filaments flat. Disc 10-lobed, pitted. Ovary glabrous; style 3-cleft up to the middle, glabrous. Capsules globose, 6–8 mm in diam., slightly depressed at the top.

Type : India, Travancore, plains between Kotakarray and Panalur. Nov. 1872, *Beddome* 301 (Holo, K !)

Fls. & Frs. : Nov.—Mar.

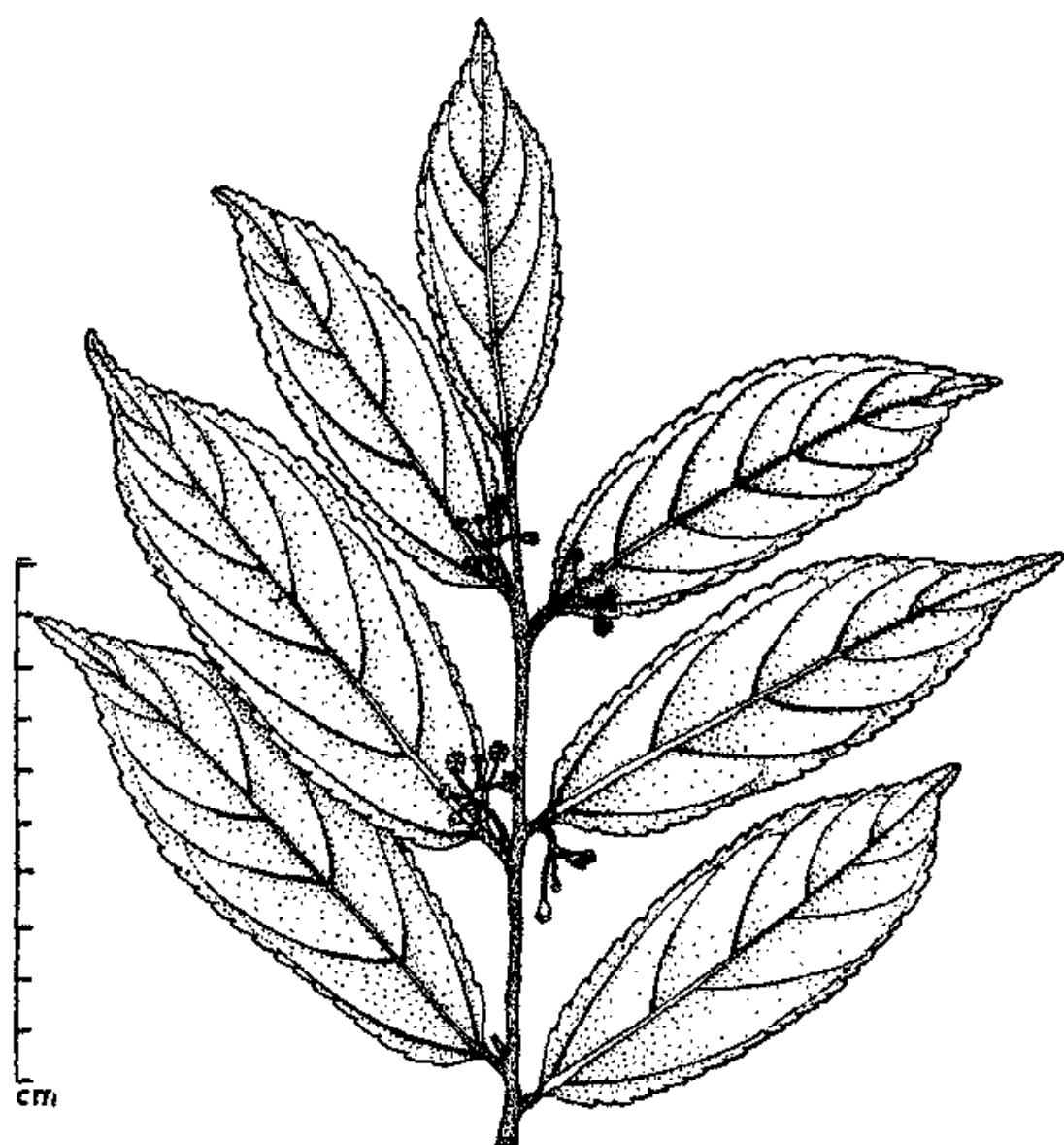


Fig. 5. *Colubrina travancorica* Bedd.

Distrib. : INDIA : Kerala--endemic.

Ecol. : Coastal forests.

3. GOUANIA

Jacq., Select. Strip. Amer. Hist. 263. 1763; Roxb., Fl. Ind. 2 : 416. 1824; DC., Prodr. 2 : 40. 1825; Wight & Arn., Prodr. 166. 1834; Benth. & Hook. f., Gen. Pl. I : 385. 1862; Lawson in Hook. f., Fl. Brit. India 1 : 643. 1875.

Climbing shrubs, branches circinate tendrilar. Leaves alternate, petiolate; stipules free, caducous. Inflorescences terminal or axillary racemes or panicles. Flowers bisexual, epigynous, pentamerous, rachis often cirrhose. Calyx lobes 5, valvate, glabrous or pubescent. Petals 5, cucullate, clawed at base, inserted below the margin of disc. Stamens 5, enclosed in petals; anthers dehisce longitudinally. Disc massive, glabrous or hairy, 5-lobed, lobes opposite to calyx lobes. Ovary connate to the bottom of calyx tube, 3-carpellary, 3-loculed, immersed in the disc, usually urceolate; style 3-cleft, obscurely or deeply 3-lobed; stigma papillose. Schizocarpic capsules trigonous, 3-winged, or cocci 3, woody, 3-locular, indehiscent. Seeds 3, obovate, plano-convex; testa shining, horny; albumen thin; cotyledons rotundate; embryo erect, furnished with perisperm.

Distrib. : c. 70 species in the world, (c. 35 in America, 14 in Asia, 15 in Madagascar and other Islands of the Indian ocean, 2 in Australia and 2 in Africa). 4 species in India.

Pollen : 3-zonocolporate P/E 22—28/28—38 μ m; oblate or suboblate spheroidal; os circular; sexine almost as thick as nexine, faintly reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 691, 1979).

KEY TO THE SPECIES

- 1a. Leaves entire; fruits rusty tomentose... *G. andamanica* 1
- 1b. Leaves crenate-serrate; fruits glabrous :
- 2a. Leaves distantly and minutely serrulate, rounded at base; flowers sessile; disc villous, the lobes rounded, emarginate... *G. microcarpa* 3
- 2b. Leaves crenate, cordate at base; flowers shortly pedicellate; disc glabrous, the lobes stellately horned :
- 3a. Inflorescence glabrous; lateral nerves 4—6 pairs... *G. leptostachya* 2

- 3b. Inflorescence puberulous; lateral nerves
6—8 pairs...
...*G. napalensis* 4

- 1.** *Gouania andamanica* King in Jour. Asiat. Soc. Beng. 65 : 382. 1897;
Brandis, Ind. Trees 175. 1971 (Repr. ed.); Parkinson, For. Fl. Anda-
man 131. 1923.

Climbing shrubs or lianas, tendrilate, young branches rusty brown pubescent. Leaves $4.3-7.5 \times 2.2-5.6$ cm, oblong or elliptic-ovate, sometimes rounded at apex, mucronate, lateral nerves 7—9 pairs, secondary veins camptodromous, tertiary veins transverse; petioles 1.0—1.5 cm long, pubescent; stipules 2 mm long, subulate, pubescent. Inflorescence axillary or terminal, racemes or 5—6-flowered clusters. Flowers 5—7 mm across, sessile; bracteoles conspicuous, 5 mm long; subulate, pubescent, deciduous. Calyx lobes 2 mm long, deltoid, glabrous within, densely pubescent without, thickened at apex. Petals 1.5 mm long, spatulate. Stamens 1.7 mm long; anthers dorsifixed. Disc glabrous, saucer-shaped; lobes stellately horned, filling the calyx tube. Style 3-cleft, up to half the length. Capsules triquetrous, crowned with persistent calyx, tardily dehiscent. Seeds minutely emarginate or retuse at apex; testa hard, gibbous.

KEY TO THE VARIETIES

- 1a. Leaves sparsely pubescent above, lateral nerves
not conspicuous; fruits not winged...
...var. *andamanica*
- 1b. Leaves glabrous above, lateral nerves conspi-
cuously impressed; fruits somewhat winged... ...var. *brevialata*

var. *andamanica*

Leaves persistently sparsely pubescent above, sparsely antrorse appressed hairy below, densely on nerves. Capsules 1.5×1.0 cm. Seeds 6×3 mm.

Type: Middle Andaman Island. Collector ? (K !).

Fls. : Oct.—Dec.; *Frs.* : May—Sept.

Distrib. : INDIA : Andaman—endemic

Ecol. : On the rocky places in thick forests near the streams.

var. *brevialata* Bhandari & Bhansali var. nov.

Folia in supra parte glabella, in parte tamen infra, pubescentia, nervi laterales, depresso. Fructus $0.8-2.0 \times 0.5-1.7$ cm, ferrugineus tomentosus, alae minus evolutae.

Leaves glabrous above, pubescent below, lateral nerves depressed above. Fruit $0.8 - 2.0 \times 0.5 - 1.7$ cm, wings slightly developed.

Type : India, North Andamans, Sengupta 6089 (Holo, DD)

2. ***Geouania leptostachya*** DC., Prodr. 2 : 40. 1825; Dalz. & Gibbs. Bomb. Fl. 50. 1861; Brandis, For. Fl. 574. 1874 & Ind. Trees 175. 1971 (Repr. ed); Lawson in Hook. f., Fl. Brit. India 1 : 643. 1875; Gamble, Man. Ind. Timb. 189. 1922 (Repr. ed.); Parkinson, For. Fl. Andaman 131. 1923; Gamble, Fl. Pres. Madras 1 : 225. 1918 (Repr. ed. 1 : 161. 1957); *G. tiliaefolia* Roxb., Pl. Cor. 67, t. 98. 1798 et Fl. Ind. 2 : 417. 1824 non Lam. 1789, nec Rottb. ex DC. 1825.

Local names : Penki tiga (Tel.); Kalalag (Hindi); Khanta (Oriya).

Unarmed climbing shrubs or lianas, upto 8 m long; tendrils axillary or extra-axillary; branches glabrous with continuous brown vertical lines; internodes 2–5 cm long. Leaves $3.5 - 8.6 \times 2.0 - 8.5$ cm, ovate, acute to acuminate, glabrous above, grey or brown antrorse hairy on veins beneath, primary and secondary veins camptodromous; petioles 1.5–3.4 cm long, glabrous; stipules $4 - 5 \times 0.5 - 1.0$ mm, subulate. Racemes in 3–7-flowered clusters. Flowers white, 5–6 mm across; pedicels 2 mm long; bracteoles subulate, pubescent at base, caducous. Calyx lobes 2.5×1.5 mm, deltoid, thickened at apex, glabrous or sparsely hairy without. Petals 1–2 mm long, spatulate, inserted below the margin of disc. Stamens 1.0–1.5 mm long; filaments alternating with subulate appendages of disc. Style 3-cleft upto middle; stigma recurved, obtuse. Capsules crowned by persistent calyx.

KEY TO THE VARIETIES

- | | | |
|--|-------------------------|-------------------------------|
| 1a. Fruits dehiscing by 3-valves. Seeds c. 5 mm long | | ... var. <i>leptostachya</i> |
| 1b. Fruits indehiscent. Seeds upto 3.5 mm long | | ... var. <i>nainitalensis</i> |
| var. <i>leptostachya</i> | | Fig. 6 |

Fruits $9 - 15 \times 7 - 12$ mm, 3-valved. Seeds 5×3 mm.

Fls. & Frts. : Aug.-Dec.

Distrib. : INDIA : Andaman & Nicobar Islands, Assam, Maharashtra, Orissa, Uttar Pradesh, W. Bengal; BURMA, NEPAL, MALAYSIA, INDONESIA, PHILIPPINES.

Ecol. : Abundant along banks of streams and in hedges.

var. *nainitalensis* Bhandari & Bhansali, var. nov.

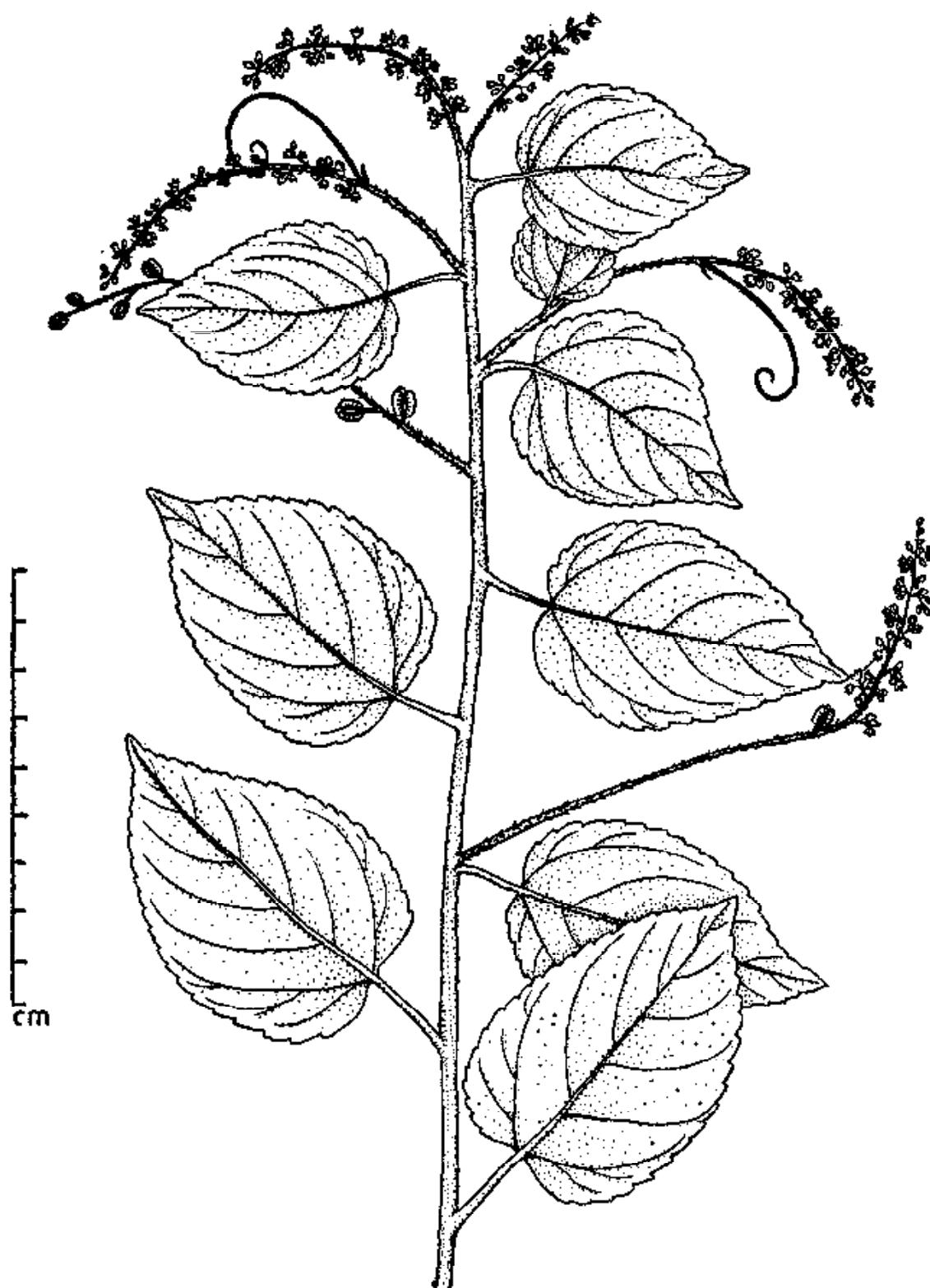


Fig. 6. *Gouania leptostachya* DC. var. *leptostachya*

Diffrer a varietate *leptostachya* fructis indehiscentibus, 7–9 × 6–9 mm, alis brevibus nitidis, seminibusques 3.5 × 4.0 mm, nigris, nitidis.

Typus : Kathgodam road, Nainital, 900 m, 28.9.1917, A. E. Osmaston 851 (Holo, DD).

var. *nainitalensis* Bhandari & Bhansali, var. nov.

Fruits indehiscent, 7–9 × 6–9 mm, wings short, shining. Seeds 3.5 × 4.0 mm, black, shining.

Type : Kathgodam road, Nainital, 900 m, 28.9.1917, A. E. Osmaston 851 (Holo, DD).

Exsicc. : Uttar Pradesh : Dehra Dun, 11.10.1817, J. F. Duthie 1451 (DD); Daurwala, Dehra Dun, 700 m, 4.10.1957, Y. K. Sarin 342B (BSD).

Distrib. : INDIA : Uttar Pradesh.

3. **Gouania microcarpa** DC., Prodr. 2 : 40. 1825; Brandis, For. Fl. 574. 1874; Lawson in Hook. f., Fl. Brit. India I : 643. 1875 Fig. 7

Climbing shrubs; tendrils axillary or extra-axillary; branchlets and tendrils with longitudinal stripes of antrorse dense brownish hairs. Leaves 2.8–9.5 × 1.5–5.6 cm, elliptic-ovate, acute at apex, rounded at base, serratures tipped by deciduous, glandular mucro, secondary veins camptodromous; petioles 5–16 mm long, villous with antrorse brownish hairs; stipules 3–6 × 0.5–1.2 mm, subulate, pubescent. Racemes 4–8-flowered clusters. Flowers white, 4–5 mm across, sessile; bracteoles conspicuous, 2–3 mm long, lanceolate. Calyx lobes 1.5–2.0 × 1.0–1.5 mm, densely pubescent without, glabrous within, deltoid, thickened at apex, keeled inside upto middle. Petals 1.0–1.5 × 2.0–2.5 mm, oblanceolate, spatulate. Stamens 1 mm long; filaments filiform. Disc saucer-shaped, glabrous. Style 3-cleft about two-third its length, style arms elongate, hairy, obtuse. Capsules 10–15 × 7–13 mm, glabrescent, polished, green, 3-winged, wings yellow, crowned by persistent calyx. Seeds 5 × 4 mm; cotyledons ovate, cordate at base, retuse at apex.

Fls. & Frts. : Jan.-May.

Distrib. : INDIA : Jammu & Kashmir, Punjab; SRI LANKA, BURMA, MALAYSIA, INDONESIA.

Uses : The fruits are edible and sold in markets for preparing condiments and chutney.

4. **Gouania napalensis** Wall. in Roxb., Fl. Ind. 2 : 417. 1824; Lawson in Hook. f., Fl. Brit. India I : 644. 1875.

Local names : Jwarpat (Asm.); Jermei-ja-main, Mei-tein-iand (Khasi); Dibok-pak-bindu, Dugithang, Dumigong (Garo); Tungvheong, Mon-rik (Lepcha).

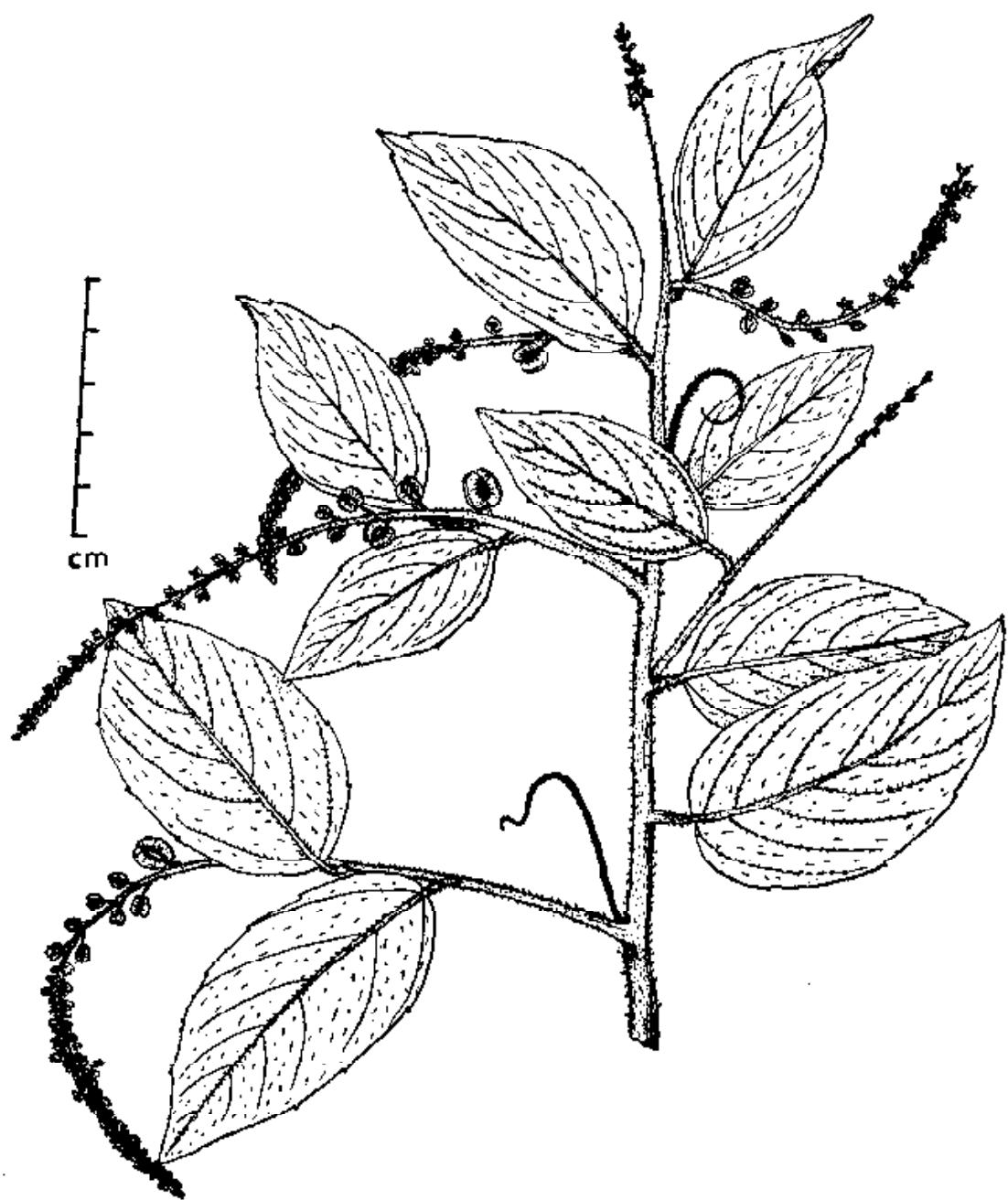


Fig. 7. *Gouania microcarpa* DC.

Extensive climbing shrubs, young branches rusty hairy; tendrils terminal or basal on racemes, simple, slender, villous, spiral. Leaves 8—16 × 4.5—5.0 cm, ovate or cordate, entire, apex acuminate, acumen cuspidate to obtuse, basal serratures glandular, subulate, primary and secondary veins camptodromous; petioles 1.0—2.8 cm long, pubescent, with a few subulate, evanescent villous glands at base; stipules membranous, lanceolate or falcate, acute, puberulous. Inflorescence terminal, cylindric, 4—6-flowered racemes or panicles. Flowers 5—6 mm across, white, pubescent; pedicels 2—4 mm long; bracteoles lanceolate, subulate, deciduous. Calyx lobes 2—3 mm long, glabrous within; tube 2 mm wide. Petals 1.5—2.0 mm long, cuneate, obtuse, glabrous. Stamens 1.2—1.8 mm long; anthers dorsifix. Disc saucer-shaped, lobes linear. Style 3-cleft, elongate. Capsules 3-winged, semicircular, 1.2 cm long, separating into 3 single seeded cocci. Seeds 5.5 × 3.5 mm.

Fls. : Jun.-Oct., *Frt.s.* : Aug.-Nov.

Ecol. : Particularly grows in wooded grasslands up to 1800 m altitude and also found near the coastal areas.

Distrib. : INDIA : Assam, Bihar, Punjab, Uttar Pradesh, W. Bengal Deccan plateau; NEPAL.

Uses : Young leaves are eaten in West Bengal.

4. HELINUS

Meyer ex Endl., Gen. Pl. 1102, 1840. *nom. cons*; Benth. & Hook. f., Gen. Pl. : 385, 1862; Lawson in Hook. f., Fl. Brit. India 1 : 640, 1875.

Unarmed, scandent, cirrhose shrubs. Leaves alternate, uppermost sometimes much reduced and bract-like, entire, petiolate; stipules linear, caducous. Inflorescence axillary, solitary or umbellate; peduncles slender, often longer than the subtending leaves; pedicels short to elongate, filiform. Calyx lobes 5, deltoid, often with membranous white margins; tube broadly campanulate or obconic, adnate to the ovary. Petals 5, yellowish or greenish-white, oblanceolate, cucullate, arcuate, ascending during anthesis. Stamens as many as petals; anthers 2-loculed, dehiscing longitudinally. Disc flat, filling the calyx tube, massive, thickened adherent to the ovary. Ovary inferior, 3-carpellary, 3-loculed; style 3-fid. Capsules schizocarpic, coriaceous; endocarp thin, crustaceous, separating into 3 mericarps, each of which releases its seeds by a sudden opening of the ventral suture.

Distrib. : 6 species in the world; 1 in Madagascar, 4 in Africa, and 1 in India.

Ecol. : Grows in thickets and wooded grasslands, forest margins, and in dry open woody vegetation, ascending up to 1200 m. Also found in ravines, banks of streams and shady places, occasionally in valleys.

Pollen : 3-zonocolporate; P/E 34-38/32-36 μm , prolate spheroidal; os circular; sexine almost as thick as nexine, faintly reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 691. 1979).

Helinus lanceolatus Brandis, For. Fl. 574. 1874 & Ind. Trees 175. 1906 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 640. 1875; Gamble, Man. Ind. Timb. 189. 1922 (Repr. ed.); Gamble, Fl. Pres. Madras 1 : 225. 1918 (Repr. ed. 1 : 161. 1957); Kanjilal, For. Fl. 132. 1969. (Repr. ed.); *Gouania lanceolata* Wall. Cat. 4273. 1838, *nom. nud.*

Bright green slender, tendriliferous shrub; tendrils usually near the tips of branches or sometimes branchlets ending in short simple tendrils, young branches hairy. Leaves ovate, lanceolate, glabrous, membranous, entire, apex acute, rounded or usually shallowly cordate at base, penninerved, lateral nerves 3-5 pairs, secondary nerves cAMPtodromous; stipules 0.5-2.0 \times 0.5-1.0 mm, subulate. Umbels 2-12-flowered. Flowers 4-8 mm across; peduncles filiform, 1.0-3.2 cm long; pedicels 4-7 mm long in flower, 7-15 mm in fruit; bracteoles 1.2 \times 0.5 mm long. Calyx 2.5-4.0 \times 1.5-2.0 mm, glabrous. Petals 5, whitish, 2.0-3.0 \times 0.5-1.0 mm, inserted on the margin of disc, margin and apex incurved, enclosing stamens. Stamens 1.5-2.5 mm long; filaments filiform, flat; anthers dorsifixed. Disc glabrous. Ovules solitary in locules; style 3-fid; stigma lobes recurved, glabrous. Fruits pendulous, 5-10 mm long, glabrous, globose to slightly obovoid, reddish-green to dark brown or black when ripe. Seeds 3, 3.5 \times 3 mm, plano-convex; testa coriaceous, shining; albumen fleshy; cotyledons large, flat, obtuse; radicle short.

KEY TO THE VARIETIES

- 1a. Leaves glabrous on both surfaces... var. *lanceolatus*
- 1b. Leaves tomentose below, slightly pubescent above on nerves only... var. *tomentella*

var. *lanceolatus*

Leaves 1.3-8.1 \times 0.3-3.2 cm; petioles filiform, 5-10 mm long, pilose.

Fls. : Jan.-Apr.; *Frt.s.* : Apr.-May (rarely throughout the year).

Distrib. : INDIA : Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Punjab, Uttar Pradesh, W. Bengal; NEPAL, PAKISTAN.

var. *tomentella* Bedd. ex Bhandari & Bhansali, var. nov.

Differet a varietate *lanceolata* ramis, cirrhis, bracteisque pilis brunneis sericeis adpressis aureis vestitis; foliis $2.3-4.6 \times 1-2.8$ cm, infra tomentosis supra leviter pubescentibus lantum ad nervos; petiolis 7 mm longis, tomentosis.

Type : *Pervulgatus* in sylvas inter Jabalpur et Mandla, *Beddome* 13 (Holo, CAL).

var. *tomentella* Bedd. ex Bhandari & Bhansali, var. nov.

Branches, tendrils and bracts appressed brown silky hairy. Leaves $2.3-4.6 \times 1.0-2.8$ cm, tomentose below, slightly pubescent above on nerves; petioles 7 mm long, tomentose.

Type : Very common amongst the ravines between Jabalpur and Mandla, *Beddome* 13 (Holo, CAL).

Notes : This new variety is based on a single specimen collected by Beddome from Madhya Pradesh. He had proposed the varietal name '*tomentella*' on the sheet; however, this name remained unpublished and it is validated here.

5. HOVENIA

Thunb., Nov. Gen. 7. 1781; Benth. & Hook. f., Gen. Pl. 1 : 378. 1862; Brandis, For. Fl. 94. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 640. 1875.

Small, unarmed trees. Leaves alternate, subbifarious, membranous, basally 3-nerved. Inflorescence axillary and terminal, dichotomous, pedunculate cymes, many-flowered. Flowers bisexual, pentamerous. Calyx lobes 5, glabrous, ovate, acute. Petals 5, cucullate, glabrous, unguiculate, inserted below the disc. Stamens 5; filaments embeded in the margins of the 5-lobed disc, filiform; anthers 2-loculed, dehiscence longitudinal. Ovary hypogynous, tricarpellary, trilocular, sunk in the disc, conical; style 3-cleft branches straight; stigma capitate. Fruits obscurely 3-lobed, indehiscent. Seeds 3, one in each locule, testa coriaceous, separating from inner membranous tegmen.

Distrib. : 5 species in the world, 1 in India.

Ecol. : Grows in dense forests at altitude ranging from 900—1950 m; in some places it grows as a large handsofme tree.

Pollen : 3-zonocolporate, P/E 28-30/24-30 μm , prolate sphaeroidal, os circular, sexine almost as thick as nexine, faintly reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 691, 1979).

Hovenia dulcis Thunb., Nov. Gen. 8. 1781 & Fl. Jap. 101. 1784; Roxb. Fl. Ind. 2 : 414. 1824 & 1 : 630 1832; DC., Prodr. 2 : 40. 1825; Lawson in Hook. f., Fl. Brit. India 1 : 640. 1875; Matthew in Rec. Bot. Surv. India 20 : 62. 1969.

Fig. 8

Local names: Chamhum (Ravi); Muralimarm (Tam.); Chamun (Chamba).

Deciduous trees with straight bole and a broad rounded crown, 9–24 m high; young shoots hairy; bark greyish-white, smooth. Leaves 6–14 × 3–9 cm, often inequilateral, cordate-ovate, acuminate, deeply and sharply serrate, glabrescent above, hairy beneath on veins when young. Cymes axillary or terminal, peduncles 5 cm long, subcylindrical, hairy when young, becoming thick with sweet red pulp after flowering. Flowers 4–7 mm across; pedicels 2–5 mm long. Calyx lobes 2.0–2.5 × 1.5–2.0 mm, whitish, tube conical with raised median ridge inside, somewhat spreading, deciduous. Petals 2.0–2.5 × 1.5–2.0 mm, yellowish, obovate, emarginate. Stamens 2–3 mm long, enclosed in petals; anthers dorsifixed. Disc lining the calyx tube, hairy, fleshy, flat. Ovary hairy, ovule one in each locule, basal; style cylindric, 3-fid. Fruits spherical, nearly dry, calyx tube adhering to the base. Seeds 4–5 × 4 mm; embryo erect, yellowish; cotyledons orbicular, radicle oval.

Fls. : Apr.-Aug.; Frts. : Jul.-Oct.

Distrib. : INDIA : Assam, Himachal Pradesh, Kashmir, Tamil Nadu, Uttar Pradesh, W. Bengal; CHINA, JAPAN.

Chr. no. : n = 12 (Dolcher in Nov. Gior. Bot. Ital. 54 : 648. 1947), 2n = 24 (Gadella *et al.* in Acta. Bot. Neerl. 18 : 74–83. 1969).

Uses : The fleshy peduncle which is sweet and aromatic is eaten. The leaves are eaten by cattle. The tree is cultivated for its fleshy peduncles which taste like Bergamot pear.

6. PALIURUS

Mill., Gard. Dict. ed. 6. 1752; Benth. & Hook. f., Gen. Pl. 1 : 375. 1862.

Shrubs or trees. Leaves alternate, basally a 3–5-nerved, petiolate; stipules prickly, usually persistent. Inflorescence axillary, pedunculate cymes. Calyx lobes 5, green, broad. Petals 5, obovate, yellow, clawed at base. Stamens 5, opposite to petals, inserted on broad green fleshy disc; filaments short, greenish. Ovary half immersed into the disc, 3-loculed; style 3-cleft. Fruits dry, indehiscent, hemispherical and 3-celled. Seeds 3.

Distrib. : 8 species in the world, 1 in India.

Pollen : 3-zonocolporate, P/E 28/30 μ m, oblate spheroidal; exine circular sexine as thick as nexine, exine reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 691. 1979).



Fig. 8. *Hovenia dulcis* Thunb.

Paliurus spina-christi Mill., Gard. Dict. ed. 8. 1768; Schneid. in Sarg., Pl. Wilson 2 : 211. 1914. *P. virgatus* D. Don, Prod. Fl. Nepal. 189. 1825.

Shrubs or small trees, 2.0—3.3 m high; bark ash coloured; branches numerous, spreading horizontally, branchlets slender, drooping. Leaves alternate, drooping, $1.9 - 3.2 \times 1.2 - 2.3$ cm, ovate or elliptic, base unequally attenuate, apex obtuse or acute, shining above, paler or slightly glaucous beneath, serrulate, serratures tipped by a deciduous, glandular mucro, two lateral nerves ending near apex, campylodromous, secondary nerves diverging from the midvein at an angle of $30^\circ - 50^\circ$; petiole 5—10 mm long, subcylindrical, slightly hairy; stipular thorns two, unequal, with thickened base, straight one 1.5 cm long, recurved one 6 mm long. Cymes axillary; peduncle 5—7 mm long. Flowers 4 mm across; pedicels 3 mm long, glabrous. Calyx lobes 1.5 mm long, acute, deltoid, thickened at apex, keeled upto middle. Petals 1 mm long, unguiculate, margin recurved. Stamens equal to petals; anthers dorsifixed, ovate, 2-celled, longitudinally dehiscent. Disc 5-lobed, glabrous. Stylar branches united upto base; stigma obtuse. Fruits spherical, 1.5—2.0 cm in diam. placed on the persistent calyx, surrounded at the top by a broad leafy entire wing. Seeds embedded in and completely concealed by the enlarged disc.

Fls. & Frts. : Jul.—Nov.

Distrib. : INDIA : Himachal Pradesh; S. EUROPE, C. ASIA.

Chr. No. : $n = 12$ (Dolcher in Nov. Gior. Bot. Ital. 54 : 648. 1947).
 $2n = 24$ (Markova in Taxon 20 : 609-14, 1971).

7. RHAMNUS

Linn., Sp. Pl. 1 : 193. 1753 & Gen. Pl. ed. 5, 89. 1754; Benth. & Hook. f., Gen. Pl. 1 : 377. 1862; Brandis, For. Fl. 91. 1874; Lawson in Hook., f. Fl. Brit. India 1 : 638. 1875; Talbot, Trees, shrubs, woody climbers Bombay Pres. 142. 1949; Gamble, Fl. Pres. Madras. 1 : 221. 1918 (Repr. ed. 1 : 159. 1957); Cooke, Fl. Pres. Bombay 1 : 243. 1902 (Repr. ed. 1 : 259. 1958).

Deciduous or evergreen, armed or unarmed, shrubs or small trees, rarely scandent. Leaves alternate, subopposite, or fascicled, petiolate, penninerved, entire or dentate; stipules minute, free, persistent or deciduous. Inflorescence axillary, solitary or cymes or fascicles, rarely panicles or thyrses. Flowers 5-or 4-merous, bisexual or polygamodioecious. Calyx lobes 4—5, triangular-ovate, erect or spreading; tube urceolate. Petals 4—5 or absent, inserted on the margin of calyx tube, cucullate or flat, shortly clawed. Stamens 4—5; filaments very short; anthers dehiscing longitudinally. Disc thin, filling the calyx tube. Ovary (2—) 3- or 4-celled, ovoid; styles 3—4-cleft, rarely 2-cleft about

half the length; stigma obtuse, papillose. Drupes with 2–4 free, 1-seeded stones, globose, encircled at base by calyx tube; pyrenes horny or cartilaginous, indehiscent or dehiscing inwardly. Seeds obovate; testa membranous or crustaceous, smooth or furrowed on the back; raphe dorsal, ventral or lateral; albumen fleshy; cotyledons flat or with recurved margins.

Distrib. : c. 150 species in Europe, Asia, America, often rare in tropics. 11 species in India. Most of the Indian species are confined to Himalayas except *R. purandharensis* and *R. wightii* which are confined to peninsular India.

Ecol. : Indian species are found in wooded or open forests in Himalayas and Western Ghats usually at altitudes ranging between 600 to 3000 m.

Pollen : 3-zonocolporate, P/E 18–26/21–26 μm ; oblate or suboblate or prolate spheroidal; ex circular, sexine almost as thick as nexine; faintly reticulate (Parveen & Bhandari in Bir, Rec. Res. Pl. Sci. 691, 1979).

KEY TO THE SPECIES

- 1a. Erect shrubs or trees, sometimes rambling :
- 2a. Plants unarmed :
- 3a. Leaves pubescent or tomentose :
 - 4a. Petals present; fruits surrounded at base by persistent, 5-lobed calyx :
 - 5a. Leaves serrate. Calyx keeled within. Style cleft nearly down to the base... *R. purandharensis* 8
 - 5b. Leaves crenate. Calyx not keeled. Style cleft only at apex... *R. triqueter* 10
 - 4b. Petals absent. Fruits surrounded at base only by rim of the calyx... *R. purpurea* 9
- 3b. Leaves glabrous :
 - 6a. Leaves closely serrate :
 - 7a. Flowers c. 6 mm across. Petals obtuse and apiculate. Disc 5-lobed. Ovary 3–4-loculed. Style 3–4-cleft... *R. wightii* 11
 - 7b. Flowers up to 3.5 mm across. Petals retuse. Disc unlobed. Ovary 2-loculed. Style 2-cleft ... *R. collettii* 1
 - 6b. Leaves distantly crenate... *R. napalensis* 3

- 2b. Plants armed (unarmed in *R. procumbens*)
- 8a. Flowers 4-merous :
- 9a. Leaves glabrous, serrulate. Petals present... *R. dahurica* 2
- 9b. Leaves pubescent, entire or faintly crenate.
Petals absent... *R. persica* 5
- 8b. Flower 5-merous... *R. pentapomica* 4
- 1b. Prostrate shrubs :
- 10a. Unarmed. Leaves alternate, sharply serrate
with acute apex. Petals absent... *R. procumbens* 6
- 10b. Armed. Leaves fascicled, distinctly crenate,
with obtuse apex. Petals present... *R. prostrata* 7
1. ***Rhamnus collettii*** Bhandari & Bhansali in Journ. Econ. Tax. Bot. 5 : 913. 1984.

Shrubs or trees; branches alternate, fluted, glabrous; internodes 0.5—2.0 cm long. Leaves 1.4—2.3 × 0.5—1.0 cm, ovate-lanceolate, base rounded or acute, apex acuminate, mucronate, margin entire below, serrate above, serratures tipped by a deciduous mucro; lateral nerves 5—7 pairs, slightly raised below, secondary veins camptodromous; petioles 2—3 mm long; stipules 0.5—2.2 mm long, subulate, pubescent. Inflorescence an axillary fascicle, fascicles 5—8-flowered; pedicels 1—2 mm long. Calyx lobes 1.0—1.5 mm long, deltoid, thickened at margin, keeled up to the middle, glabrous. Petals 0.5—1.0 mm long, obovate, deeply cucullate, enclosing stamens. Stamens 0.5—0.8 mm long, anthers dorsifixed, filament acicular. Ovary bicarpellary, glabrous; style 2-cleft at top. Fruit not seen.

Type : India, Punjab Himalayas, 1892, H. Collett s. n. (Holo, CAL).

Distrib. : INDIA : Himachal Pradesh.

2. ***Rhamnus dahurica*** Pall. in Reiss. 3 : 721. 1776 & Fl. Ross. 2, t. 61. 1789 : Brandis, For. Fl. 92. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 639. 1875; Kanjilal, For. Fl. 128. 1969. (Repr. ed.). *Rhamnus cathartica* Pall., Reiss. 3 : 423. 1776, non Linn. 1753. *R. virgata* Roxb., Fl. Ind. 2 : 351. 1824 & Fl. Ind. 1 : 605. 1832; Gamble, Fl. Pres. Madras I : 222. 1918 (Repr. ed. 1 : 159. 1957). *R. hirsuta* Wight & Arn., Prodri. 165. 1834.

Fig. 9

Local names : Ihanthar, Chaurdha (Hindi); Chato, Chedwala, Chadua Phipni, Tadru, Setapajja. Kanji, Mamral, Shomfol, Reteon, Gogsa Sindrol, Mutani, Nior, Chatr, Romusk, Dadur (Punj.).

Large shrubs or small trees, 4.5—6.0 m high; branches, much ramified, straight, branchlets forming a dense rounded crown, and terminating into



Fig. 9. *Rhamnus dahurica* Pall.

a thorn. Leaves $1.4-8.0 \times 0.6-2.9$ cm, rarely subopposite, frequently fascicled on short branchlets, membranous, lanceolate or ovate-oblong, acuminate, base rounded, serratures tipped by deciduous, glandular mucro, slightly pubescent on nerves beneath when young; lateral nerves 3-4 pairs, arcuate, converging near margins; petioles 4-10 mm long, pubescent. Flowers crowded in the axil of fascicled leaves or at the base of branchlets, 12 mm across, dioecious; pedicels 10 mm long, filiform. Calyx lobes 5-7 mm long, deltoid, acuminate, glabrous, not keeled; tube campanulate or turbinate. Petals 1-2 mm long, entire, linear or spatulate, deeply cucullate enclosing stamens. Stamens 2-3 mm long; anthers dorsifixed. Ovary 2 (-3-4)-carpellary, 2 (-3-4)-loculed, smooth; ovules one in each locule; style filiform, 2-4-cleft, connate one-fourth to one-third the length, segments recurved. Drupes 4-5 mm in diameter.

Fls. : Mar.-Jun.; *Frts.* : Oct.-Nov.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Punjab, Tamil Nadu, Uttar Pradesh; AFGHANISTAN, BHUTAN, BURMA, CHINA, JAPAN, PAKISTAN.

Ecol. : Grows in wooded and grassland forests between 200 to 2400 m altitudes.

Uses : The leaves fall early and fresh foliage appears in March and April often after profuse flowering. The wood is hard and close-grained and is used for making agricultural implements. The bitter fruit is given in affections of the spleen and also used as an emetic and purgative.

Notes : There appears to be two varieties of this species, one with hirsute leaves and other with glabrous leaves as is evident from materials examined at Kew. In Kew herbarium there are many specimens with hirsute leaves all of them from Pulney and Nilgiri Hills.

3. *Rhamnus napalensis* (Wall.) Lawson in Hook. f., Fl. Brit. India 1 : 640 1875. Gamble, Man. Ind. Timb. 187. 1922 (Repr. ed.) & Fl. Pres. Madras 1 : 222. 1918 (Repr. ed. 1 : 159. 1957); Brandis, Ind. Trees 173. 1971 (Repr. ed). *Ceanothus napalensis* Wall. in Roxb., Fl. Ind. 2 : 375. 1824. *Colubrina nepaulensis* G. Don, Gen. Syst. 2 : 36. 1832.

Fig. 10

Local names : Archal (Nep.); Birringa (Asm.)

Large suberect or rambling shrubs; branches slender, glabrescent; nodes slightly enlarged around the leaf scars. Leaves $5.7-15.0 \times 3.7-6.8$ cm, oblong or elliptic-oblong, chartaceous, deciduous, glandular mucro, base usually rounded, apex shortly acuminate, crenations tipped with lateral nerves, 4-7 distichous; petioles 0.9-1.8 cm long, subglabrous. Inflorescence axillary, fascicles in simple or branched racemes; peduncles 2 mm long.

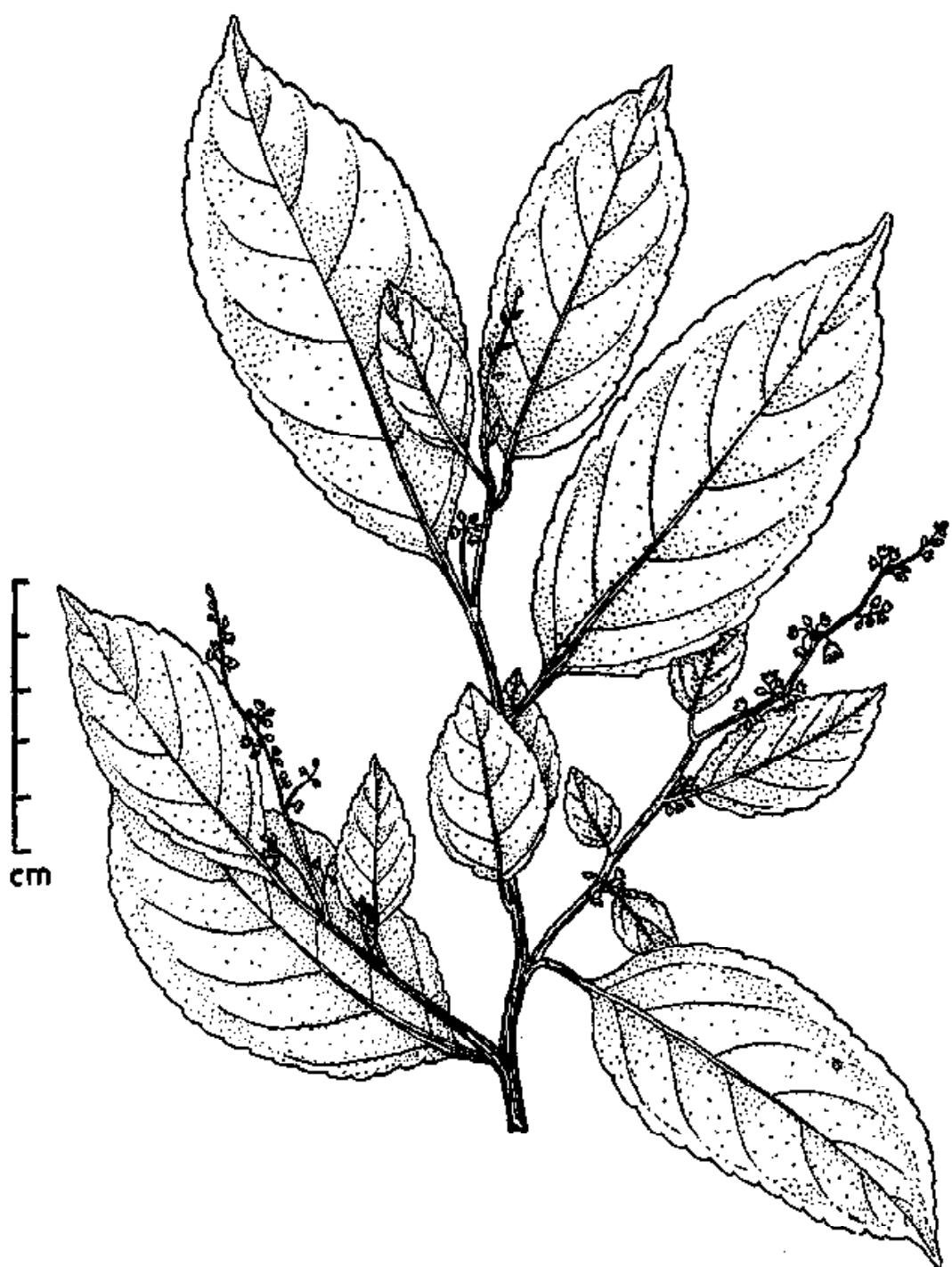


Fig. 10. *Rhamnus napalensis* (Wall.) Lawson

Flowers 6 mm across, 5-merous; bracts leafy, 3 mm long. Calyx lobes 2–3 mm long, deltoid, not keeled, glabrous within, pubescent without; tube campanulate. Petals 1.5–2.0 mm long, oblong, tip shortly acuminate, deeply cucullate, enclosing stamens. Stamens 1.5–2.0 mm long; anthers dorsifixed. Disc glabrous, thin, circular. Ovary tricarpellary, 3-loculed, glabrous; style 3-cleft, cohering up to the middle; stigmatic lobes tapering, curved. Fruits 7 mm in diameter, blackish, broadly obovate, seated on the reflexed calyx. Seeds 3, 2–3 × 2.0–2.5 mm, obovoid, blackish-brown with a long open groove on the back.

Type : Valley of Nepal, Wallich 1831 (Syn, K-W !).

Fls. : July-Oct.; *Fris.* : Nov.-Feb.

Distrib. : INDIA : Andhra Pradesh, Assam, Bihar, Orissa, W. Bengal; NEPAL, BURMA, CHINA, MALAYSIA.

Ecol. : It is generally found on the moist rocky places in the mountains up to 1350 m in the tropical evergreen forests.

Uses : The pounded fruits macerated in vinegar, are prescribed for the treatment of herpes.

4. *Rhamnus pentapomica* Parker in Kew Bull. 1921 : 216. 1921. *R. persica* Lawson in Hook f., Fl. Brit. India, 1 : 638. 1874, p. p. non Boiss. 1872.

Local names : Chhetulo Chira, Charyula (Hindi); Kukai, Kander, Nikki Wurak (Punj.).

Deciduous shrubs or small trees, branches velutinous, ending in thorns. Leaves 1.2–5.0 × 0.4–2.2 cm, oblong, elliptic-lanceolate or elliptic-ob lanceolate, apex and base acute, glabrous above, velvety beneath, margin distantly serrulate or entire, lateral nerves 3–4 pairs, prominent below; petioles 2–10 mm long, pubescent. Flowers crowded in the axils of fascicled leaves; pedicels 3–5 mm long. Calyx lobes deltoid, acute. Petals oblanceolate, deeply cucullate enclosing stamens. Stamens equal to petals; anthers ovate, dorsifixed. Ovary 2–4-carpellary, 2–4-loculed, glabrous; style 2–4-lobed. Drupes 5 mm long, 3–4 mm in diameter, black, obovoid-globose. Seeds 2–4, 2–3 × 2.0–2.5 mm, shining, verrucose, margin cartilaginous, with a open groove on back.

Type : Uttar Pradesh, Garhwal, Lace 3960 (K!).

Fls. & Frs. : Oct. — Mar.

Distrib. : INDIA : N. W. Himalayas-Garhwal to Kashmir; PAKISTAN.

Uses : Leaves are browsed by camels, sheep and goats. Bark yields a red dye. Fruit is sweet and is eaten; it possesses emetic properties.

5. *Rhamnus persica* Boiss., Fl. Orient. 2 : 17. 1872; Brandis, For. Fl. 93 : 1874. & Ind. Trees 172. 1971 (Repr. ed.); Gamble, Man. Ind. Timb. 185. 1922 (Repr. ed.); Kanjilal, For. Fl. 128. 1969 (Repr. ed.). Fig. 11

Local names : Chirla (Hindi) Jalicular, Kuchni, Nikki Kander, Kukei, Nar (Punj.); Cheetulo (Gharwal); Charyula (Kumaon).

Deciduous shrubs or small trees, 2–6 m high; branches stiff, coarse, often thorny; bark smooth, yellowish or dark cinerous, epidermis often whitish. Leaves 1.0–2.6 × 0.7–1.3 cm, coriaceous, alternate or fascicled on short shoots, ovate, elliptic-lanceolate, obovate or oblong, apex—obtuse, base cuneate, lateral nerves 2–5 pairs, camptodromous; petioles 3–10 mm long. Flowers crowded in the axils of fascicled leaves or at base of branchlets, 5 mm across; pedicels 5 mm long. Calyx lobes 3–4 mm long, deltoid, glabrous, not keeled. Stamens 2.0–2.5 mm long. Ovary glabrous, 2–4-loculed, often one or more cells abortive, style 2–4 cleft at the top. Drupes 5 mm in diameter, 5–7 mm long, ovoid, seated on a flat circular base of calyx. Seeds shining, with a wide open groove on the back, edge of which thickened and curved inwards at the top.

Type : Himalaya, near Tehri, alt. 2,000 ft, Edgeworth 360 (Kl).

Fls. : Mar.—May. *Frt.s.* : Nov.—Dec. Before the appearance of new leaves, the plants remain leafless for few months in a year, new leaves appear in April and May.

Ecol. : Grows between 600-1800 m altitude.

Distrib. : INDIA: Himachal Pradesh, Kashmir, Punjab, Uttar Pradesh; PAKISTAN, IRAN.

Uses : Fruits are eaten and the leaves are browsed by camel, sheep and goats. Gamble (*op. cit.*) mentions "A beautiful wood. It would make very pretty turnery articles".

6. *Rhamnus procumbens* Edgew. in Trans. Linn. Soc. 20 : 43. 1851; Brandis, For. Fl. 95. 1874 & Ind. Trees 173. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 641. 1875; Gamble, Man. Ind. Timb. 188. 1922 (Repr. ed.); Kanjilal, For. Fl. 131. 1969, (Repr. ed.). *Rhamnus rupestris* Royle, Ill. Bot. Himal. 168. 1835 *nom. nud non* Scop. *nec* Vill.

Prostrate shrubs; young branches pubescent; internodes 0.5–2.5 cm long, nodes slightly swollen around the leaf scar. Leaves 1.2–4.3 × 0.5–1.5 cm, lanceolate or elliptic, coriaceous, serratures mucronulate, apex acute or subacute, base acute, glabrous, midrib prominent beneath, depressed above, lateral nerves faint; petioles 2–7 mm long; stipules subulate, persistent. Inflorescence an axillary fascicle. Flowers 4 mm

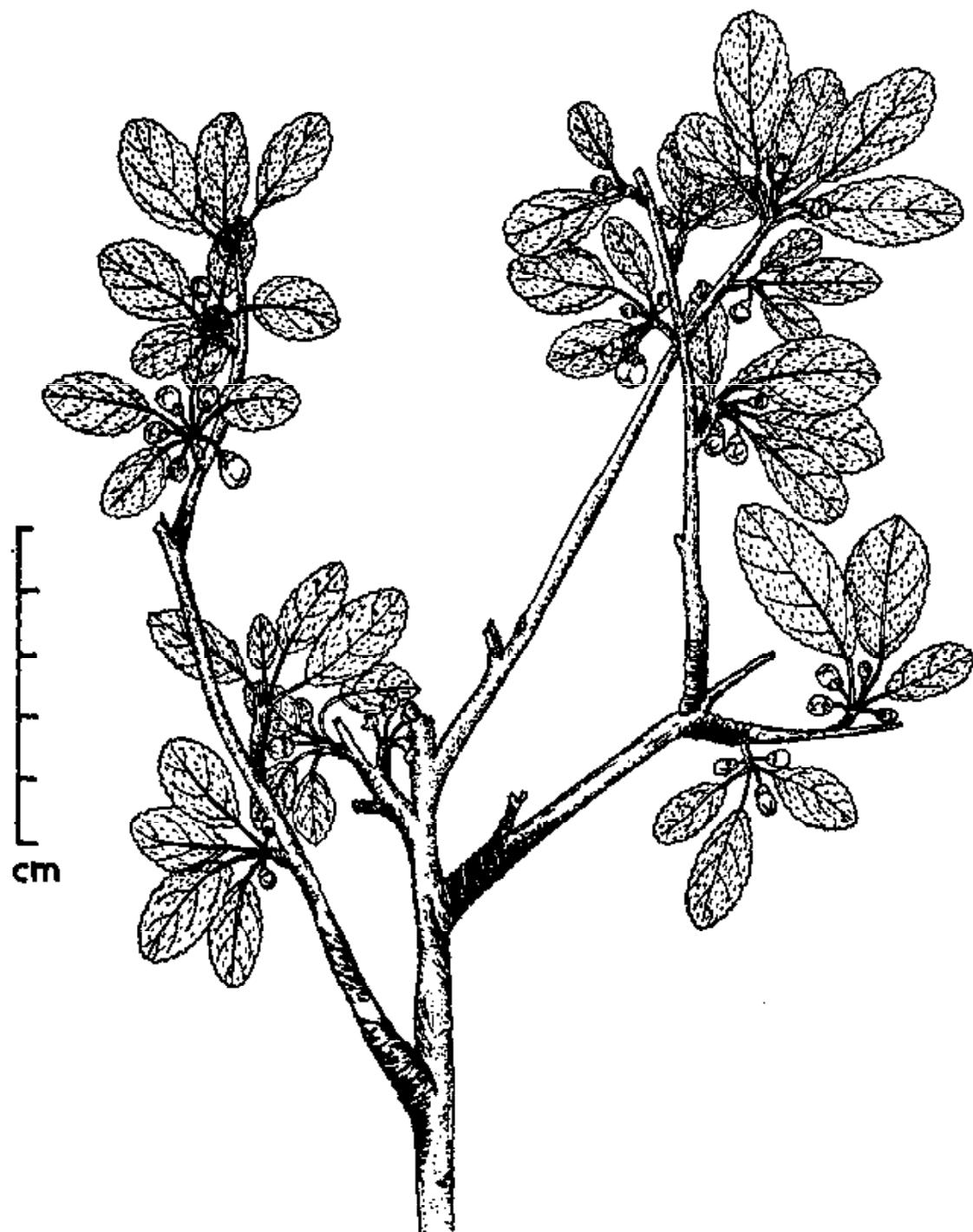


Fig. 11. *Rhamnus persica* Boiss.

across, pentamerous; pedicels 8–10 mm long, slender; bracts 3–4 mm long, deciduous. Calyx lobes 2 mm long, deltoid, glabrous, acute, not keeled. Petals absent. Stamens 1–2 mm long; anthers dorsifixed, lobes ovate. Ovary tricarpellary, 3-loculed; style 3-cleft. Fruits 3–5 mm in diam., obovoid, fleshy. Seeds 3, with a groove on the back.

Type : Deoban, Himalayas, 7000-8000 ft, *Edgeworth* 374 (K!).

Fls. : Jul.-Aug.; *Frt.s.* : May-Jun. (subsequent year).

Ecol. : Common on rocks from 2100 m to 2550 m altitude.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Punjab, Uttar Pradesh.

7. *Rhamnus prostrata* Jacq. ex Parker in Kew Bull. 1921 : 217. 1921.

Local name : Koni (Garhwal)

Deciduous, prostrate shrubs; branches short, terete, tomentose when young, ending in thorns; internodes 0.5–1.5 cm long, nodes swollen around the leaf scars. Leaves 0.7–1.5 × 0.4–0.6 cm, elliptic, glabrescent, mucronate, base tapering, crenations tipped with deciduous dark mucro, lateral nerves 2–3 pairs, inconspicuous, camptodromous; petioles 1–3 mm long. Flowers in the axil of fascicled leaves, pentamerous. Calyx lobes deltoid, acute. Petals minute, obovate, cucullate, enclosing stamens. Anthers dorsifixed; filaments acicular. Disc glabrous. Ovary tricarpellary, 3-loculed; style 3-cleft. Drupes 5 mm long, 3 mm in diam., obovoid-globose, black. Seeds 3, 2–3 × 2 mm, verrucose, shining, with a long open groove on the back.

Fls. & Frts : Mar.—Aug.

Ecol. : Prostrate on rocks up to an altitude of 3000 m.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Uttar Pradesh; PAKISTAN, AFGHANISTAN, IRAN.

8. *Rhamnus purandharensis* Bhandari & Bhansali in Jour. Econ. Tax. Bot. 5 : 911. 1984.

Unarmed shrubs or trees, 6 m high; young branches white tomentose, glabrous with age; internodes 5–25 cm long, nodes slightly enlarged around the leaf scars. Leaves 0.5–6.2 × 0.3–2.6 cm, ovate or elliptic, base rounded, apex acute or obtuse, mucronate, densely pubescent on nerves beneath, glabrescent, serratures tipped by deciduous mucro, lateral nerves 5–6 pairs, prominent below, camptodromous; petioles 0.3–1.7 cm long, pubescent; stipules 1.1–2.5 mm long, linear, pubescent, deciduous. Racemes axillary, flowers in fascicles of 5–8. Flowers 5–7 mm across, pentamerous; pedicels 2–5 mm long, pubescent. Calyx 3–5 mm long, pubescent

without, glabrous within; lobes deltoid, acute, margin thickened. Petals 2.0–2.5 mm long, deeply cucullate, obovate. Stamens 1.5–2.0 mm long, anthers dorsifixed; filaments flat. Disc rounded, massive, glabrous. Ovary tricarpellary, 3-loculed, glabrous; style 3-cleft to two-third of length. Fruits 5–6 mm in diam., glabrous, 3-lobed, slightly depressed at top. Seeds 3.

Type : Purandhar, slopes above R.C. Ch., 22.12.1945, H. Santapau 8176 (Holo, BLAT).

Fls. & Frts. : Oct.—Dec.

Distrib. : INDIA : Maharashtra.

9. *Rhamnus purpurea* Edgew. in Trans. Linn. Soc. 20 : 44. 1851; Brandis, For. Fl. 91. 1874 & Ind. Trees 173. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 639. 1875; Gamble, Man. Ind. Timb. 186. 1922 (Repr. ed.); Kanjilal, For. Fl. 129. 1969 (Repr. ed.). Fig. 12

Local names : Luhish, Lhish (Hindi); Tandra, Sinjal, Maimarari, Kunji, Rangrek, Zanani, Tunani, Chaterni (Punj.); Babauro (Garhwal); Payan (Kumaon).

Unarmed, deciduous shrubs or moderate sized trees, the previous year's branchlets purple with white spots, pubescent, young when branchlets alternate; internodes 1–3 cm long, nodes slightly enlarged around the leaf scars. Leaves 3.5–17.0 × 1.8–7.8 cm, membranous, ovate, sometimes obovate, elliptic or ovate-lanceolate, acute, base rounded, closely and finely serrate, serratures tipped by deciduous mucro, glabrescent beneath, lateral nerves 5–10, parallel, nearly straight on either side of the midrib, crenatodromous, impressed above and raised below; petioles 0.7–1.6 cm; stipules linear, early deciduous leaving broad scars at the base of petiole. Cymes axillary, flowers in fascicles of 5–10. Flowers 5–6 mm across, buds ovoid; pedicels 5 mm long. Calyx lobes 3–4 mm long, deltoid, not keeled, having prominent line in the middle, acute; tube campanulate. Stamens 4–5, 1–2 mm long; anthers dorsifixed. Ovary tricarpellary, 3-loculed; style short, 3-cleft nearly to the base; stigma capitate. Drupes 6 mm in diam., pear shaped, subglobose, bitter. Seeds 3, with a deep furrow on the outer side.

Type : Choor, Kashmir, Edgeworth, s. n. (K!).

Fls. : May–Jun. : *Frts.* : Jul.–Oct.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Punjab, Uttar Pradesh; NEPAL, PAKISTAN.

Ecol. : Usually in the open areas of the forest at an altitude of 1350–3000 m.

Uses : Fruit used as a purgative.

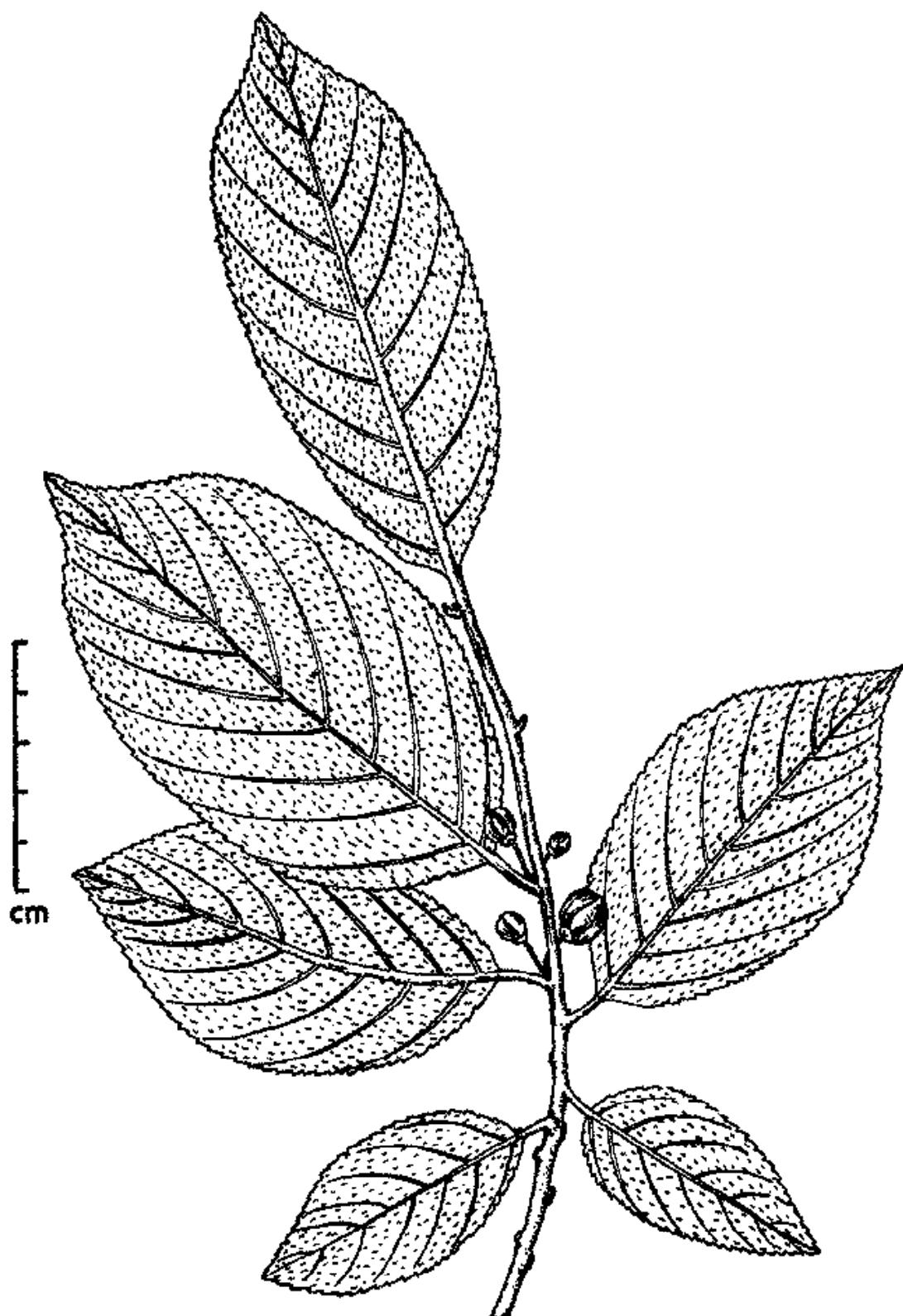


Fig. 12. *Rhamnus purpurea* Edgew.

10. *Rhamnus triqueter* (Wall.) Brandis, For. Fl. 92. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 639. 1875; Gamble, Man. Ind. Timb. 186. 1922 (Repr. ed.); Talbot, Trees, shrubs, woody climbers Bombay Pres. 149. 1942; Cooke, Fl. Pres. Bombay 1 : 244. 1902 (Repr. ed. 1 : 260. 1958); Kanjilal, For. Fl. (Repr. ed.) 129. 1969. *Ceanothus triqueter* Wall. in Roxb., Fl. Ind. 2: 376. 1824. *Colubrina triquetra* G. Don, Gen. Syst. 2 : 37. 1832.

Fig. 13

Local names : Kethera (Jaunsar); Gaunt (Dehra Dun, Garhwal); Fagora, Gurdhan, Phulla, Gogsa, Ghanti, Ghont (Punj.).

Unarmed, deciduous shrubs, 2—3 m high, branches alternate, tomentose; bark greyish-brown or blackish-purple, scabrous with elevated specks. Leaves alternate, 4.6—13.4 × 2.0—7.0 cm, ovate, oblong or elliptic or oblong-lanceolate, subcoriaceous, woolly tomentose beneath, glabrous above, base tapering, apex acuminate, crenate, teeth tipped by deciduous mucro; lateral nerves 6—10, prominent; petioles 1.8—3.0 cm long; stipules 2 mm long, subulate, deciduous. Flowers fascicled, in axillary racemes, 5 mm across, pentamerous, buds ovoid, puberulous; pedicels 5 mm long; bracts 1.5 cm long. Calyx lobes 2.0—2.5 mm long, deltoid with prominent line in the middle, acute, puberulous without. Petals 1.0—1.5 mm long, shortly clawed, emarginate, broadly obovate, deeply cucullate, enclosing stamens. Stamens 0.5—1.0 mm long. Ovary tricarpellary, 3-loculed, glabrous; style 3-cleft; stigma obtuse. Drupes 4—5 mm in diam., 5—6 mm long, obovoid. Seeds 3, obovoid with a long, broad open groove on the back.

Type : Shri Nagar (Srinagar), Wall. Cat. 4265 (K-W!).

Ecol. : Grows particularly on the steep rocky slopes of Himalayas.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Uttar Pradesh, Maharashtra, Punjab; PAKISTAN, NEPAL.

11. *Rhamnus wightii* Wight & Arn., Prodr. 1: 164. 1834 Wight, Ic. t. 159; 1839; Dalz. & Gibbs., Bombay Fl. 50. 1861; Bedd., Fl. Sylv. 70. 1871; Lawson in Hook. f., Fl. Brit. India 1 : 639. 1875; Talbot, Trees, Shrubs, woody climbers Bombay Pres. 142. 1949; Gamble, Fl. Pres. Madras 1 : 222. 1918 (Repr. ed. 1 : 159. 1957); Cooke, Fl. Pres. Bombay 1 : 244. 1902 (Repr. ed. 1 : 259. 1958). *Ceanothus wightianus* Wall. Cat. 4264. 1828 *nom. nud.*

Local names : Ragat-roda, Ragat-rorar (Mar.).

Large, glabrous, unarmed, shrubs or small trees, c. 3 m high; younger parts dry black; nodes enlarging around the leaf scars. Leaves alternate, rarely a few subopposite, 2.5—9.3 × 1.3—3.5 cm, subcoriaceous, elliptic-ovate, base rounded, serratures with glandular black tip, lateral nerves c. 5—7 pairs, camptodromous; petioles 0.7—1.6 cm long, puberulous; stipules

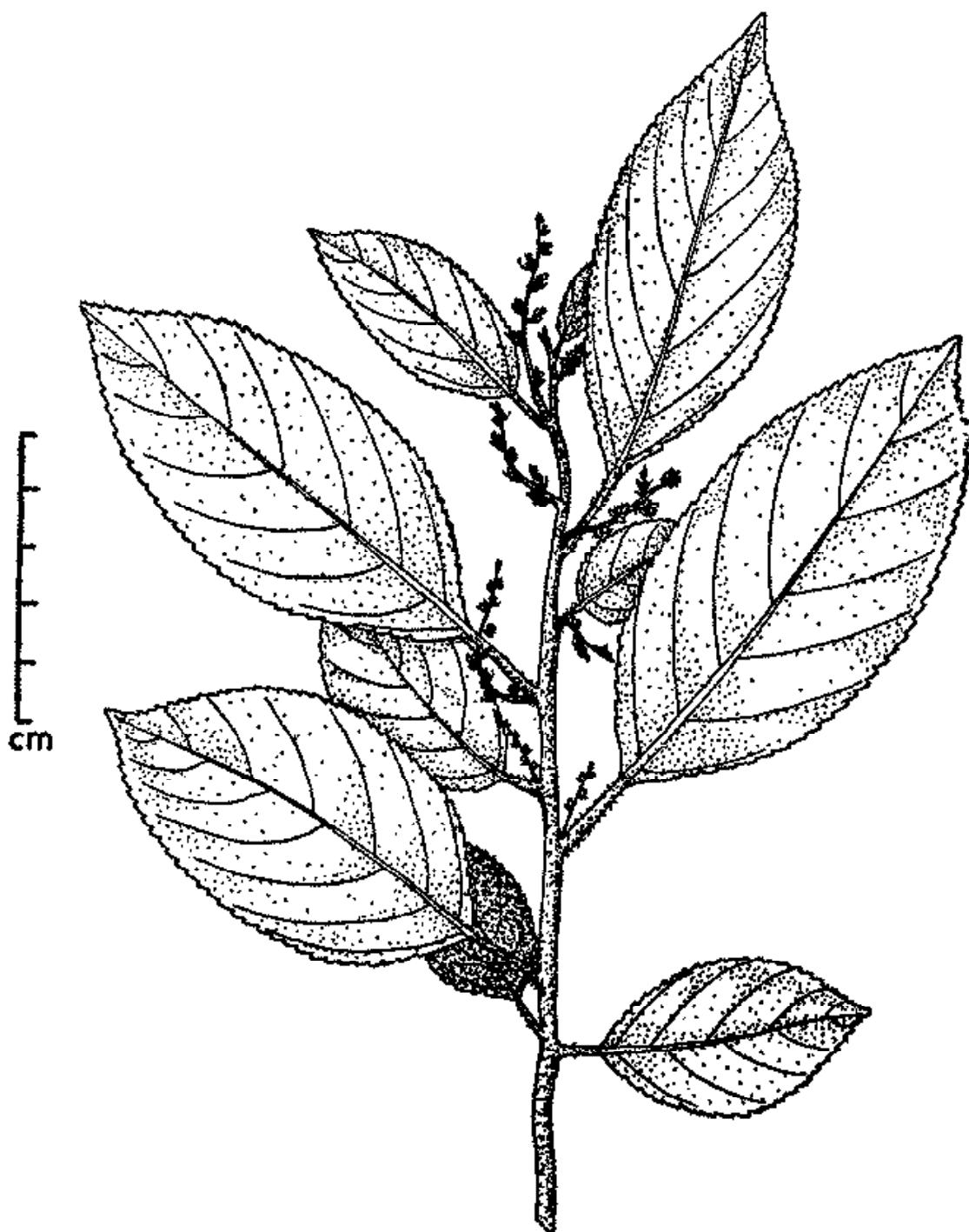


Fig. 13. *Rhamnus triqueter* (Wall.) Brandis

2.5 mm long, subulate, minutely pubescent, caducous. Flowers in axillary fascicles of 10—20, yellow, pedicels 2.3 mm long, accrescent. Calyx 2.5—3.5 mm long; lobes deltoid, thickened at apex; tube 2 mm wide, campanulate, minutely pubescent without. Petals 1.5—2.0 mm long, cuneate, obovate, cucullate. Stamens 1.0—1.5 mm long, pale brown. Disc saucer-shaped, glabrous. Ovary glabrous; styles 3—4-cleft one-fourth to one-third the length, diverging. Drupes 4—5 mm in diam., 6—10 mm long, obovoid, smooth, reddish-purple when ripe, tipped with the remains of styles; stones 3, 1-seeded. Seeds 4.0—4.5 mm long, with a deep furrow on the back.

Type : Peninsular India, Wight 507 (K!).

Fls. & Frts. : Jan.—Apr.

Distrib. : INDIA : Madhya Pradesh, Maharashtra, Tamil Nadu; SRI LANKA, NEPAL.

Ecol. : It grows in evergreen forests or bush-lands up to an altitude of 2100 m.

Uses : Bark is used in Bombay under the name of 'Rakta Rohida' and gives a drug similar to 'Cascara'. It contains small quantities of a bitter principle, tannin and resin.

8. SAGERETIA

Brongn., Mem. Fam. Rham. 52. 1826 & in Ann. Sci. Nat. Ser. 10 (1) : 359. t. 13, f. 2. 1827; Benth. & Hook. f., Gen. Pl. 1 : 379. 1862; Brandis, For. Fl. 94. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 641. 1875; Gamble, Fl. Pres. Madras 1 : 223. 1918 (Repr. ed. 1 : 160. 1957).

Armed or unarmed shrubs or trees, rarely scandent. Leaves opposite or subopposite, serratures tipped with deciduous, glandular mucro; stipules minute, deciduous. Inflorescence terminal or axillary panicles. Flowers bisexual, pentamerous. Calyx urceolate, persistent, lobes deltoid, acute, keeled inside, thickened towards apex and margin. Petals cucullate, clawed. Stamens enclosed in petals; filaments filiform; anthers 2-loculed, dehiscence longitudinal. Disc saucer-shaped, 5-lobed, fleshy, nectiferous, filling the calyx tube. Ovary glabrous, superior, tricarpellary, 3-loculed, almost immersed in the disc but free from it; style short, thick, 3-loculed, lobes coherent. Drupes 3-loculed, globular or obovate, suffused at base by the adnate, accrescent calyx tube and disc, with 3-coriaceous, indehiscent kernels. Seeds 3, completely filling the kernels; embryo straight; cotyledons flat, orbicular, foliaceous, enclosed in thin, fleshy albumen, testa crustaceous.

Distrib. : 40 species in the world, 8 in India.

Pollen : 3-zonocolporate; P/E 14-17/14-18 μm , oblate spheroidal, os circular, sexine as thick as nexine; psilate (Parveen & Bhandari in Bir, Rec. Res. Pl. Sci. 692. 1979).

KEY TO THE SPECIES

- 1a. Leaves persistently woolly on lower surface ...*S. brandrethiana* 1
- 1b. Leaves glabrous on lower surface or pubescent becoming glabrous with age :
 - 2a. Stamens longer than the petals :
 - 3a. Leaves tapering into a long acumen at apex, finely serrulate, lateral nerves 6-8 pairs. Flowers pubescent ...*S. hamosa* 3
 - 3b. Leaves obtuse or acuminate, distantly serrate, lateral nerves 4-5 pairs. Flowers glabrous :
 - 4a. Leaves more than 2.5 cm long, ovate or elliptic. Petals notched ...*S. coimbatorensis* 2
 - 4b. Leaves up to 2.5 cm long, rotundate or orbicular. Petals notched and mucronate ...*S. kistwarensis* 5
 - 2b. Stamens shorter than or equal to petals :
 - 5a. Flowers glabrous :
 - 6a. Leaves less than 2 cm long; petals notched and mucronate ...*S. kashmirensis* 4
 - 6b. Leaves more than 2 cm long. Petals notched but not mucronate ...*S. thea* 7
 - 5b. Flowers pubescent :
 - 7a. Lateral nerves 3-5 pairs ...*S. wallichii* 8
 - 7b. Lateral nerves 5-7 pairs ...*S. parviflora* 6

1. ***Sageretia brandrethiana*** Aitch. in Jour. Linn. Soc. 8 : 62. 1865; Brandis, For. Fl. 95. 1974. & Ind. Trees 173. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 642. 1875; Gamble, Man. Ind. Timb. 188. 1922 (Repr. ed.).

Local names : Bajan, Bhamdi, Ganger, Goher, Kanger, Koher, Kunjar (Punj.); Gangeri (Kashm.).

Armed shrubs, up to 5 m high; branches stiff, divergent, generally opposite, often ending in spines. Leaves 0.5-2.7 \times 0.3-1.8 cm, elliptic

or oblong, ovate, sharply serrulate; base rounded, apex acute, glabrous above; petioles 3—7 mm long; stipules 2—4 mm long, lanceolate, deciduous. Panicles sessile. Flowers 4—5 mm across, glabrous; bracts 1—2 mm long, ovate, brown. Calyx lobes 1.5—2.0 mm long, keeled within up to the base. Petals 0.7—1.5 mm long, obovate, notched, incurved, apex obtuse. Stamens equal to the petals; anthers dorsifixed. Disc massive, thickened around the ovary. Ovary narrowed into 3, short coherent styles. Drupes ovoid, 3-lobed, succulent, black with raised longitudinal lines.

Fls. : Jun.-Apr.; *Frts.* : May

Distrib. : INDIA : Kashmir, Punjab; PAKISTAN, IRAN, ARABIA.

Ecol. : In Himalayas up to an altitude of 2550 m.

Uses : The fruits are sweet and are a great favourite with the Afghans and are sold in the market. In some places as a condiment. Chutney is made from fruits.

2. *Sageretia coimbatorensis* Bhandari & Bhansali in Jour. Econ. Tax. Bot. 5 : 921, f. 1. 1984.

Large shrubs or small trees; branches scandent, alternate, fluted, glabrous; bark cinereous, often white speckled, armed with thorns; internodes 2—5 cm long. Leaves 4.8—8.7 × 2.5—4.0 cm, ovate or elliptic, base rounded, apex acuminate with a callous point, subcoriaceous, nerves impressed above, lateral ones comptodromous near margin, tertiary nerves reticulate; petioles 0.8—1.0 cm long, pubescent; stipules 1.2—1.5 cm long, lanceolate, deciduous. Panicles axillary and terminal. Flowers 5—6 in fascicles, 4.5—5.0 mm across, sessile; bracts 1.0—1.5 mm long, pubescent, deciduous. Calyx lobes 1.5—2.0 mm long, keeled up to the middle. Petals 0.8—1.2 long, obcordate. Stamens 1.0—1.5 mm long; anthers dorsifixed; filaments slender, flat at base. Disc round or slightly 5-lobed, margin free, thickened around ovary. Style 3-lobed or grooved; stigma capitate. Fruit not seen.

Type : India : Tamil Nadu, Coimbatore Dist., Thekkumalai Hills, 666 m, 12.11.1956, K. M. Sebastian 1729 (Holo, MH).

Fls. : Nov.—Jan.

Distrib. : INDIA : Tamil Nadu.

3. *Sageretia hamosa* (Wall.) Brongn., Mem. Fam. Rham. 53. 1826 & in Ann. Sci. Nat. Ser. 10 (1) : 360. 1827; Lawson in Hook. f., Fl. Brit. India 1 : 641. 1875; Gamble, Fl. Pres. Madras 1 : 223. 1918 (Repr. ed. 1 : 160. 1957); Brandis, Ind. Trees 5 : 173. 1971 (Repr. ed.). *Ziziphus hamosa* Wall. in Roxb. Fl. Ind. 2 : 369. 1824. *Sageretia ramosa* Royle, Ill. Bot. Himal. 5 : 169. 1835.

Fig. 14

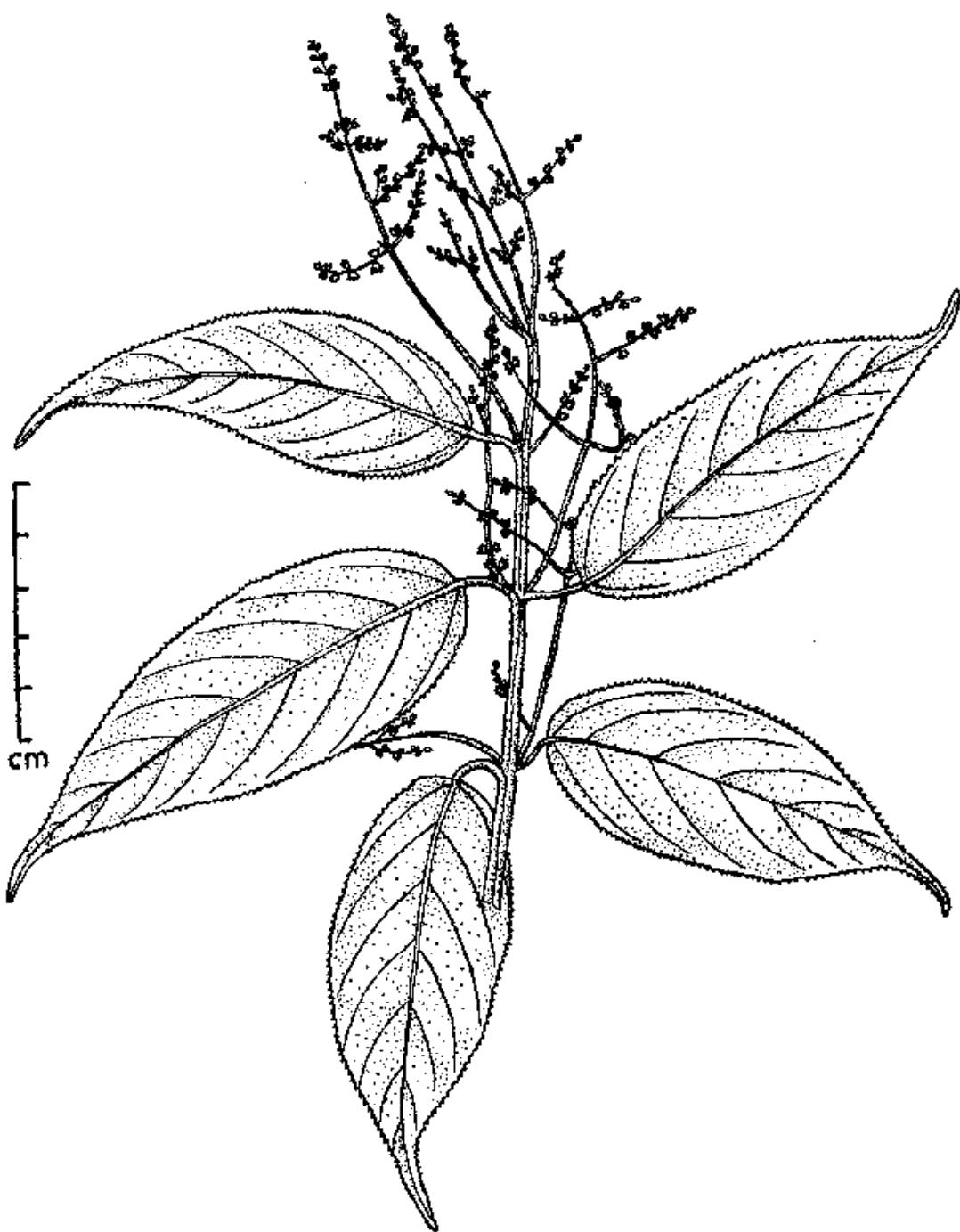


Fig. 14. *Sageretia hamosa* (Wall.) Brongn.

Large shrubs, branches, long, scandent, glabrous, lateral floriferous branches modified into or ending in thorns. Leaves subopposite, $9.1 - 13.5 \times 4.4 - 6.0$ cm, elliptic-oblong or lanceolate, glabrous, coriaceous, base rounded; petioles $0.8 - 1.3$ cm long, channelled above; stipules $1 - 3$ mm long, linear, deciduous. Flowers $3.0 - 4.5$ mm across, sessile, pubescent; bracts minute, ovate, brown. Calyx lobes $1.2 - 2.5 \times 1.0 - 1.5$ mm, glabrescent. Petals 1.5×2.0 mm, obovate, apex slightly emarginate, margin inrolled. Stamens 2.0 mm long; anthers dorsifixed. Disc glabrous, entire or slightly 5-lobed. Ovary urceolate; style very short; stigma 3-grooved, convex. Drupes 1.0×0.8 cm, ovoid, pointed. Seeds 3, $3 - 4$ mm long.

Type : Wall. Cat. 4253, (CAL! K-W).

Fls. : Aug.—Oct.; *Frt.s.* : Nov.—Jan.

Distrib. : INDIA : Assam, Kerala, Tamil Nadu, Uttar Pradesh; NEPAL, TAIWAN, SRI LANKA.

Ecol. : Grows on hills up to an elevation of 1850 m.

Chr. No. : n = 12 Sareen *et al.* in Taxon 18 : 433-442. 1974.

Note : This species is based on *Ziziphus hamosa* Wall., the Holotype of which is preserved in CAL (Wallich 4253). Wallich's original material is heterogenous. Wallich 4253 should be considered as Type of *S. hamosa* whereas the other material (Wallich 4253 B) forms the Type of *S. wallichii*.

4. ***Sageretia kashmirensis* Bhandari & Bhansali** in Journ. Econ. Tax. Bot. 5 : 923, f. 2. 1984.

Armed shrubs with spinescent branchlets; branches glabrous, often modified into thorns $0.5 - 4.0$ cm long, strong, subcylindric, pointed forward; internodes $10 - 3.2$ cm long. Leaves $0.6 - 1.6 \times 0.5 - 1.2$ cm, ovate-elliptic, base and apex obtuse, lateral nerves 3—4 pairs, camptodromous; glabrous; petioles $1 - 2$ mm long, hairy; stipules $0.5 - 0.8$ mm long, caducous. Flowers 2—3 in fascicles; bracts $1 - 2$ mm long, caducous. Calyx lobes $1.0 - 1.5$ mm long. Petals $0.5 - 0.8$ mm long, obovate. Stamens $0.5 - 0.7$ mm long, filaments flat; anthers dorsifixed. Disc entire or slightly 5-lobed. Style 3-cleft at apex; stigmas obtuse. Fruit not seen.

Type : Kashmir, Bhadarwah, alt. 1830 m, 21.8.1962, B. M. Wadhwa & J. N. Vohra 560 (Holo, CAL).

Fl. : Jul.—Sep.

Distrib. : INDIA : Kashmir.

5. ***Sageretia kishtwarensis* Bhandari & Bhansali** in Journ. Econ. Tax. Bot. 5 : 925, f. 3. 1984.

Armed shrubs, branches scandent, glabrous, opposite, fluted, bark cinereous, white speckled; thorns 2 cm long, pointed forward; internodes

0.8—3.0 cm long, nodes enlarged around the leaf scar. Leaves 1.0—2.5 × 0.6—2.0 cm, orbicular to rotundate, obtuse, mucronate, shining, subcoriaceous, glabrous lateral nerves, craspedodromous, camptodromous near margin, impressed above; petioles 2.0—2.5 mm long; stipules 2 mm long, lanceolate, minutely pubescent. Panicles with alternate, racemose ramifications. Flowers 2—3 in fascicles, 3—5 mm across, sessile; bracts 1 mm long, caducous. Calyx lobes 1.5—2.5 mm long, keeled below the middle. Petals 0.8—1.5 mm long, obovate. Stamens 1.5—2.0 mm long; anthers dorsifixed; filaments acicular. Disc thick. Fruit not seen.

Type : India, Kashmir, Kishtwar hills, 1800—2000 m, 21.9.1958, T. A. Rao 7799 (Holo, BSD).

Fls. : May—Dec.

Distrib. : INDIA : Kashmir.

Exsicc : Kashmir : Batote, Chenab Valley, 1200—1700 m, 10.9.1958. T. A. Rao 7335 (BSD); Thathri-Kishtwar, 680—1800 m, 19.9.1958, T. A. Rao 7770 (BSD); Bhadarwah-Jai, 29.5.1959, T. A. Rao 9035 (BSD); Bhadarwah, 1850—2000 m, 25.9.1958, T. A. Rao 7920 (BSD).

6. *Sageretia parviflora* (Roem. & Schult.) G. Don, Gen. Syst. 2 : 29. 1832; Gamble, Fl. Pres. Madras 1 : 223. 1918 (Repr. ed. 1 : 160. 1957); Balakr. in Ind. For. 67 : 58. 1970. *Rhamnus parviflora* Roem. & Schult., Syst. Veg. 5 : 295. 1819. *Ziziphus oppositifolia* Wall. in Roxb., Fl. Ind. 2 : 370. 1824. *Sageretia oppositifolia* Brong., Mem. Fam. Rham. 53 : 1826 & in Ann. Sci. Nat. Ser. 1, 10 : 360. 1827; Brandis, For. Fl. 95. 1874 & Ind. Trees 173. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 641. 1875; Cooke, Fl. Pres. Bombay 1 : 245. 1902 (Repr. ed. 1 : 261. 1958); Kanjilal, For. Fl. 131. 1969 (Repr. ed.). **Fig. 15**

Local names : Dyarry (Hindi) Kanak, Gidardak, Drange, Girthan (Punj.); Aglaia (Kumaon); Lohari (Almora); Gonta (Dehra Dun); Abinkand (Garhwal); Manchi, Surabi (Tel.).

Large shrubs or small trees up to 1.8 m high; branches often climbing, angular, armed with thorns. Leaves 2.5—10.2 × 1—4 cm, ovate-elliptic or lanceolate, apex shortly acuminate, base rounded, serrulate; subcoriaceous, dark green, shining above, hairy on nerves beneath when young; petioles 2—13 mm long, villous; stipules 1.5—3.0 mm long, linear, villous. Panicles with opposite racemose ramifications, flower-bearing branches tomentose. Flowers 5 mm across, sessile, usually only 1 flower per fascicle setting fruit; bracts 1—2 mm long, tomentose linear, deciduous. Calyx 1.0—2.5 mm long, villous outside, keeled within. Petals 1.0—1.5 mm long, obovate, emarginate. Stamens 1.0—1.5 mm long. Disc flat. Ovary urceolate; stigma capitate. Drupes 10 × 5 mm, turbinate, black when ripe, pointed with permanent style. Seeds 3—4 × 2.0—2.5 mm.

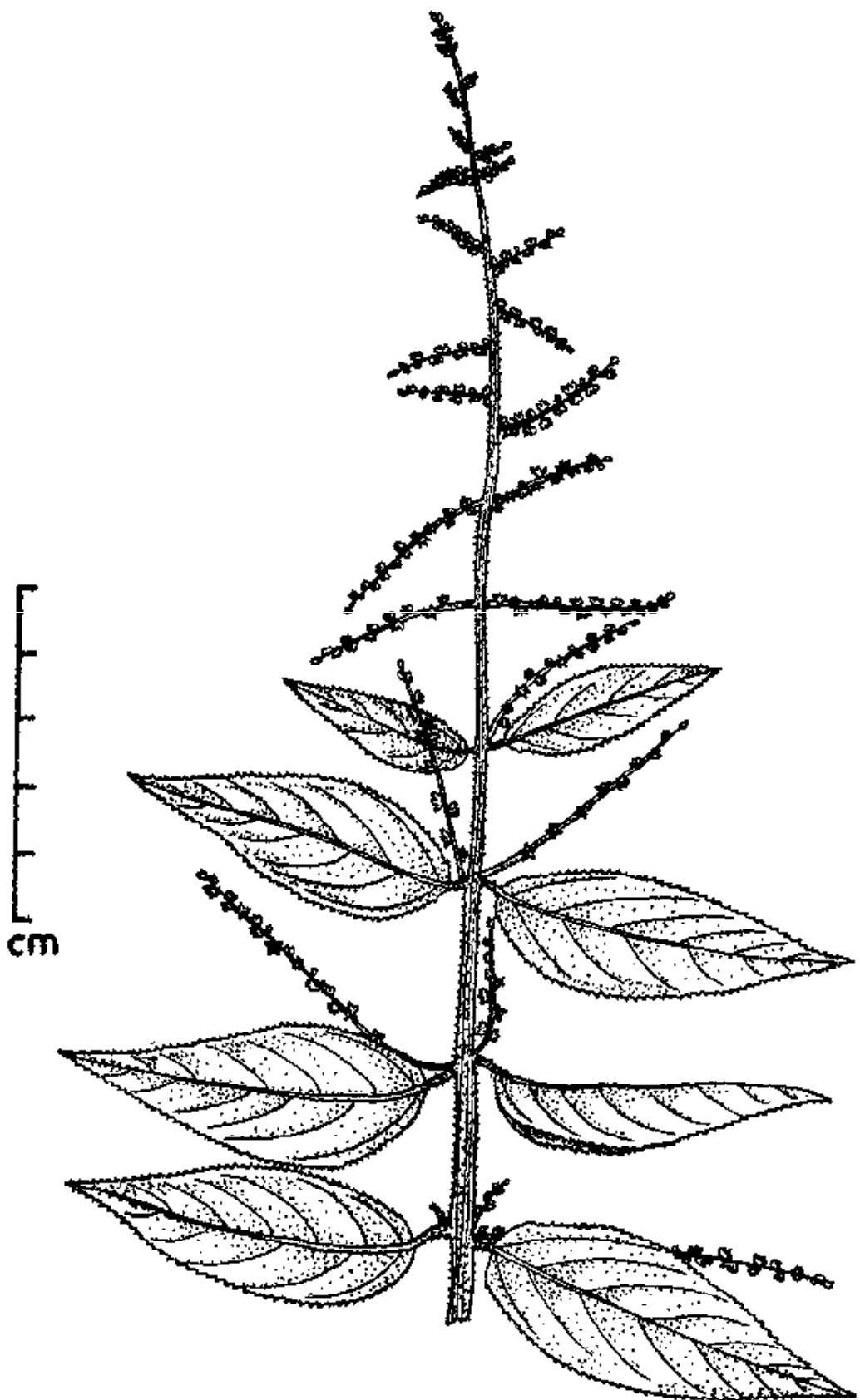


Fig. 15. *Sageretia parviflora* (Roem. & Schult.) G. Don

Fls. : Jul.—Oct.; *Frts.* : Nov.—Jan.

Distrib. : INDIA : Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Karnataka, Kashmir, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh, W. Bengal; NEPAL, INDONESIA.

Ecol. : Grows in wooded grasslands on rocky places at an altitude of 2100 m.

Uses. : The sweet fruits are eaten.

7. *Sageretia thea* (Osb.) Johnst. in Journ. Arn. Arbor. 49 : 337 1968.
Rhamnus thea Osb. Dagb. Ofwer Ostind. Resa 232. 1757 & Reise nach Ostindien und China 210, 302. 1765 & Voy. China E. Indies I : 375. 1771; *op. cit.* 2 : 345. 1771. *Rhamnus theezans* Linn., Mant. 207. 1771. *Sageretia theezans* (Linn.) Brongn., Mem. Fam. Rham. 53. 1826; Brandis, For. Fl. 95. 1874 & Ind. Trees 174. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 641. 1875. *Sageretia theezans* var. *diospyrifolia* Lawson in Hook. f., Fl. Brit. India 1 : 641. 1875, ('*diospyrifolia*').

Fig. 16

Local names : Kahdgu, Kurkha, Kutku (Garhwal); Ankol, Brinkol, Chaunsh, Orangu, Kanda, Karur, Kauli, Katrain, Kim, Phompli, Thum (Punj.); Dargola (Simla); Brankil (Kashmi.).

Sarmentose, spinous shrubs, up to 3 m high; branches slender, glabrous or finely tomentose when young, armed with thorns. Leaves opposite at basal nodes, upper ones alternate, 2.2—5.2 × 0.8—2.8 cm, ovate or elliptic, base rounded, apex obtuse, serrulate, shining, glabrous on both surfaces; petioles 2—5 mm long, glabrous; stipules 2.0—2.5 mm long, linear. Panicles with opposite racemose ramifications; rachises squarrose. Flowers 3—4 mm across; bracts 1—2 mm long, glabrous, deciduous. Calyx lobes 1.5—2.0 mm long. Petals yellow, 1.0—1.5 mm long, obovate, emarginate. Stamens 1.0—1.5 mm long; filaments flat, anthers dorsifixed. Disc glabrous, massive, thickened around the ovary. Ovary 3-grooved; style lobes coherent. Fruits ovoid, 5 mm in diam., 8 mm long, succulent, irregularly rugose, dark brown when ripe. Seeds 3.0—3.5 × 2.3 mm.

Fls. : May—Jun.; *Frts.* : Aug.—Nov.

Ecol. : Very common in open scrub forests up to an elevation of 2400 m.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Punjab, Uttar Pradesh; PAKISTAN, CHINA, AFGHANISTAN.

Uses : The fruits are sweet to taste and are extensively eaten; the leaves are sometimes used as a substitute for tea leaves.

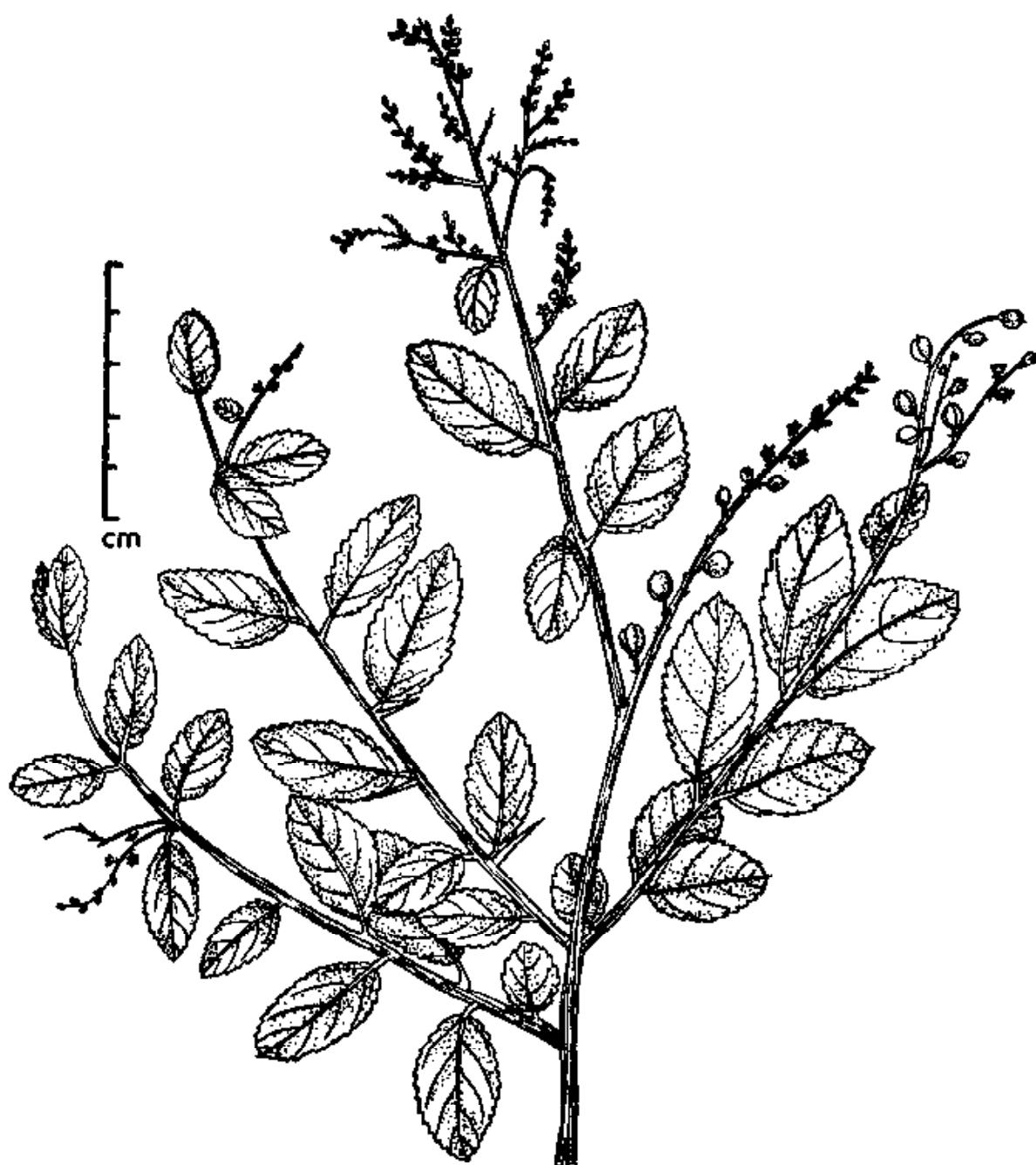


Fig. 16. *Sageretia thea* (Osb.) Johnst.

8. *Sageretia wallichii* Bhandari & Bhansali in Journ. Econ. Tax. Bot. 5 : 927, f. 4. 1984.

Shrubs; branches scandent, alternate, brown pubescent, fluted, having small white lenticels. Flower bearing lateral branches modified into or ending in thorns; thorns thin, 1.2—3.2 cm long, sharp pointed, subcylindric; internodes 1.2—5.6 cm long, nodes enlarged near the leaf scar. Leaves 1.0—4.5 × 0.5—2.5 cm, opposite or subopposite, ovate-elliptic, base rounded, apex acute with mucro, shining, dark green and glabrous above, villous beneath when young, more so on nerves, finely serrulate, lateral nerves campylocladous near the margin, tertiary reticulate; petioles 2—6 mm long, villous, terete; stipules 1—2 mm long, lanceolate, pubescent. Panicles with opposite or subopposite cylindric racemes. Flowers 3—4 mm across, sessile, 3—4 in each fascicle; bracts 0.5—1.2 mm long, lanceolate. Calyx lobes 1.5—2.2 mm long, pubescent. Petals 0.8—1.5 mm long, oblong-obovate, entire. Stamens 0.6—1.2 mm long; filaments flat at base, anthers dorsifixed. Disc rounded, thickened around the ovary. Stigma 3-cleft at top. Fruit not seen.

Type : Wall. Cat. 4253 B (CAL).

Distrib. : INDIA.

Exsicc. : Wallich s. n., Acc. No. 89564, 89563, 89565, 89566, 89567, 89568, 89562 (CAL).

9. SCUTIA

Comm. ex Brongn., Mem. Fam. Rham. 55. 1826, *nom. cons.*; Benth. & Hook. f., Gen. Pl. 1 : 379. 1862; Lawson in Hook. f., Fl. Brit. India 1 : 640. 1875; Cooke, Fl. Pres. Bombay 1 : 244. 1902 (Repr. ed. 1 : 260. 1958); Gamble, Fl. Pres. Madras 1 : 222. 1918 (Repr. ed. 1 : 159. 1957).

Small trees or shrubs, rarely scandent, glabrous or nearly glabrous, unarmed or armed with straight or recurved thorns; branchlets usually angular. Leaves opposite or subopposite, ovate or obovate, often variable, obscurely dentate, obtuse at both ends, mucronate; petioles short; stipules triangular, usually deciduous. Cymes condensed, axillary, solitary or in umbellate fascicles. Flowers pentamerous, bisexual. Calyx lobes valvate in bud, deltoid. Petals deeply obcordate or bilobed, cucullate or flat. Anthers dorsifixed, ovate, 2-celled. Disc lining the calyx cup, rather thin. Ovary 2—3-celled, sunk in the disc; style very short, slightly lobed. Drupes nearly globose, with 2—3 seeds enclosed in free endocarpous stone; stones embedded in a thin fleshy pulp at maturity, irregularly dehiscent.

Distrib. : 4 species in the world; 1 in India.

Pollen: 3-zonocolporate; P/E 22-25/24-27 μm , oblate spheroidal, os circular, sexine as thick as nexine, faintly reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 692, 1979).

Scutia myrtina (Burm. f.) Kurz in Journ. Asiat. Soc. Bengal 44 : 168. 1975; Gamble, Fl. Pres. Madras 1 : 223. 1918 (Repr. ed. 1 : 160. 1957). *Rhamnus myrtina* Burm. f., Fl. Ind. 60. 1768, ('*myrtinus*'), *R. circumscissa* Linn. f., Suppl. 152. 1781 (*circumscissus*); Roxb., Fl. Ind. 1 : 603. 1832. *Rhamnus lucida* Roxb., Fl. Ind. 2 : 353. 1824 & 1 : 605. 1832. *Scutia indica* Brongn. Mem. Fam. Rham. 56. t. 4. 1826. *nom. superfl.* Wight & Arn., Prodr. 1 : 165. 1834; Dalz. & Gibbs., Bombay Fl. 50. 1861; Lawson in Hook. f., Fl. Brit. India 1 : 640. 1875; Cooke, Fl. Pres. Bombay 1 : 244. 1902 (Repr. ed. 1 : 260. 1958).

Fig. 17

Local names: Gariki (Tel.), Tuvadi, Patty chollimela, Chimati (Tam.), Cheemat, Wait-a-bit (Mar.).

Straggling or scandent shrubs, rarely small trees 2-5 (-10) m tall; branchlets often decussate, usually armed with subopposite 2-7 mm long, recurved, thorns. Leaves coriaceous, glabrous; stipules 2-5 \times 2.0-2.5 mm. Inflorescence condensed cymes or 2-15-flowered fascicles. Flowers 2.0-2.5 mm across, yellowish-green, 1 flower per cyme developing into fruit; peduncle up to 6 mm long, glabrous; pedicels 1-2 mm long, accrescent; bracts up to 1 mm long, ciliate, glabrous, tomentose or sometimes puberulous at apex. Calyx lobes 1.5-2.0 mm long, glabrous, erect, keeled below thickened apex. Petals yellowish, 0.6-1.0 mm long, apex emarginate or deeply 2-lobed, unguiculate. Stamens 0.7-1.0 mm long; filaments filiform, inserted on calyx-tube, slightly swollen at base. Disc glabrous, inconspicuous. Ovary bicarpellary, glabrous; style shortly 2-lobed. Drupes glabrous; endocarp 5-6 mm long, readily separating into 2, free, indehiscent stones. Seeds 2, plano-convex, light brown, compressed; testa membranous.

KEY TO THE VARIETIES

- 1a. Leaves orbicular, elliptic to ovate, rounded at apex ...var. *myrtina*
- 1b. Leaves obcordate, emarginate at apex ...var. *emarginata*
- var. *emarginata* Bhandari & Bhansali, var. nov.

Differ a varietate *myrtina* foliis 1-2 \times 0.8-2.2 cm, obcordatis, apice emarginatis, basi cuneatis, margine integris, saepe 2/3 patibus distalis utrinque cum 3-6 dentibus crenulatis, marginibus in sicco perrugasis et aliquando revolutis, costis utrinque cum 4-5 nervis secundariis obcurvis; petiolis 2-5 mm longis; fructibus 4-6 mm in diam., globosis.

Typus: Andhra Pradesh, Chittoor, Mogili Ghat, 7.3.1957, S. K. Wagh 5478 (BLAT).

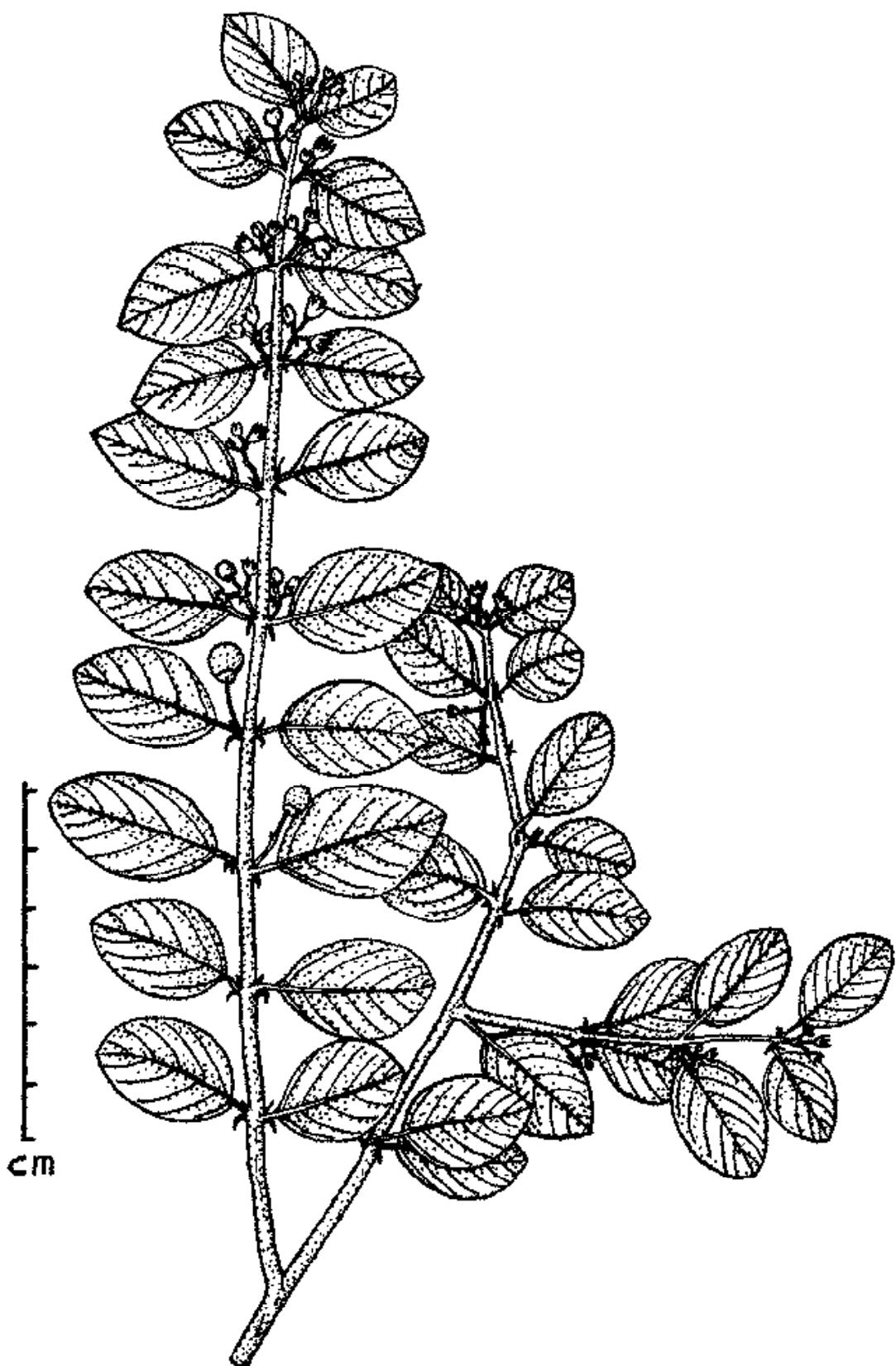


Fig. 17. *Scutia myrtina* (Burm. f.) Kurz

var. *emarginata* Bhandari & Bhansali *var. nov.*

Leaves 1–2 × 0.8–2.2 cm, obcordate, apex emarginate and mucronulate, base cuneate, margin entire, often distal two thirds with 3–6 distinct crenulate teeth on each side, margin after drying much wrinkled and occasionally revolute, on each side of midrib 4–5 obscure secondary nerves and some even more obscure intermediate ones; petioles 2–5 mm long. Fruits 4–6 mm in diam. globose.

Type : Andhra Pradesh, Chittoor, Mogili Ghat, 7.3.1957, S.K. Wagh 5478 (BLAT).

Fls. & Frts. : Jan.–Aug.

Distrib. : INDIA : Andhra Pradesh, Maharashtra.

Exsicc. : Andhra Pradesh : Rapur, Nellore, 23.7.1957, S. K. Wagh 6443, 6444 (BLAT); Mogili Ghat, Chittoor, 7.3.1957, S. K. Wagh 5479 (BLAT); Madani Konda, Chittoor, 15.7.1957, S. K. Wagh 6260 (BLAT); Cuddpah, 27.1.1958, S. K. Wagh 8084 (BLAT); Maharashtra : Bombay, Talbot s.n. Herb. Sims. (K).

Notes : The leaves in this variety are obcordate, emarginate at apex and cuneate at base compared to var. *myrtina*.

var. *myrtina*

Leaves 0.5–5.0 × 0.6–3.5 cm, orbicular, elliptic or obovate to ovate, entire, base rounded to cuneate, apex acuminate, secondary nerves 4–7, obscure; petioles 2–11 mm long. Fruits 5–9 mm long.

Type : India, "Coromandeli", leg. Burmann ?, could not be located there or elsewhere; Neotype designated Johnston (1974) : India, Madras state, s. l. 1667 m, 27 Mar. 1957, s.n. (M).

Fls. : Feb.–May; *Frts.* : Sep.–Dec.

Distrib. : INDIA : Andhra Pradesh, Bihar, Karnataka, Maharashtra, Orissa, Tamil Nadu; BURMA, SRI LANKA, MAURITIUS.

Ecol. : Occurs in a wide variety of situations from forest margins to bushland, thick and wooded grasslands; mostly near the sea coast, in evergreen coastal scrub and in evergreen forest at higher altitudes.

Uses : This species is grown as hedge plant. Fruit is edible and considered as astringent. Leaves are said to be used in an ointment locally applied to hasten parturition.

Notes : The species is very variable in the size, shape and denticulation of leaf but Johnston (1974) suggests that the recognition of taxa on these characters is not practicable. However, the very conspicuous emarginate leaves of specimens from Andhra Pradesh has prompted us to describe a new variety i.e. var. *emarginata*.

10. SMYTHERA

Seem. ex A. Gray in Bonplandia 10 : 35, t. 9. 1862; Hook. f. in Benth. & Hook. f., Gen. Pl. 1. : 375. 1862; Lawson in Hook. f., Fl. Brit. India 1 : 632. 1875; King in Journ. Asiat. Soc. Bengal 65 : 381. 1896; Parkinson, For. Fl. Andaman 130. 1923; Narayanswami in Journ. & Proc. Asiat. Soc. Bengal. n. s. 27 : 356. 1931; Banerjee & Mukerjee in Ind. For. 96 : 206. 1970.

Scandent or subscandent woody shrubs or climbers; branches flexuous, puberulous at least when young, having longitudinal ridges and furrows. Leaves alternate, ovate-oblong to elliptic-lanceolate, base obtuse, unequal, margin serrate or dentate, coriaceous to chartaceous. Inflorescence axillary fascicles or rarely paniculate. Flowers pentamerous, complete. Calyx lobes thickened, incurved, acute at apex, keeled, puberulous outside. Petals alternate with sepals, obovate, cucullate, broadly emarginate or 2-lobed, with or without a small tooth in the notch. Stamens opposite and generally equaling the petals; filaments basally attached to the petals. Disc 5-lobed or entire, flat, filling the calyx tube. Ovary bicarpellary, bilocular; style with two slightly divergent, stigmatic arms. Fruits capsular, 1-celled, ovate, acuminate or oblong-elliptic with rounded tip ending in mucro, compressed bilaterally, basal seed chamber not marked outwardly by any constriction, median line generally double at least at base, associated with parallel reticulations at sides, dehiscing vertically into 2 valves. Persistent calyx tube attached only at base of the fruit. Seeds 1, compressed, elongated, reniform or obovate, exalbuminous.

Distrib. : 7 species in the World, 4 in India.

Pollen : 3-zonocolporate; P/E 22–26/22–30 μ m, prolate or oblate spheroidal; os circular; sexine as thick as nexine, psilate or faintly reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 692. 1979).

KEY TO THE SPECIES

- 1a. Tufts of hairs in axils of lateral nerves on the lower surface of leaf present; crenatures callous tipped. Fruits elliptic-oblong, broadest at or above the middle :

 - 2a. Leaves acute. Branchlets not cirrhiform. Fruits 4.0–6.5 × 0.9–1.3 cm, densely brown fulvous pubescent. Seeds 3 × 1.5 mm, obovate, hairy at apex ...*S. bombaiensis* I
 - 2b. Leaves acuminate. Branchlets cirrhiform. Fruits 8.0–10.5 × 1.5–2.0 cm, glabrous.

- Seeds 6×2 mm, oblong, reniform, glabrous ... *S. macrocarpa* 4
- 1b. Tufts of hairs in axils of lateral nerves on the lower surface of leaf absent; crenatures callous tipped. Fruits ovate, broadest below the middle :
- 3a. Leaves entire to distantly denticulate. Stamens longer than the petals. Fruits cinereous tomentose, attenuated above ... *S. lanceata* 3
- 3b. Leaves crenate-serrate. Stamens equal to petals. Fruits brown woolly tomentose, oblique, truncate above ... *S. calpicarpa* 2
1. ***Smythea bombaiensis* (Dalz.) Banerjee & Mukerjee** in Ind. For. 96 : 214. 1970. *Ventilago bombaiensis* Dalz. in Hook. Journ. Bot. 3 : 36. 1851; Dalz. & Gib. Bombay Fl. 48. 1861; Benth. in Journ. & Proc. Linn. Soc. 5 : 72. 1861; Lawson in Hook. f., Fl. Brit. India 1 : 631. 1875; Cooke, Fl. Pres. Bombay 1 : 239. 1902; Talbot, For. Fl. Bombay 1 : 290. 1909; Gamble, Fl. Pres. Madras 1 : 218. 1918; Sant. in Journ. Bombay Nat. Hist. Soc. 44 : 496. 1944. & in Rec. Bot. Surv. India 16 (1) : 49. 1953.

Fig. 18

Large woody, evergreen straggling or climbing shrubs, 8—10 m high; branches fulvous pubescent. Leaves $3.2-11.2 \times 1.5-4.0$ cm, lanceolate, ovate or elliptic-ovate, subcoriaceous, acute, mucronate, crenate, shining, glabrous; nerves 4—5 pairs, secondary veins camptodrome, nervules fulvous pubescent below; petioles 2—8 mm long; stipules 2—4 mm long, subulate. Inflorescence axillary, 6—12-flowered fascicles. Flowers 5—6 mm across, greenish yellow, only one or two maturing into fruits; pedicels 2—4 mm long, fulvous pubescent. Calyx lobes 2—3 mm long, deltoid, densely fulvous pubescent without; tube obconical, persistent. Petals 1.5—2.0 mm long, truncate or obovate, bilobed, toothed at the notch, cuneate below. Stamens 1.5—2.0 mm long; filaments flattened; anthers subglobose connective produced into a short process. Disc 5-lobed, glabrous. Ovary hairy, half sunken in the disc. Capsules samaroid, wing 1-nerved, rounded or truncate at apex, apiculate. Seed 1, dull-black, testa membranaceous, exaluminous, cotyledons thick, fleshy.

Type : Maharashtra, Charla Ghat, Bombay, Jan. 1850, Dalzell s.n. (K)

Fls. : Dec.—Feb; *Frts.* : Apr.—Jun.

Distrib. : INDIA : Karnataka, Kerala, Maharashtra.

Notes : This species has been described under the genus *Ventilago* in all the Indian floras. But due to its dehiscent fruits with divided wing and

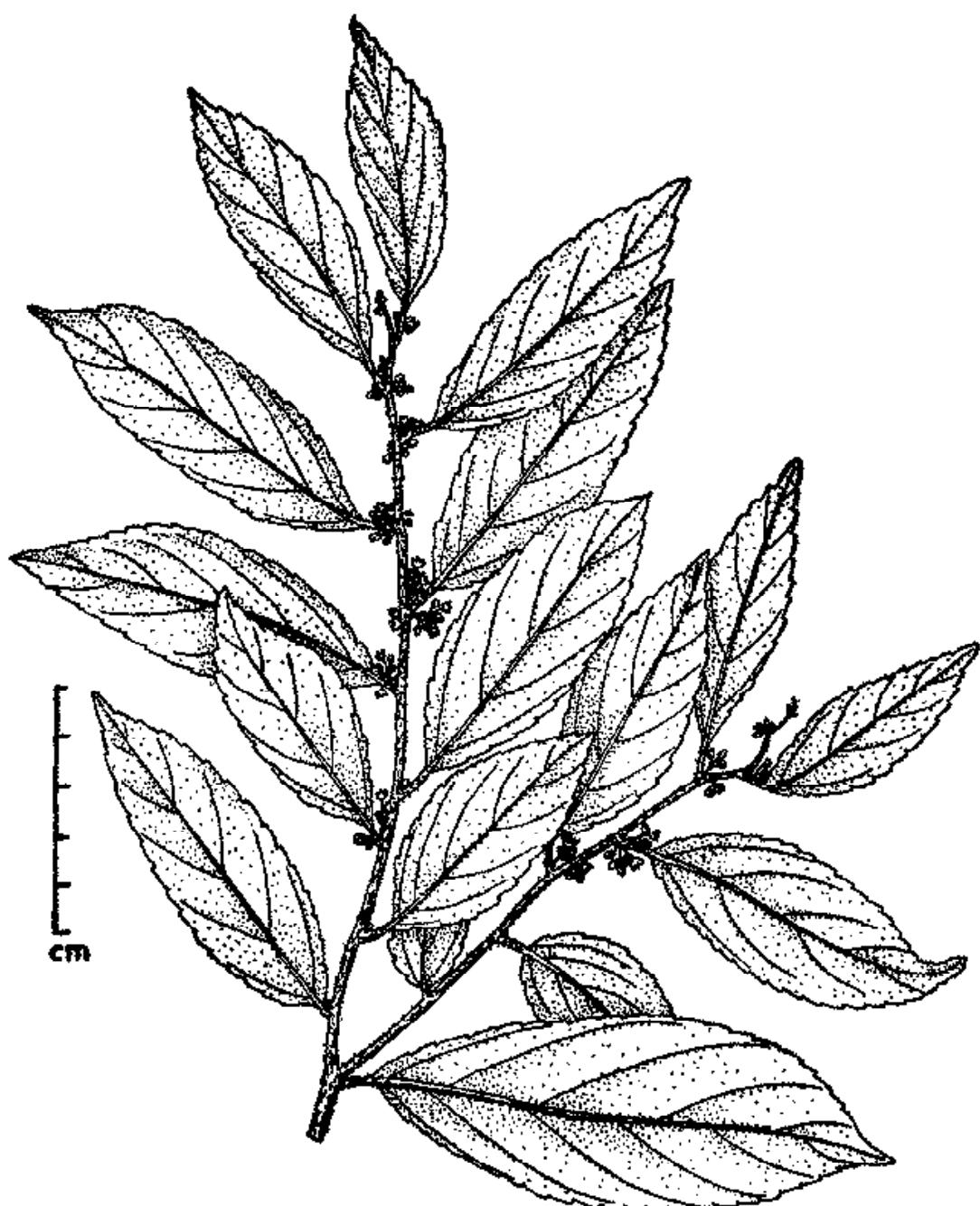


Fig. 18. *Smythea bombaiensis* (Dalz.) Banerjee & Mukerjee

axillary flowers, it should be included in the genus *Smythea* as has been done by Banerjee and Mukerjee (1970).

2. ***Smythea calpicarpa*** Kurz in Jour. Asiat. Soc. Beng. 41 : 301. 1872; Lawson in Hook. f., Fl. Brit. India 1 : 632. 1875; King in Jour. Asiat. Soc. Beng. 65 : 382. 1896; Parkinson, For. Fl. Andaman 130. 1923; Banerjee & Mukerjee in Ind. For. 96 : 214. 1970. *Ventilago calpicarpa* (Kurz) Oza in Ind. For. 94 : 267. 1968.

Fig. 19

Evergreen, scandent shrub; young branches fulvous pubescent. Leaves 6–10 × 2–4 cm, lanceolate, ovate-elliptic or elliptic-lanceolate, acute at apex, oblique at base, lateral nerves 5–7 pairs; petioles 2–3 mm long, tomentose. Inflorescence 3–10-flowered fascicles, sometimes on leafless branches. Flowers 4.0–6.5 mm across; pedicels 1.5 mm long, pubescent. Calyx lobes 2.0–3.2 mm long, deltoid. Petals 1.2 mm long, apex with a tooth at the notch, cuneate below. Stamens 1–2 mm long, connective produced into a short hard black process. Disc glabrous. Ovary villose, 2-loculed, of the 2 locules only one fertile; style bifid, curved. Capsules samaroid, ovate-oblong, 3–6 × 1.3 cm, coriaceous. Seed 1 or 2, 5 × 5 mm.

Type : Burma, Tenasserim, Hefler 2026/I (Lecto, CAL, K!).

Fls. & Fts. : Feb.—Sep.

Distrib. : INDIA : S. Andaman Islands; BURMA.

Notes : The number of flowers range from 3 to 10 per fascicle, but solitary as stated by Lawson (1875). The report of this species from Assam by Kanjilal *et al* (1936) was based on misidentification.

3. ***Smythea lanceata* (Tul.) Summerh. in Kew Bull. 1928 : 389. 1928; Oza in Ind. For. 94 : 403. 1968; Banerjee & Mukerjee in Ind. For. 96 : 212. 1970. *Ventilago lanceata* Tul. in Ann. Sci. Nat. Ser. 8, 4 : 121. 1857. *S. reticulata* King in Jour. Asiat. Soc. Beng. 65 : 318. 1896.** Fig. 20

Glabrous, scandent shrubs. Leaves 5.5–15.0 × 3.0–6.0 cm, ovate or ovate-oblong, apex acuminate, mucronate, base acute or rounded, glabrous, lateral nerves 4–6 pairs, camptodromous near the margin, tertiary veins perpendicular to midrib; petioles 3–6 mm long, glabrous. Flowers in 10–15-flowered fascicles, 4–5 mm across, puberulous; pedicels 2–6 mm long. Calyx lobes 2.5 mm long, keeled within up to the middle. Petals 1.0–1.5 mm long, emarginate with a tooth at the notch. Stamens 2.2 mm long; connective with a short apical appendage. Disc glabrous, 5-angled or rounded. Ovary hairy. Capsules 4–8 × 2–3 cm, pyriform, acute to acuminate, crustaceous, tomentose. Seeds 1 cm long, vertically elongate, cuneate at base, glabrous.

Type : “Viget et Littora Oceani in insula Mahe Sechellarum, Pervillei Herb. no. 126”.

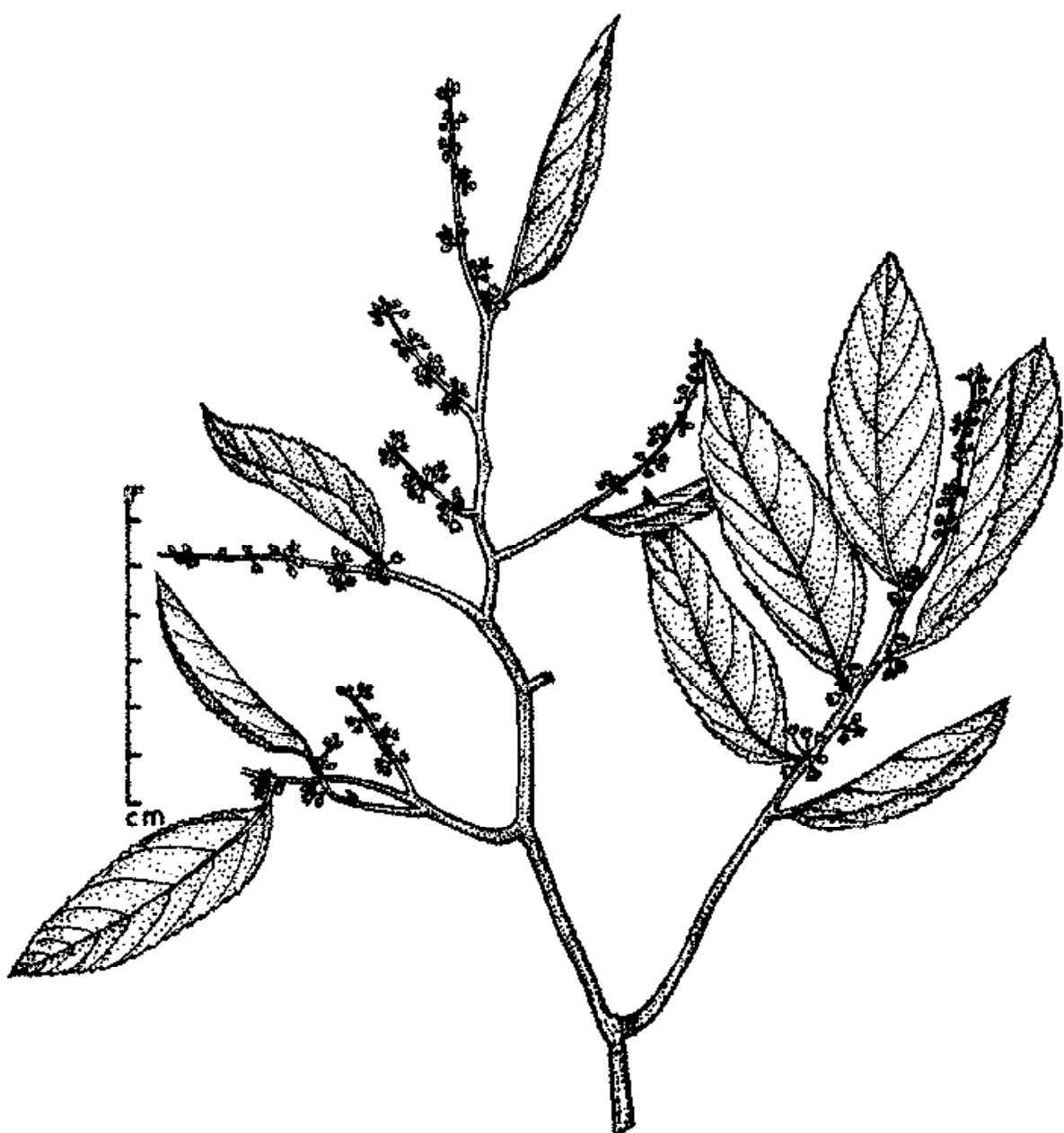


Fig. 19. *Smythea calpicarpa* Kurz

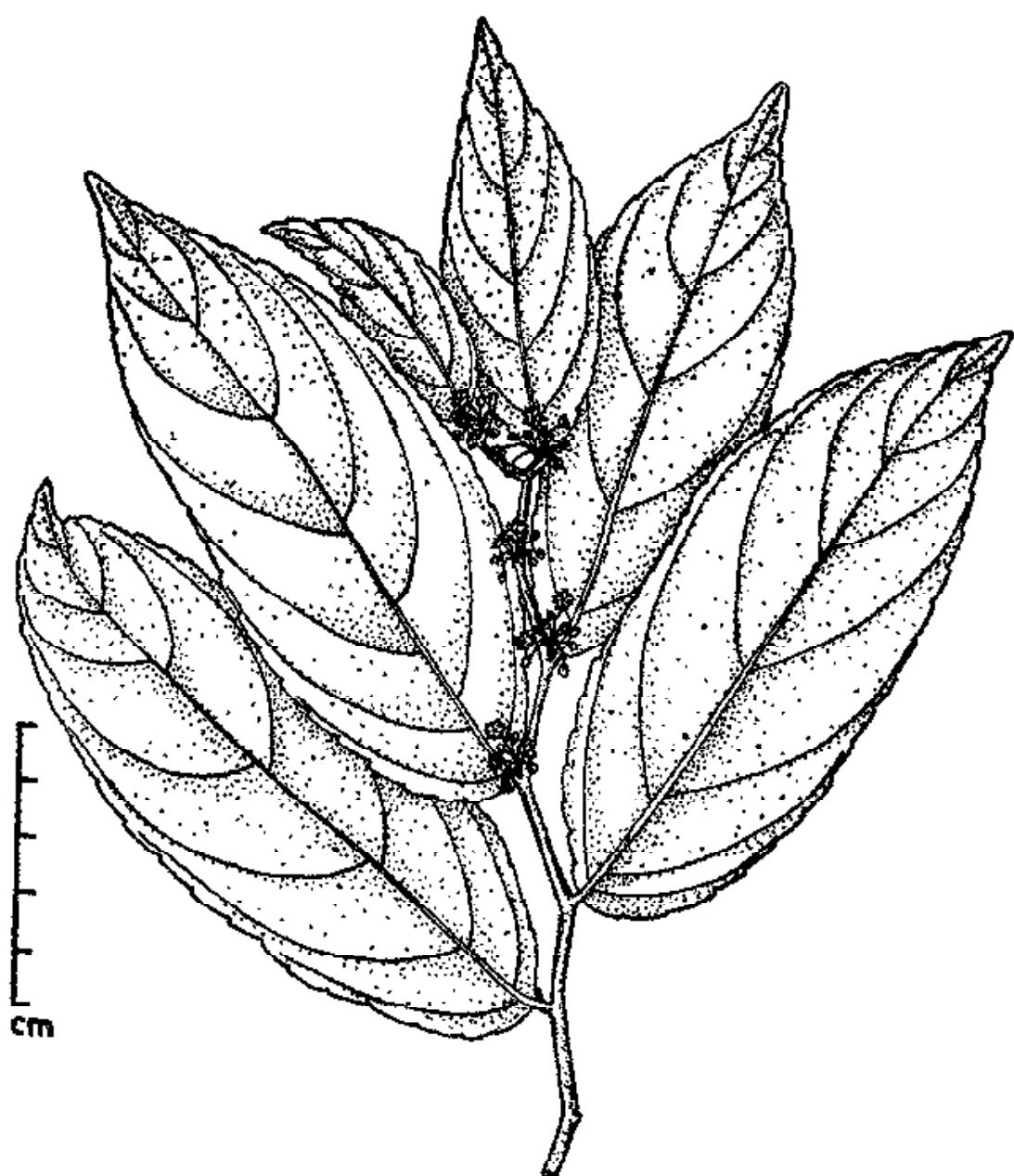


Fig. 20. *Smythea lanceata* (Tul.) Summerh.

Fls. & Frts. : Feb.—Jul.

Distrib. : INDIA : Andman and Nicobar Islands.

Exsicc. : Andamans : Havelock Island, 23.2.1916, C. E. Parkinson 1031 (CAL); Long Island, 3.7.1915, C. E. Parkinson 675 (DD); Nicobar, 3.3.1916, K. Thothathri & S. P. Banerjee 11306, 11320 (CAL).

Notes : An examination of *Smythea pacifica* Seem. and *S. lanceata* (Tul.) Summerh. reveals that *S. pacifica* is quite distinct from *S. lanceata*. The Plate t. 9 in *Bonplandia* given by A. Gray (1862) is considered to be type of the former. This plate does not resemble *S. lanceata* in having flowers borne in axillary fascicles, larger stamens, bilobed petal with a tooth in the middle, calyx being thickened at the apex and its margin being keeled up to the middle. *S. pacifica* has, therefore, been excluded from the synonymy of *S. lanceata*.

Parkinson's collections (nos. 675 and 1031) identified as *Smythea calpicarpa* Kurz from Andaman and Nicobar Islands have been found to be *S. lanceata* (Tul.) Summerh.

4. ***Smythea macrocarpa*** Hemsl. in Hook., Ic. Pl. 16. t. 1558. 1886-87; King in Jour. Asiat. Soc. Beng. 65 : 381. 1896; Narayanswami in Jour. & Proc. Asiat. Soc. Beng. n.s. 27 : 468. 1931; Banerjee & Mukerjee in Ind. For. 96 : 214. 1970.

Large woody climber; branches scandent, rufous puberulous. Leaves 4—10 × 1.5—3.5 cm, glabrous, shining, ovate-lanceolate to oblong-elliptic, ending in a thicker acumen, crenate-serrate, lateral nerves 5—7 pairs; petioles 5 mm long; stipules 3—5 mm long, subulate, deciduous. Inflorescence 10—15-flowered fascicles, on bifid, short peduncle. Flowers 5.0—5.5 mm across, bracteate; pedicels 5 mm long, rusty brown puberulous. Calyx lobes 2.5 mm long, deltoid. Petals 1.5 mm long, truncate, shortly clawed. Stamens 1.5 mm long; connective with hard, black point. Disc glabrous. Ovary glabrous, only one ovule develops into seed. Capsules samaroid, one or more in the axils of leaves, stalked, obovate or elliptic-oblong, wing glabrous, apex rounded or acute, apiculate, base narrowed and grey to brown pubescent. Seed black, smooth or faintly wrinkled.

Type : Waterfall Hills, Larut, Perak, Aug. 1885, Hemsley 36 (K!).

Fls. & Frts. : Dec.—Jan.

Distrib. : INDIA : Assam

Notes : This species differs from *S. lanceata* (Tul.) Summerh. and *S. calpicarpa* Kurz in its foliage and shape of the fruit. Hemsley (1886-87) described the fruit as ovate-oblong but the materials from Assam show a tendency towards obovate-oblong shape. In this character it matches with some collections from Malaya (Perak), housed in CAL.

11. VENTILAGO

Gaert., Fruct. 1 : 223, t 49, f. 2. 1788; DC., Prodr. 2 : 38. 1825; Benth. & Hook. f., Gen. Pl. 1 : 375. 1862; Lawson in Hook. f., Fl. Brit. India 1 : 630. 1875.

Scandent or climbing shrubs; branches slender, striate, branchlets often zig-zag, stout. Leaves alternate, simple, coriaceous, secondary nerves ascending, converging along the margin; stipules minute. Inflorescence axillary or terminal, umbellate cymes, fascicled or in panicles. Flowers bisexual, pedicellate. Calyx lobes 5, keeled with a hard incurved point at apex within, puberulous outside, tube obconical. Petals 5, cucullate, membranous, truncate, obcordate, clawed at base. Stamens 5, opposite to and enclosed by petals, adnate to their bases; filaments filiform; anthers dorsifix, introrse. Disc thick, filling the calyx tube, 5-lobed or angled, adnate to the lower half of ovary. Ovary 2-celled, more or less sunk in the disc; style hairy at base, with two short stigmatic lobes. Samara 1-seeded, indehiscent, the basal seed chamber thinly double-walled, prolonged above into a linear or linear-oblong coriaceous wing, style developed into elongated terminal strap-like flat wing the plane of which bisects the 2 original cells, tip crowned by 2 minute persistent styles; mesial line on wing single or double. Seeds globose to subglobose; testa membranaceous; exaluminous, cotyledons thick, fleshy, radicle very short.

Distrib. : c. 70 species, occurring in Indo-Malayan region, Polynesian Islands, Australia and Madagascar. 4 species in India.

Pollen : 3-zonocolporate. P/E 15–24/12–26 μm , oblate to prolate spheroidal; os circular sexine as thick as nexine, reticulate (Parveen & Bhandari in Bir, Rec. Res. Plant Sci 692. 1979).

Notes : The genus *Ventilago* was first proposed by Gaertner (1788). The genus was typified by *Ventilago madraspatana* Gaertn. Gaertner's concept of the genus was based on Rumphius's '*Funis viminalia*' (Herb. Amboinense 5 : 3. t. 2. 1750).

KEY TO THE SPECIES

- 1a. Calyx tube saucer-like, adnate only to the base of the fruit :
- 2a. Branches slender, pale. Panicles minutely grey-pubescent. Wing grey puberulous ... *V. madraspatana* 4
- 2b. Branches stout, dark. Panicle golden villosus. Wing brown, tomentose ... *V. gamblei* 2
- 1b. Calyx tube cup-like, adnate to the lower part of the fruit :

- 3a. Leaves ovate to ovate-elliptic, usually unequally rounded at base. Disc villous. Fruit girt up to more than middle by the calyx tube ... *V. denticulata* 1
- 3b. Leaves oblong-lanceolate, attenuate at base. Disc glabrous. Fruit girt upto one-third portion by the calyx tube ... *V. goughii* 3
1. *Ventilago denticulata* Willd. in Ges. Naturf. Fr. Neue. Schr. 3 : 417. 1801; Oza in Jour. Bomb. Nat. Hist. Soc. 63 : 455. 1966; Banerjee & Mukerjee in Ind. For. 96 (3) : 209. 1970. *V. madraspatana* Roxb., Cor. Pl. 1 : 55, t. 76. 1796 et Fl. Ind. 2 : 413. 1824 non Gaertn. 1788. *V. calyculata* Tul. in Ann. Sci. Nat. Ser. 8, 4 : 124. 1857; Benth. in Jour. & Proc. Linn. 5 : 72. 1861 : Brandis, For. Fl. 96. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 631. 1875. *V. macrantha* Tul. in Ann. Sci. Nat. Ser. 8, 4 : 123. 1857. *V. silhetiana* Tul. in Ann. Sci. Nat. Ser. 8, 4 : 125. 1857. *V. madraspatana* Gaertn. var. *calyculata* King in Jour. Asiat. Soc. Bengal 65 : 378. 1896; Duthie, Fl. Upp. Gang. Pl. 1 : 162. 1903.

Local names : Rackat-pita, Kalalag, Latapal, Raidhani (Hindi); Bonga-Sarjom (Santali); Surati, Chekka (Tel.).

Large woody, climbing shrubs; stem 15–30 cm in diam.; branchlets green, pubescent; bark dark grey, smooth when young. Leaves 4–16 × 2.3–7.5 cm, obtuse or subacute at apex, oblique at base, crenate-serrate, rarely entire, pubescent, subcoriaceous, nerves 5–8 pairs, arcuate, camptodromous near the margin; petioles 3–14 mm in length, pubescent, channelled. Panicles axillary or terminal, pubescent. Flowers pungent; pedicels 2–5 mm long. Calyx lobes 2.8 mm long, deltoid, hairy within. Petals 1.5 mm long, spatulate, truncate, obcordate or emarginate at apex. Stamens 1.5 mm long, connective prolonged. Disc 5-lobed, rarely 10-lobed having depression or furrows. Ovary bicarpellary, hairy; stigmatic arms diverging. Samaras with median line single or often double from middle; seed chamber pubescent outside.

Notes : Tulasne (1857) described 5 species of *Ventilago* from E. India besides a few forms which according to him deserve specific status. He also pointed out the hitherto neglected characters derived from the degree of the adherence of calyx to fruit. The fruit character is most important in specific diagnosis and yet Tulasne (*op. cit.*) described these species some of which without having access to the fruit material. Bentham (1861) merged Tulasne's *V. macrantha*, *V. calyculata*, *V. smithiana*, *V. sulphurea* with the common North Indian species figured by Roxburgh (1796-98) under Gaertner's name in which the adnate calyx is cup-shaped. Bentham (*op. cit.*) selected *V. calyculata* for the four species proposed by

Tulasne but this name is illegitimate, due to an earlier valid name *V. denticulata* Willd. (1801) as pointed out by Oza (1966) and followed by Banerjee and Mukherjee (1970).

Brongniart's plate I, f. 4 (in Mem. Fam. Rham. 1926) represents the characters of both *V. madraspatana* and *V. denticulata*. The fruit enclosed by the calyx tube up to the middle as shown in the plate is that of *V. denticulata* while the flower and glabrous disc indicate the characters of *V. madraspatana*. The wing of the fruit of *V. calyculata* does not bifurcate at apex and therefore, the diagram of the fruit resembles the fruit of *V. denticulata* var. *bifida*, var. nov.

KEY TO THE VARIETIES

- 1a. Apex of the fruit wing bifid ...var. *bifida*
 - 1b. Apex of the fruit wing not bifid :
 - 2a. Apex of the fruit wing acute ...var. *acuta*
 - 2b. Apex of the fruit wing obtuse ...var. *denticulata*
- var. *acuta* Bhandari & Bhansali, var. nov.

Differ a varietate *denticulata* capsulis samaroideis, alis 4—5.6 × 0.5—0.9 cm, pubescentibus, oblongis, elliptico-lanceolatis, apice acutis, loculis seminiferis basalibus globosis, 6 mm diam., usque ad medium in calycis tubo inclusis; semine 1, 6 × 3 mm, nigro, ovoideo.

Typus : Assam, Kamrup, 16.4.1915, U. N. Kanjilal, 5479 (Holo, DD).
var. *acuta* Bhandari & Bhansali, var. nov.

Capsule samaroid, wing 4.0—5.6 × 0.5—0.9 cm, pubescent, oblong, elliptic-lanceolate, acute, basal seed chamber globose, 6 mm in diameter, enclosed by the calyx tube upto the middle. Seeds 1, 6 × 3 mm black, ovate, broad at base.

Type : Assam, Kumrup, 16.4.1915, U. N. Kanjilal 5479 (Holo, DD).

Distrib. : INDIA : Assam, Uttar Pradesh.

Exsicc. : Assam : s.l. (?) s.n. (CAL); Uttar Pradesh : Bahrich Dt., 120-150 m, 23.4. 1950, Hiratal 487 (DD); Dogari, Haldwani, Diva, 360 m, 26.4.1914, N. K. Mukerji 9937 (DD); Pawalgarh Forest, 23.4.1958, M. A. Rau 5229 (BSD).

Notes : Specimens cited above are mostly in fruits and have been identified as *Ventilago denticulata* Willd., but the fruits of *V. denticulata* have obtuse apex and girt round the middle by persistent calyx tube. The prominent character of these specimens is the acute apex of fruit which immediately distinguishes it from the fruit of the *Ventilago denticulata* var. *denticulata*.

var. bifida Bhandari & Bhansali, *var. nov.*

Differet a varietate *denticulata* fructibus 3.8—6 × 0.8—1 cm, pubescentibus, alis ad apices acutos bifidis, partibus bifidis 3.5 mm longis.

Typus : Mysore, Bellary Dist., Ramandurga, 16.2.1917 Coll. (?) 14431 (Holo, MH).

var. bifida Bhandari & Bhansali, *var. nov.*

Fruit 3.8—6.0 × 0.8—1.0 cm, pubescent; fruit wing bifid at apices, acute bifid portion 3.5 mm long.

Type : Mysore, Bellary Dist., Ramandurg, 16.2.1917, Coll. (?) 14431 (Holo, MH).

Distrib. : INDIA : Bihar, Karnataka, Madhya Pradesh, Orissa, Uttar Pradesh.

Exsicc. : Orissa : Chander, Kharda, Feb. 1881, J. S. Gamble 9256 (K!). Bihar : Bongasarium Jogle, Mar. 1899, Haines s. n. (K!); Pratap Forest, 27.1.1916, Haines 4749 (K!). Madhya Pradesh : Piplide, Khandawa Dist. 10.12.1888 (*Datlue* s. n. (K!). Uttar Pradesh : Dehra Dun, April 1897, P. W. Mackinnon s. n. (CAL!); Dehra Dun, 10.4.1897, P. W. Mackinnon s. n. (CAL!). Karnataka : Belgaum Ghats, Dr. Ritchie s. n. (K!).

var. denticulata

Fruits 3.5—5.5 × 2.0 cm, brownish golden to grey pubescent; wing oblong; seed chamber 10 mm in diameter. Seeds subglobose, 2—3 × 6 mm, black.

Type : "Samulcotta in Ostindien" Willdenow (B)

Fls. : Sept.—Mar.; *Frts.* : May—Jun.

Distrib. : INDIA : Andaman & Nicobar Islands, Assam, Bihar, Gujarat, Karnataka, Kashmir, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal.

Ecol. : Grows in thick forests up to an altitude of 700 m on rocky soils also found throughout the plains of India, chiefly in the dry forests.

Uses : Wood is used as fuel. The extract of the bark and young shoots is applied to the body as pain killer during malarial fever. The seeds yield an oil used for cooking purpose. Rings made from the tendril is worn on the finger as a cure against toothache. The bark yields a good cordage fibre.

2. *Ventilago gamblei* Suessen, in Engl. & Prantl, Nat. Pflazefam. 20d : 152. 1953; Banerjee & Mukerjee in Ind. For. 96 : 209. 1970. *Ventilago lanceolata* Gamble in Kew Bull. 134. 1916 non Merr. 1915 & Fl. Pres. Madras 2 : 218. 1918.

Climbing shrubs, branches dark, glabrous or puberulous when young. Leaves 5.0–9.5 × 2.5–4.5 cm, elliptic to oblong-lanceolate, strongly crenate, younger ones puberulous, apex acuminate or mucronate, base obtuse, unequal; lateral nerves 6–8 pairs, camptodrome near the margin; petioles 6–8 mm long, puberulous. Panicles axillary. Flowers 4–5 mm across; bracts caducous; bracteoles subglomerulate-linear. Calyx lobes 2.5 mm long, triangular, keeled within at apex. Petals 1.0–1.5 mm long. Stamens 1.0–1.5 mm long; anther connective apiculate, recurved. Disc glabrous or slightly villous. Ovary glabrous. Fruits 5.3 × 1.1 cm, mucronate, wing flat, with double line and accessory reticulations; seed chamber globose, 4 mm in diam., rusty brown tomentose. Seeds globose, 3–4 × 2.5 mm, blackish-grey.

Type : Malabar, Kannoth, Dec. 1913, C.A. Barber s.n. (MH!).

Fls. & Frts. : Jan.–Mar.

Distrib. : INDIA : Andhra Pradesh, Maharashtra, Tamil Nadu.

Notes : This species is quite distinct due to its glabrous disc and ovary. The most outstanding character is its saucer-shaped calyx tube which cups the fruit only at the base.

3. *Ventilago goughii* Gamble in Kew Bull. 1916: 134. 1916 & Fl. Pres. Madras 2: 218. 1918; Suessenguth in Engl. & Prantl, Nat. Pflanzenfam. 20d: 152. 1953; Banerjee & Mukerjee in Ind. For. 96: 210. 1970.

Climbing shrubs, minutely grey puberulous. Leaves 8.5–10.0 × 3.5 cm, apex abruptly acute or obtuse, base oblique, obscurely serrate, glabrous, minutely puberulous on veins, lateral nerves 6–9 pairs, impressed. Flowers 4–5 mm across, arranged in fascicles on panicles. Calyx lobes 2.0–2.5 mm long, triangular, keeled inside at apex. Petals 1.0–1.5 mm long, obovate. Stamens 1.0–1.5 mm long, opposite the petals; filaments short; anthers oblong, connective apiculate. Ovary villous. Capsules samaroid; wing 5.0 × 2.2 cm, oblong, grey puberulous; median line double with accessory reticulations, apex mucronate; seed chamber subglobose, grey puberulous, 1.1 × 0.9 cm. Seeds 5.3 × 3.0 mm, black.

Type : South India, Coorg, 1911, Viscount Gough s.n. (Para, K!).

Fls. & Frts. : Mar.

Distrib. : INDIA : Karnataka.

Notes : Type sheet at (K) consists of two elements :

(a) *V. goughii* Gamble (b) *V. denticulata* 514 of Wight.

4. *Ventilago madraspatana* Gaertn., Fruct. 1: 223, t. 49, f. 2. 1788; Wight, Ic. 1: t. 163. 1839; Brandis, For. Fl. 96. 1874 & Ind. Trees (Repr. ed.)

167. 1971; Lawson in Hook. f., Fl. Brit. India 1 : 630. 1875; Haines, Bot. Bih. & Or. 1 : 193. 1921; Kanjilal *et al.*, Fl. Assam 1 : 276. 1936; Gamble, Fl. Pres. Madras 1 : 218. 1918 (Repr. ed. 1 : 156. 1958); Banerjee & Mukerjee in Ind. For. 96 : 207. 1970.

Local names : Lokandi, Kanwail, (Mar.); Surati, Surati Chekka, (Tel.); Vempadam (Tam.); Poplichukay (Kan.); Keoti Kalibel (Hindi).

Large woody climbers; young branches grey pubescent or glabrous, pale grey, old stem dark grey, cracked. Leaves oblong-lanceolate or elliptic-ovate, apex acute, sub-acuminate or obtuse, base rounded or cuneate to oblique, entire or crenate, glabrous; lateral nerves 4–9 pairs, comptodromous near the margin. Inflorescence axillary and terminal panicles, occasionally with leafy bracts. Calyx lobes spreading. Petals emarginate with a tooth in the middle. Stamens 1.5 mm long, anthers oval. Disc glabrous. Ovary villous, style arms divergent or curved. Capsules samaroid, yellow to grey, blunt or muronate at apex, median line single, seed chamber globose, 2.0–2.5 mm in diam. Seed 5 × 4 mm, globose, brown, thin walled, exalbuminous, cotyledons thick, fleshy.

Notes : For the typification of *Ventilago madraspatana* Gaertn. no herbarium specimen could be traced. But from the protologue it is evident that Gaertner's concept of the species was mainly based on *Funis viminalis* Rumph. (Herb. Amboinense 5 : 3, t. 2. 1747). Gaertner cited Rumphius' t. 2, along with his own figure (Gaertn. Fruct. 1 : t. 49. f. 2). Rumphius reference (*op. cit.*) includes only fruit of the same type along with a few dissected parts. So it is preferred to treat t. 2 of Rumphius in Herb. Amboinense 5 : 3. 1747 as Lectotype. In this connection it is interesting to note Merrill's (1917) observation "that all Rumphian plants were lost and that interpretation of the species therefore had always to be based on the description and to some extent on the drawings".

It has not been possible to find any sheet from Eastern India to support its distribution as reported by Prain (1903), Haines (1921) and Kanjilal *et al.* (1936). However, the key and description given by Prain and Haines, are in some way reliable, those followed by Kanjilal *et al.* are misleading. In some cases these reports are based on misidentifications, e.g., all sheets from Assam, are not found to be *V. madraspatana* and even those annotated by U. N. Kanjilal himself are not *V. madraspatana*. A large number of collections from Andamans preserved in CAL, so far identified as *V. madraspatana*, are actually *V. denticulata*.

KEY TO THE VARIETIES

- | | |
|--------------------------------------|-----------------------------|
| 1a. Apex of the fruit wing not bifid | ...var. <i>madraspatana</i> |
| 1b. Apex of the fruit wing bifid | ...var. <i>fructifida</i> |

var. madraspatana

Woody climbers, 7–11 m high. Leaves $1.8\text{--}8.0 \times 1.2\text{--}3.0$ cm, entire or crenate; petioles 3–6 mm long. Flowers 5–6 mm across, yellowish-green; pedicels 4 mm long. Calyx lobes 1.5–2.5 mm long, spreading. Petals 1.0–1.5 mm long. Stamens c. 1.5 mm long. Fruit wing $3.0\text{--}4.5 \times 0.6\text{--}0.8$ cm, elliptic-oblong.

Fls. : Sep.–Mar; *Frts.* Mar.–May.

Ecol. : Throughout the plains, chiefly in the drier hilly forests, ascending upto an altitude of 900 m.

Distrib. : INDIA : Andhra Pradesh, Andamans, Assam, Bihar, Karnataka, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh, W. Bengal; BURMA, SRI LANKA, INDONESIA.

Uses : Cordage is made of the bark. The root of this species is collected and used as a red dye in Karnataka and Tamil Nadu. The root bark produces a valuable dye which is used for dyeing tasar silk. The bark is also used in native medicine.

var. fructifida Santapau in Kew Bull. 1949 : 340. 1949 *et in Rec. Bot. Surv. India* 16(1) : 52. 1953.

Climbers, branches grey or ferruginous puberulous. Leaves 7×3.8 cm, bluntly acuminate crenate from half way above, glabrescent, midvein hairy. Flowers not seen. Fruits 5.5×1.0 cm, globose, glabrescent, wing flat, leathery, brownish puberulous, the apex bifid and divergent, the splitting comes down for about 1 cm. Seed 1 per seed chamber, 4 mm in diam., globose, brownish-black.

Fls. & Frts. : Mar.–May.

Distrib. : INDIA : Maharashtra.

Exsicc. : Maharashtra : Khandala, ravine below Echo point 5.5.1951, H. Santapau 12767 (BLAT); Khandala water pipe, 25.5.1960, Collector? 4972 (BLAT).

12. ZIZIPHUS

Tourn. ex Mill., Gard. Dict. Abr. ed. 3. 1754. Roxb. Fl. Ind. 2 : 353. 1824; Brandis, For. Fl. 84. 1874 & Ind. Trees 169. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 632. 1875; Gamble, Man. Ind. Timb. 180. 1922 (Repr. ed.) & Fl. Pres. Madras. 1 : 218. 1918 (Repr. ed. 1 : 157. 1957); Cooke, Fl. Pres. Bombay 1 : 240. 1902 (Repr. ed. 1 : 225. 1958); Kanjilal, For. Fl. 122. 1969 (Repr. ed.).

Shrubs or trees, rarely decumbent or creeping; branches often zig-zag. Leaves alternate or opposite, entire or crenate, coriaceous, 3–5-nerved

from the base, petiolate; stipules either single or rarely both spinescent, spines sharp, curved or straight, recurved one shorter. Inflorescence axillary or terminal cymes or thyrses. Flowers pentamerous, bisexual or polygamous, perigynous, pedicellate. Petals cucullate, incurved or deflexed, rarely absent. Stamens included or excluded, inserted below the disc. Disc flat or pitted, 5 or 10-lobed, or rarely entire, often with 10 depressions covering the receptacle, margins free. Ovary immersed in the disc and adnate to its base, 2-4-loculed; style 2-4, free, diverging or combined; stigma papillose. Drupes, globose or oblong, putamen woody or horny, 1-3-celled. Seeds 1-3, plano-convex, testa thin, brittle, smooth, shining, exaluminous or with scanty endosperm; cotyledons thick; radicle short.

Distrib. : c. 135 species in temperate and tropical parts of the world chiefly in Asia and America, a few extending to the Pacific Islands and Australia. 17 species in India.

Pollen : 3-zonocolporate; P/E 20-36/20-32 μm , oblate to prolate spheroidal, os circular, sexine as thick as nexine, exine faintly reticulate or psilate (Parveen & Bhandari in Bir, Rec. Res. Pl. Sci. 692-93, 1979).

KEY TO THE SPECIES

- 1a. Cymes axillary, sessile or shortly pedunculate :
- 2a. Flowers in sessile, cymes or cymose fascicles :
- 3a. Leaves glabrous beneath. Disc not pitted :
- 4a. Branchlets fasciculate ... *Z. jujuba* 9
- 4b. Branchlets not fasciculate :
- 5a. Leaves elliptic, obtuse, basal nerves prominent beneath and continued to the apex ... *Z. glabrata* 6
- 5b. Leaves ovate, not obtuse, basal nerves not prominent beneath and not continued to the apex ... *Z. oxyphylla* 13
- 3b. Leaves tomentose beneath. Disc pitted :
- 6a. Leaves obliquely ovate, entire or minutely denticulate, base oblique :
- 7a. Transverse nerves at right angle to midrib ... *Z. brunoniania* 3
- 7b. Transverse nerves not at right angle to midrib ... *Z. oenoplia* 12
- 6b. Leaves not obliquely ovate, serrulate, base rounded :

- 8a. Leaves truncate at apex ... *Z. truncata* 15
- 8b. Leaves not truncate at apex :
- 9a. Leaves fuscous-tomentose beneath ... *Z. mauritiana* 10
- 9b. Leaves grey-tomentose beneath ... *Z. nummularia* 11
- 2b. Flowers in pedunculate cymes :
- 10a. Style 3-cleft, distinct or nearly so :
- 11a. Leaves and fruits tomentose ... *Z. xylopyra* 17
- 11b. Leaves glabrous except on nerves beneath.
Fruits glabrous :
- 12a. Plants armed with thorns ... *Z. horrida* 7
- 12b. Plants unarmed ... *Z. caracutta* 4
- 10b. Style 2-cleft, connate up to the middle :
- 13a. Ovary villous :
- 14a. Leaves acuminate. Petals absent. Fruits obovoid, pointed at apex ... *Z. apetala* 2
- 14b. Leaves obtusely caudate-acuminate. Petals present. Fruits globose, not pointed at apex ... *Z. andamanica* 1
- 13b. Ovary glabrous :
- 15a. Leaves more than 5 cm long, lateral nerves continuous to the apex. Petioles up to 7 mm long ... *Z. incurva* 8
- 15b. Leaves less than 5 cm long, lateral nerves end near the apex. Petioles more than 7 mm long ... *Z. williamii* 16
- 1b. Cymes terminal or flowers in lateral panicles, distinctly pedunculate :
- 16a. Petals absent, primary nerves branched ... *Z. rugosa* 14
- 16b. Petals present, primary nerves unbranched ... *Z. funiculosa* 5
1. *Ziziphus andamanica* Bhandari & Bhansali, nom. nov.
Z. glabra King in Jour. Asiat. Soc. Beng. 65: 376. 1897 non Roxb. 1824.

Fig. 21

Scandent shrubs, young branches puberulous, spine solitary, recurved, 2–3 mm long. Leaves 5.5–9.3 × 3.2–43 cm, ovate-oblong, rarely ovate-lanceolate, serrulate or subentire, glabrous, shining, except the pubescent

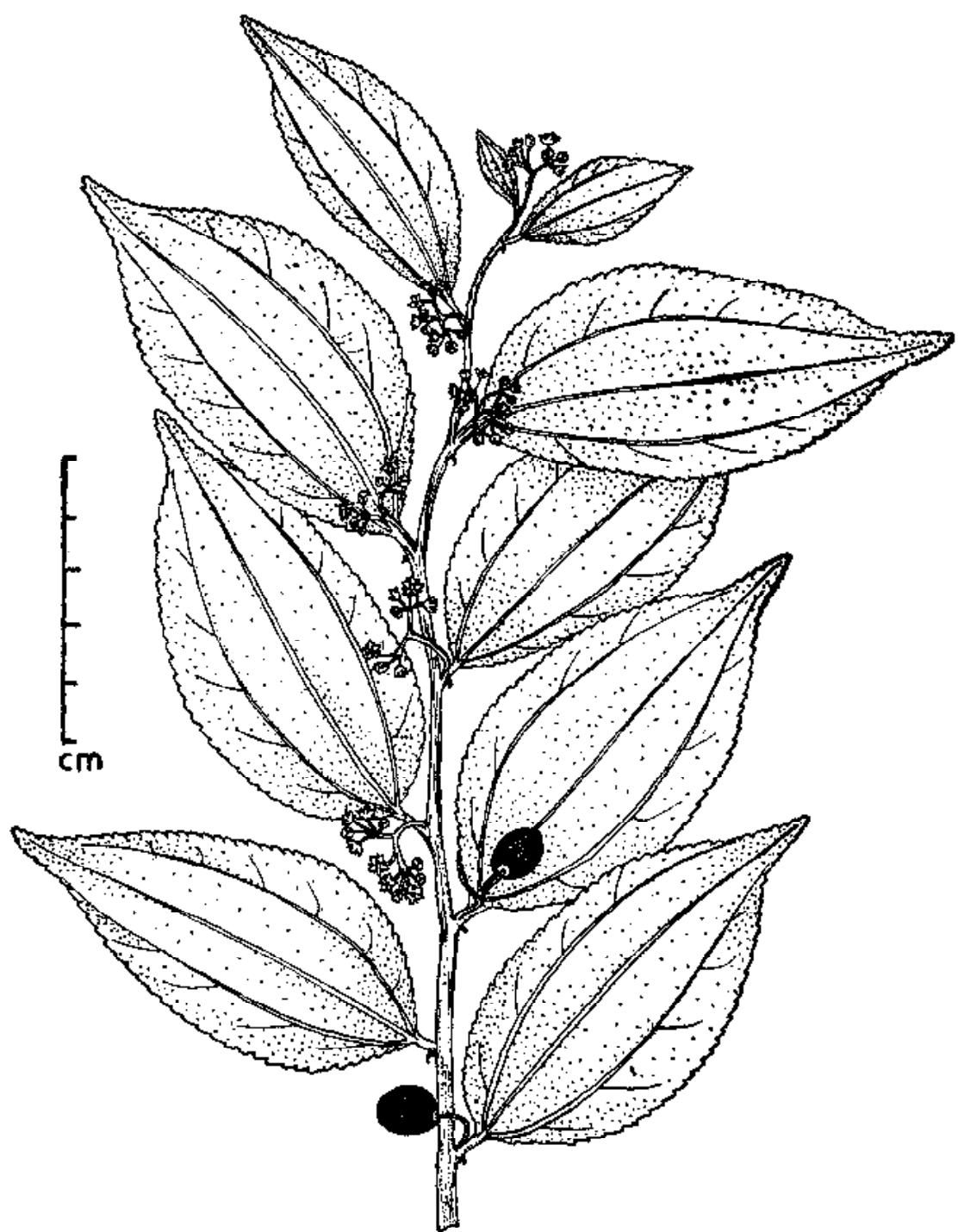


Fig. 21. *Ziziphus andamanica* Bhand. & Bhan.

midvein, base slightly narrowed, oblique, 3-nerved; transverse nerves parallel, two outer primary nerves with comptodromous secondary nerves diverging at 30°-40°, angle; petioles 6—8 mm long, pubescent. Inflorescence 20—25-flowered, pubescent cymes. Flowers 5 mm across, peduncles longer than the petiole, pedicels 2 mm long, accrescent. Calyx lobes 2 mm long, acute, ovate, keeled inside, thickened at apex, pubescent without. Petals 1.5 mm long. Stamens equal to petals, filaments linear. Disc glabrous, hairy at centre with 10 obscure teeth at the edge. Ovary bicarpellary, 2-loculed. Drupes 1.5 × 1.3 cm, glabrescent, yellow, 1-celled. Seed 1, 8 mm in diam., compressed, brown.

Type : Andaman, Port Blair, 20.3.1884, King 194 (CAL).

Fls. : & *Frt.* : Oct.—Apr.

Distrib. : INDIA : Andman Island, Assam.

Ecol. : Damp places on the margins of canals.

Exsicc. : Andaman Islands : Andaman, 1884, King s. n. (CAL); Havelock Island, 23.2.1916, C. E. Parkinson 1030 (CAL); S. Andaman, Hill Jungle, Hobdaypur, 4.3.1893, King s. n. (CAL); S. Andaman, 1900, Prain 62 (CAL); S. Andaman 27.10.1897, R. L. Heining s. n. (CAL); S. Andaman, Corbys Cove, Hill Jungle, 26.3.1892 Coll. s. n. (CAL); locality? King s. n. (CAL); Andaman, 6.2.1899, Prain s. n. (CAL); Assam, Uakum Dihing river, 16.3.1894, G. A. Gammie 46 (CAL).

Notes : King (1897) while describing his *Z. glabra* stated that "this species resembles *Z. glabra* Roxb., but the outer nerves of the leaves are broadly branched outwards and the fruit is minutely tomentose. The specimens of this are scanty. When more material of this and *Z. glabra* Roxb. are obtained, it may be found impossible to keep this up as more than a variety of the older specimen". King's *Z. glabra* as drawn on plate 8 (*op. cit.*) is certainly very different from Wallichian specimen no. 4242, the Holotype of which has been examined at K. King's name, being occupied by Roxburgh's plant is a latter homonym and, therefore, a new name *Z. andamanica* is proposed here.

2. *Ziziphus apetala* Lawson in Hook. f., Fl. Brit. India 1 : 635. 1875;
Brandis, Ind. Trees 171. 1971 (Repr. ed.). Fig. 22

Climbing shrubs, armed, young branches ferruginous-tomentose; prickles recurved, 3—4 mm long, base tomentose. Leaves 4.2—12.5 × 1.8—7.0 cm, obliquely ovate or elliptical, mucronate, oblique at base, glabrous above, ferruginous-pubescent below membranous, serrate, basally 3-nerved, primary and secondary veins camptodromous; petioles 8 mm long, brownish hairy. Inflorescence 10—15-flowered, axillary, dichotomous cymes, peduncles up to 3 mm long, brown pubescent. Flowers 6—7 mm across, pedicels 4 mm long. Calyx lobes 2—3 mm long, deltoid, acute, glabrous

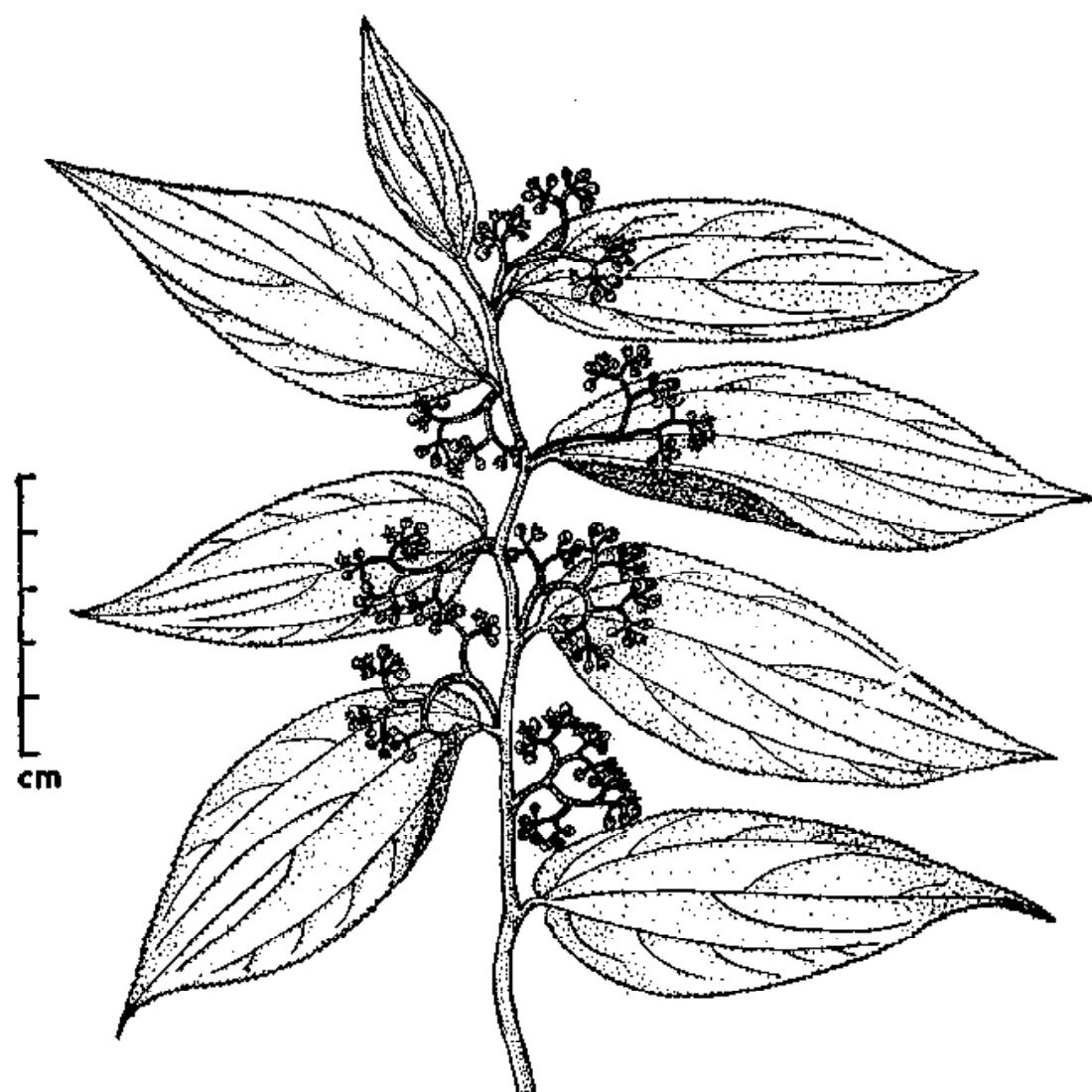


Fig. 22. *Ziziphus operata* Lawson

within, thickened along the margin and apex. Stamens equal to the calyx. Disc 5-lobed, hairy towards ovary. Ovary bicarpellary, unilocular, brownish hairy at base; style hairy upto the middle. Fruits compressed, 1-celled, 1.2—1.6 cm in diam., 1.5 cm long, glabrous. Seeds 1, compressed, 11 mm long, 8 mm thick.

Distrib. : INDIA : Assam, W. Bengal.

Uses : Ripe fruit is eaten.

3. *Ziziphus brunoniana* Brandis, Ind. Trees 169. 1971 (Repr. ed.).

Climbing shrubs, branchlets strigose, alternate; internodes 1.0—2.3 cm long; spines solitary or in pairs, 2—3 mm long, fulvous tomentose at base. Leaves alternate, 2.0—4.5 × 1.0—2.7 cm, acute to sub-acuminate or distantly serrulate, serratures callous tipped, glabrous above, appressed fulvous hairy beneath, basally 3-nerved; secondary veins from the outer 2 primary veins camptodromous, diverging at 30°-40° angle; petioles 3—4 m long, rusty tomentose. Inflorescence 5—10-flowered axillary fascicles. Flowers sessile. Calyx lobes 1.2—1.5 mm long, deltoid, thickened at apex, keeled up to the middle, pubescent without. Petals 0.8 mm long. Stamens shorter than petals, anthers dorsifixed. Disc 10-lobed, glabrous, massive. Ovary bicarpellary, bilocular, glabrous; style 2-cleft, united above the middle; stigma obtuse. Drupes 6—8 mm long, obovate, glabrous, 2(-1)-celled. Seeds 2, black, 4 × 3 mm, compressed.

Type : E. Silhet, 1800, Wallich 4246 F (CAL !).

Fls. & Frts. : Oct.—Dec.

Distrib. : INDIA : Andaman Islands, Assam, Tripura.

Exsicc. : Andamans : S. Andaman, March 1901, R. L. Heining 635 (CAL). Tripura : Agartala, Rangamura Tipperah Hill, 150—240 m, 31.11.1914, P. M. Debbarman, 568 (CAL); Tipperah Hill, 23.10.1915, P. M. Debbarman 922 (CAL).

4. *Ziziphus caracutta* Roxb., Fl. Ind. 2 : 361. 1824 et Fl. Ind. 1 : 612. 1832. *Ziziphus xylopyra* var. *glaberrima* Sedgw. in Ind. For. 45 : 71. 1919; Sant. in Kew Bull. 1948. 489-490. 1949. *Ziziphus glaberrima* Sant. in Journ. Bomb. Nat. Hist. Soc. 51 (4) : 803. 1953 et Fl. Saurashtra 94. 1962.

Fig. 23

Local name : Bara-bera (Hindi)

Small trees, up to 7.5 m high, rarely armed, branches glabrescent. Leaves 3.2—6.0 × 1.8—2.8 cm, ovate-elliptic, crenate, acute, apex obtuse or slightly emarginate, base acute or rounded and very unequal, 3-nerved,

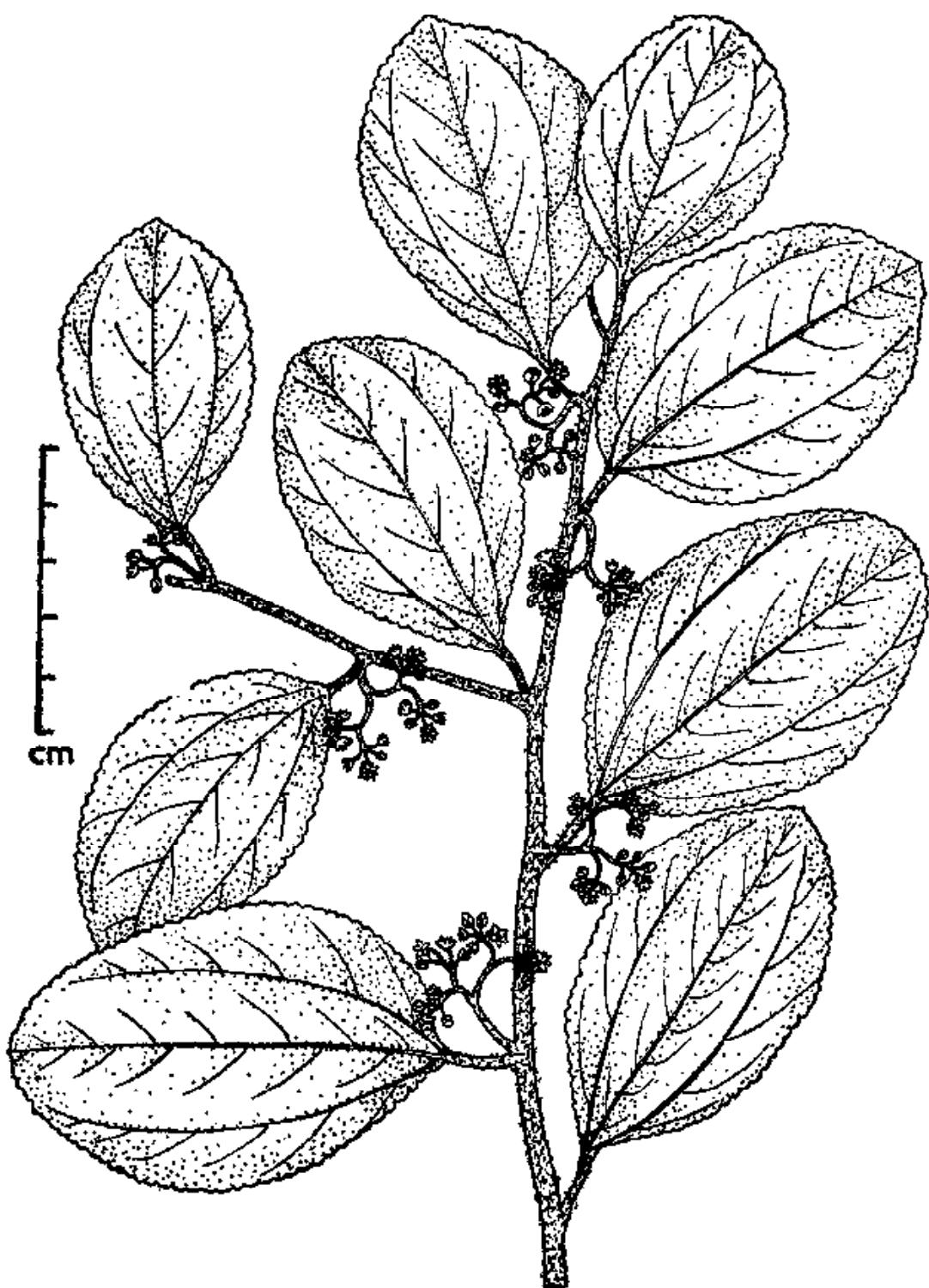


Fig. 23. *Ziziphus caracutta* Roxb.

the nerves not converging towards apex; petioles 6 mm long, tomentose; stipules 5 mm long, filiform, caducous, scars prominent. Inflorescence axillary fascicles, peduncles upto 12 mm long. Flowers 5 mm across, pale green. Calyx lobes 2.0–2.5 mm long, acute, thickened at apex, keeled up to the middle, glabrous within, pubescent without. Petals 2 mm long. Stamens equal to and opposite the petals; filaments somewhat thicker, anthers minute, 2-celled, dorsifixed. Disc 5-lobed, glabrous. Ovary tricarpellary, trilocular, stylar arms connate up to the middle. Drupes green, when ripe greyish-brown or black, globose or slightly compressed at poles, 21 mm in diam., pericarp woody. Seeds 3, black, orbicular, 8 mm in diam., 2mm thick, compressed.

Fls. : Mar.—Apr.; *Frt.s.* : Apr.—Jun.

Distrib. : INDIA : Bihar, Karnataka, Maharashtra, Orissa, Uttar Pradesh.

Ecol. : Scattered from near base to the top of the hills; also in scrub jungle near sea coast.

Notes : *Z. caracutta* Roxb. was described in 1824. Later authors reduced it as a synonym of *Z. xylopyrus* var. *glaberrima*. Santapau (1953) raised it to the status of a species *Z. glaberrima*. A critical study of the above two taxa reveals that they are conspecific and therefore, they are treated here under a single taxon *Z. caracutta*, being the earliest valid name.

5. *Ziziphus funiculosa* Buch.-Ham. ex Lawson in Hook. f., Fl. Brit. India 1 : 635. 1875; Badhwar & Fernandez, Edible Wild Pl. Himal. 116. 1964; Brandis, Ind. Trees 172. 1971 (Repr. ed.).

Local names : Abor, Miri (Tatke-riubi); Bons-boguri (Asm.); Ingsu-dompo (Mikir).

Large climbing shrubs; branches slender, golden silky hairy, glabrous with age, internodes 1—5 cm long; prickles stout, recurved, glabrous or slightly pubescent at base. Leaves alternate, 5—10 × 2—4 cm, obliquely ovate or elliptic-oblong, oblique at base, serrate, glabrous, slightly pubescent on nerves, basally 3-nerved, campylodromous; petioles 0.8—1.0 cm long, pubescent. Inflorescence panicles. Flowers 5 mm across. Calyx lobes 2 mm long, deltoid, acute, glabrous within, tomentose without, thickened at the margins and at triangular apex. Petals 1.5 mm long, spreading, obovate. Stamens 5, equal to petals, filaments flat. Disc 5-lobed, sometimes faintly 10-lobed, glabrous, thickened around the ovary. Ovary bicarpellary, bilocular, glabrous; style 2-cleft nearly to base, curved near apex. Drupes 1.3—1.8 cm long, egg-shaped, yellow, 1-celled, glabrous, with scanty pulp. Seeds 1, black, 1 × 1 cm, compressed.

Type : Silhet, Wallich 4234 (K-W!).

Fls. : Mar. — Jun. *Frt.s.* : Jul. — Oct.

Distrib. : INDIA : Assam, Kashmir, W. Bengal; BANGLADESH, BURMA, MALAYSIA, BORNEO.

6. *Ziziphus glabrata* Heyne ex Roth, Nov. Pl. Sp. 159. 1821; Wight & Arn. Prodr. 162. 1834; Wight, Ic. 1 : 15-16. t. 282. 1840. Bedd., Fl. Sylv. 118. 1871; Lawson in Hook. f., Fl. Brit. India 1 : 633. 1875; Sant. Fl. Saurashtra 92. 1962; Brandis, Ind. Trees 170. 1971 (Repr. ed.). *Ziziphus trinervia* Roxb., Fl. Ind. 364. 1824 et 1 : 614. 1832; Gamble, Man. Ind. Timb. 182. 1922 (Repr. ed.) et Fl. Pres. Madras 1 : 220. 1918 (Repr. ed. 1 : 157). *Ziziphus trinervia* var. *glabratus* Heyne in Roth, Nov. Sp. 159. 1821.

Trees, c. 6 m high, unarmed; branchlets glabrous. Leaves alternate, 1.8—10.3 × 1.3—5.2 cm, lanceolate or ovate-oblong, apex acute, base rounded or subcordate, crenulate, the crenations tipped with callous points, glabrous, shining, bifarious, basally 3-nerved, primary nerves campylodromous; petioles 3—9 mm long, stipules filiform deciduous. Inflorescence axillary fascicles, peduncles 2—3 mm long. Flowers 5—6 mm across, slightly puberulous, yellowish-green, pedicels 4—5 mm long. Calyx lobes 2—3 mm long, glabrous within, keeled inside up to middle. Petals 1—2 mm long, obtiangular, acute or rounded at apex. Stamens c. 3 mm long; filaments flattened. Disc faintly 10-lobed, glabrous, fleshy. Ovary glabrous, style 2-cleft, connate up to the middle, curved. Fruits 10—11 mm in diam., globose or obovate, considerably flattened, 1—2-loculed, with a sweet gelatinous pulp. Seeds brownish, soft, embryo erect, cotyledons nearly orbicular, radicle obovate.

Fls. : Sep. — Dec.; *Frt.s.* : Dec.—Jan.

Distrib. : INDIA : Andamans, Gujarat, Himachal Pradesh, Kashmir, Maharashtra, Punjab, Rajasthan, Tamil Nadu, W. Bengal; BHUTAN, BANGLADESH.

Ecol. : Grows in dry plains and in grasslands at low elevations.

Uses : Fruits are noted for their emollient and pectoral properties. They are rather sour, when dried become somewhat sweet. Cultivated varieties have sweet aromatic, mealy whitish pulp. They are eaten fresh or sun dried and used in off season. They are also eaten boiled with millet or rice, stewed or baked. A decoction of the leaves is given to purify the blood and as an alternative in venereal diseases.

7. *Ziziphus horrida* Roth, Nov. Sp. 159. 1821; Lawson in Hook. f., Fl. Brit. India 1 : 638. 1875; Cooke, Fl. Pres. Bombay 1 : 243. 1902 (Repr. ed. 1 : 258. 1958).

Shrubs or small trees, branches slender, divaricate, glabrous; thorns paired, one straight 1.7 cm long, other recurved 5 mm long, glabrous, hard, shining, base broad. Leaves alternate, $0.8 - 1.8 \times 0.7 - 1.8$ cm, broadly elliptic or suborbicular, apex acute, base rounded, crenate, basally 3-nerved; petioles 2 mm long. Flowers 4 mm across, pedicels shorter than the peduncles. Calyx lobes 2 mm long, acute, deltoid, pubescent without, glabrous within, keeled up to the middle, thickened at the apex and margin. Petals 1.5 mm long, broadly obovate, very long clawed. Stamens equal to petals. Disc 5-angled, not pitted. Ovary tricarpellary, trilocular. Drupes globose, woody, 3-celled. Seeds 3, black, compressed.

Distrib. : INDIA : Maharashtra.

Ecol. : Found only on hills.

Notes : Lawson (*op. cit.*) regards this as a very remarkable distinct species which G. Watt found only in vegetative condition from Mao, Manipur, 1800 m (Watt. 7429). Cooke mentions to have seen only one specimen of this species from Bombay in K, but without precise information. No specimen of this species could be examined and it has been included solely on the authority of Lawson and Cooke.

8. *Ziziphus incurva* Roxb., Fl. Ind. 2 : 364. 1824 et Fl. Ind. 1 : 614. 1832; Lawson in Hook. f., Fl. Brit. India 1 : 635. 1975; Brandis, Ind. Trees 170. 1971 (Repr. ed.). *Z. paniculata* Buch.-Ham. ex D. Don, Prodr. Fl. Nep. 190. 1825.

Fig. 24

Local name : Kookusee (Nep.).

Very large shrubs or small trees, usually unarmed, branches stiff and stout, bark smooth, grey; young shoots, petioles and main nerves strigose. Leaves $5.6 - 11.3 \times 2.2 - 5.2$ cm, ovate or ovate-oblong, apex acute to acuminate, rounded or acute at base, unequal, glabrous, serrulate with hard brown point, shining above, hairy on nerves beneath, membranous, black on drying, obscurely 5-nerved; petioles pubescent; stipules linear, villous, deciduous. Inflorescence dichotomous 5–10-flowered cymes, peduncles 15 mm long. Flowers 5 mm across; pedicels 2 mm long; bracts ovate. Calyx lobes 2.0–2.5 mm long, deltoid, keeled up to the middle, acute, rusty tomentose without, glabrous within. Petals 1.0–1.5 mm long, subcucullate, convex at distal end. Stamens equal to petals, anthers dorsifix. Disc 10-lobed, glabrous. Ovary bicarpellary, stylar arms straight. Drupes 13 mm in diam, ellipsoid, 8 mm long, 2-celled, smooth, shining, putamen thick, hard. Seeds compressed, black.

Type : Nepal, Wallich 4237 (K-W!).

Fl. : Apr.–Aug.; *Frts.* : Oct.–Dec.

Distrib. : INDIA : Assam, Tamil Nadu; NEPAL.

Ecol. : Frequently found on hill tops.

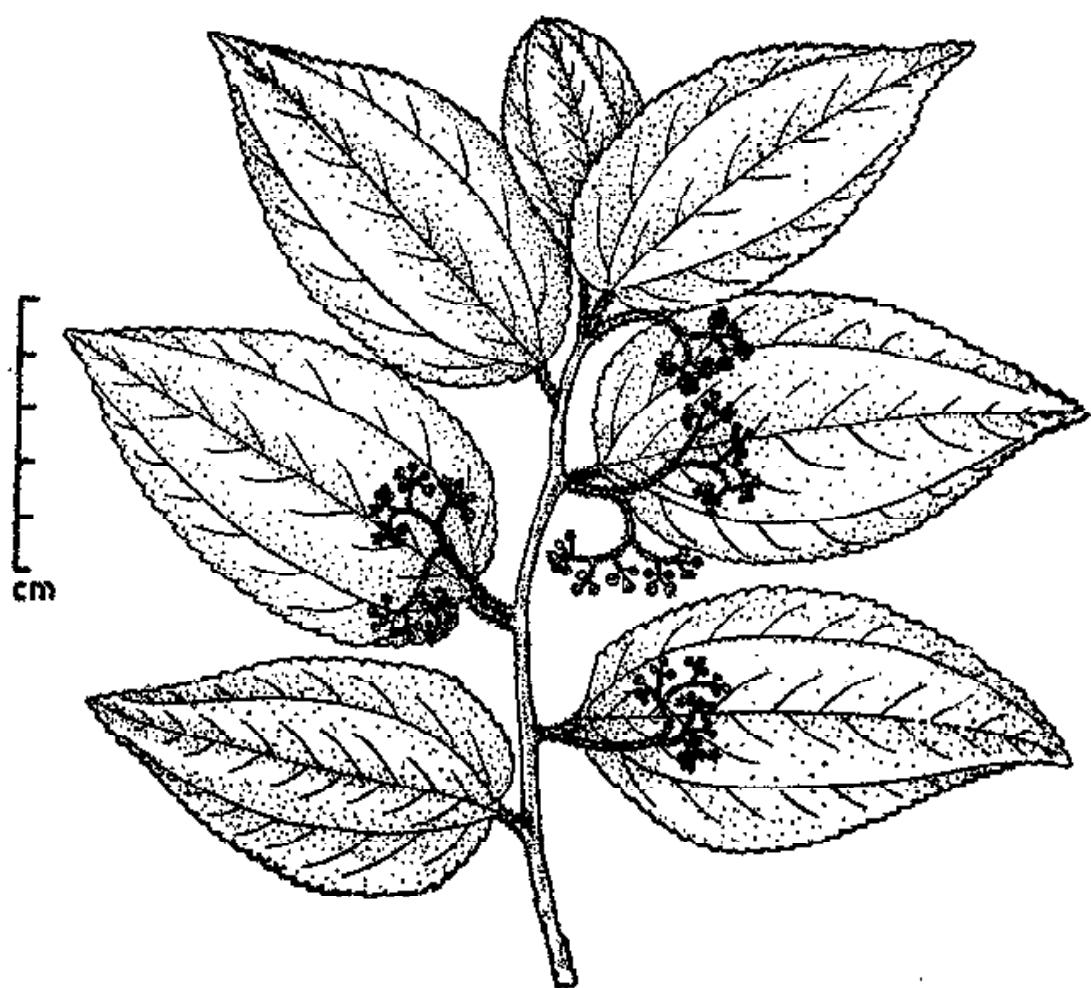


Fig. 24. *Ziziphus incurva* Roxb.

9. *Ziziphus jujuba* Mill. Gard. Dict. ed. 8, 1768; Sant. in Journ. Bombay Nat. Hist. Soc. 51 : 802. 1953. *Z. sativa* Gaertn., Fruct. 1 : 202. 1788. *Z. vulgaris* Lam., Encycl. 3 : 317. 1789; Roxb., Fl. Ind. 2 : 358. 1824 et 1 : 609. 1832; Lawson in Hook. f., Fl. Brit. India 1 : 633. 1875; Gamble, Man. Ind. Timb. 182. 1922 (Repr. ed.); Brandis, Ind. Trees 171. 1971 (Repr. ed.).

Local name : Sinjli, Simli, Ban, Beri, Phitni, Ber, Kandika, Kandiari, Birari (Punj.).

Small trees or shrubs, 7.5—9.0 m high, glabrous; branches flexuous often with dull grey cuticle; prickles unequal, one straight, about 3 cm long, the other recurved, c. 0.7 cm long. Leaves 1.3—5.0 × 0.7—7.3 cm, obliquely ovate-lanceolate, glabrous, apex obtusely acute, base slightly acute or rounded, crenulate, basally 3-nerved, primary and secondary nerves campylodromous; petioles 2—4 mm long. Inflorescence 2—12-flowered axillary fascicles. Flowers 5 mm across, glabrous pedicels 1—2 mm long, bracts subulate. Calyx lobes 1.5 mm long, deltoid, acute, keeled within to the base, thickened at margin and triangular apex. Petals 1.2 mm long. Stamens equal to petals, anthers dorsifixed. Disc thin, 5-lobed, sometimes faintly 10-lobed, glabrous lobes emarginate. Ovary bicarpellary, bilocular, style 2-cleft, connate up to the middle, arms curved at apex. Drupes dark red or black, 1.7 × 1.0—1.5 cm, ovoid-oblong, succulent, obtuse at both ends, glabrous; kernel 2-celled, rugose. Seeds 2, compressed, black.

Fls. : Mar.—June.; *Frls.* : Throughout the cold season.

Distrib. : INDIA : Himachal Pradesh, Kashmir; PAKISTAN, AFGHANISTAN, IRAN, CHINA, JAPAN, S. EUROPE, MONGOLIA.

Chr. No. : 2n = 42, 72, 96 (Srinivasan in Cur. Sci. 21 : 224. 1952; Moringa *et al.* in Cytologia 1 : 16. 1929).

10. *Ziziphus mauritiana* Lam., Encycl. 3 : 319. 1789. *Rhamnus jujuba* Linn., Sp. Pl. 194. 1753. *Ziziphus jujuba* (Linn.) Gaertn., Fruct. 1 : 203. 1788 non Mill. 1768; Roxb., Fl. Ind. 2 : 357. 1824 et Fl. Ind. 1 : 608. 1832; Wight, Ic. 1 : t. 99. 1838; Dalz. & Gibbs., Bombay Fl. 49. 1861; Lawson in Hook. f., Fl. Brit. India 1 : 632. 1875; Gamble, Fl. Pres. Madras 1 : 219. 1918 (Repr. ed. 1 : 157. 1957); Cooke, Fl. Pres. Bombay 1 : 240. 1902 (Repr. ed. 1 : 256. 1958); Kanjilal, For. Fl. 123. 1969 (Repr. ed.).

Local names : Ber, Bordi (Guj.); Dieng-Soh-broi (Kh.); Guter, Khalis (Kumaon); Thakri-arong (Mikir); Unab (Punj.); Thai-Gangil (Kachari); Theng-khi (Garo); Bagri (Beng.); Boguri (Miri & Asm.); Gamge-asing (Abor).

Large shrubs or trees; bark dark grey or nearly black, with deep vertical cracks, reddish and fibrous inside, younger parts rusty tomentose; spines solitary or in pairs, straight or one of the pair recurved; nodes slightly enlarged around the leaf scars. Leaves alternate, basally 3-nerved; stipules spinescent. Inflorescence short axillary cymes or 10–13-flowered fascicles. Flowers 4–6 mm across, green-white; pedicels 2–5 mm in flowers, 3–7 mm in fruits, tomentose. Calyx lobes glabrous within tomentose without, tube campanulate. Petals 1.0–1.5 mm long, spatulate. Stamens equal to petals. Disc distinctly 10-grooved, fleshy. Ovary bicarpellary, bilocular, glabrous; style short, 2-cleft, united to the middle; stigmatic lobes curved. Drupes 2 (–1)-celled; kernel irregularly furrowed with a hard, thick bony shell. Seeds 1 or 2, compressed.

KEY TO THE VARIETIES

- 1a. Flowers born in cymes; peduncles more than 6 mm long var. *pedunculata*
 - 1b. Flowers born in fascicles; peduncles less than 2 mm long :
 - 2a. Leaves pubescent above var. *pubescens*
 - 2b. Leaves glabrous above :
 - 3a. Mature fruits exceeding 1 cm in diameter var. *mauritiana*
 - 3b. Mature fruits less than 1 cm in diameter var. *fructicosa*
- var. *fructicosa* (Haines) Sebast. & Balak. in Ind. For. 89 : 525. 1963.
Z. jujuba Lam. var. *fructicosa* Haines, For. Fl. Chotanagpur 270. 1910.
 et in Bot. Bih. 2 : 198. 1921; Gamble, Fl. Pres. Madras 1 : 220. 1918
 (Repr. ed. 1 : 157. 1957). *Z. mauritiana* Lam. var. *fructicosa* (Haines)
 Raizada & Saxena in Ind. For. 92 : 326. 1966. *nom. illeg.*

Local name : Jhar Bari (Hindi)

Branched thorny shrubs, c. 1.0–1.5 m high. Leaves 2–3 × 1–2 cm, variable in shape, serrulate, tomentose beneath. Fruits 7–10 mm in diam., globose, yellow or red, shining.

Type : India, Bihar, Ranchi, 28.8.1818, Haines 4409 (K).

Fls. : Aug.–Sept.; *Frt.s.* : Dec.–Feb.

Distrib. : INDIA : Andhra Pradesh, Madhya Pradesh, Orissa, Tamil Nadu, Uttar Pradesh,

var. *mauritiana*

Evergreen trees, 5–15 m high; internodes 2.0–2.8 cm long. Leaves 3–6 × 1.5–4.0 cm, broadly elliptic or ovate, serrulate or entire, rounded

at both ends, often mucronate at apex, densely brown or white silky tomentose beneath; petioles 8–11 mm long. Peduncles 1–5 mm long. Flowers 4–6 mm across. Calyx lobes 1.5–2.0 mm long. Drupes 1–2 cm in diam., globose or spherical, fleshy, glabrous, dark brown, orange or red when ripe.

Type : Ceylon, Hermann 89 (BM!).

Distrib. : INDIA : Throughout; SRI LANKA, PAKISTAN, AFGHANISTAN, CHINA, AUSTRALIA, TROPICAL AFRICA.

Ecol. : Extremely common in dry places. There are nearly 30 known cultivars.

Chr. No. : $2n = 48$ (Srinivasan in Cur. Sci. 21 : 224, 1952).

Uses : The timber is hard, reddish, and is much valued for agricultural implements, fuel and charcoal. The fruit is eaten. Lac is produced on its branches. The bark is used as dye; root is used as febrifuge in native pharmacy. A gum exudes from the trunk. In South India oil is extracted from the kernel. The leaves are much valued as cattle fodder. But the tree is mainly cultivated for its fruits; the pulp is nearly sweetish, with a pleasant taste.

Notes : The name *Z. jujuba* Lam., under which name this tree is known in our floras, cannot be used for this species, as it was previously used for another taxon of Southern Europe and Africa by Miller. It is Miller's plant that goes under the English name of the 'common Jujube'. It is extensively cultivated throughout India for its fruit, and there are nearly 30 named cultivars.

var. *pedunculata* Bhandari & Bhansali, var. nov.

Dissert a varietate *mauritiana* foliis 5.3–9.8 × 2.8–4.3 cm, supra glabris, infra tomentosis, apice obtusis, basi cuneatis, floribus in cymis pedunculatis axillaribus, pedunculis 6–8 mm longis; fructibus 3.4 × 1 cm, ovato-oblongis, drupaceis, apice acutis; semine, compresso, elongato, nigro.

Typus : Sin. loc., 23.9.1909, G.L. Law 3074 (CAL!).

var. *pedunculata* Bhandari & Bhansali, var. nov.

Leaves 5.3–9.8 × 2.8–4.3 cm, glabrous above, tomentose beneath, apex obtuse, base cuneate. Flowers in axillary cymes, peduncle 6–8 mm long, pubescent. Drupes 3.4 cm long, 1 cm thick, ovate-oblong, pointed at apex. Seed 1, compressed, elongate, black.

Type : Sin. loc. 23.9.1909, G.L. Law 3074 (CAL!).

Fls. & Frts. : Aug.—Mar.

Distrib. : INDIA : Bihar, Delhi, Madhya Pradesh, Punjab, Rajasthan, Tripura, Uttar Pradesh..

var. pubescens Bhandari & Bhansali, *var. nov.*

Differet a varietate *mauritiana* foliis 2.1—4.2 × 1.3—4.1 cm, supra pubescentibus, infra lanato-tomentosis, margine integris, apice obtusis.

Type : Hassanur, Coimbatore, 22.8.1914, *Coll. (?) 10551 (MH!)*.

var. pubescens Bhandari & Bhansali, *var. nov.*

Leaves 2.1—4.2 × 1.3—4.1 cm, pubescent above, woolly tomentose beneath, margin entire, apex obtuse.

Type : Hassanur, Coimbatore, 22.8.1914. *Coll. (?) 10551 (MH!)*.

Fls. & Frts. : Aug.—May.

11. *Ziziphus nummularia* (Burm. f.) Wight & Arn., Prodr. 162. 1834; Brandis, For. Fl. 88. 1874 & Ind. Trees 170. 1971 (Repr. ed.); Dalz. & Gibbs., Bombay Fl. 49. 1861; Lawson in Hook. f., Fl. Brit. India 1: 633. 1875; Gamble, Man. Ind. Timb. 182. 1922 (Repr. ed.) & Fl. Pres. Madras 1: 220. 1918 (Repr. ed. 1: 158. 1957); Sant., Fl. Saurashtra 93. 1962; Maheshwari, Fl. Delhi 102. 1963. *Rhamnus nummularia* Burm. f., Fl. Ind. 61. 1768. *Ziziphus rotundifolia* Lam., Encycl. 3: 319. 1789; Cooke, Fl. Pres. Bombay 1: 241. 1902 (Repr. ed. 1: 257. 1958).

Local names : Bal, Mella, Kokanber (Punj.); Bhor, Jhar-bhor, (Ajmer); Ber, Berra, Bihar, Jhari, Jharberi, Jand, Kanta (Hindi), Chanyabor (Guj.).

Straggling shrubs, 2.0—3.5 (—5) m tall; branches widely divaricating exuous branches, young branches tomentose, profusely armed; spines paired, one straight, slender and very sharp, nearly as long as the petiole, other much shorter, hooked, bent downwards. Leaves serrate, each tooth marked by a deciduous, callous point, basally 3-nerved with few prominent lateral nerves; petioles 5—10 mm long, tomentose. Inflorescence short, axillary, compact 10—20-flowered cymes, sessile or very shortly pedunculate. Flowers 4—5 mm across; pedicels 2—5 mm long, tomentose. Calyx lobes 1.7—2.2 mm long, deltoid, acute, keeled nearly to the base, campanulate, thickened at the apex. glabrous within, pubescent without. Petals 1.0—1.5 mm long, obovate-spathulate, margin convolute, rounded or truncate at the apex. Stamens 0.8—1.2 mm long. Disc slightly 10-lobed. Ovary bicarpellary, bilocular; style 2-cleft, united to above the middle. Drupes 0.8 cm in diam., globose, woody, glabrous, black red and shining when ripe, kernel rugose, with a hard, bony shell. Seeds 2 (—1), compressed, black.

KEY TO THE VARIETIES

- | | |
|---|-----------------------------|
| 1a. Leaves tomentose on both surfaces | ... <i>var. nummularia</i> |
| 1b. Leaves glabrous above and tomentose beneath | ... <i>var. glabrescens</i> |

var. *nummularia*

Leaves 1.2—2.5 × 1.2—1.8 cm, ovate, elliptic or orbicular, whitish or buff-tomentose beneath, base oblique, apex obtuse.

Fls. : Mar.—Jun., *Frtis.* : Nov.—Jan.

Distrib. : INDIA : Andaman, Gujarat, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh; PAKISTAN, AFGHANISTAN, IRAN, IRAQ.

Ecol. : Particularly grows in dry and arid regions.

Uses : Commonly used for fencing; the sweet subacid fruit is used as food, especially in times of famine. Leaves are thrashed out and used as fodder for sheep and goats, they are also used in curing scabies and boils, the fruit is used as an astringent.

var. *glabrescens* Bhandari & Bhansali, var. nov.

Differ a varietate *nummularia* foliis 1.0—1.5 × 0.5—1 cm, alternis, supra glabris, infra lanato-tomentosis, basi rotundatis, apice obtusis vel acutis.

Typus : *Sin. loc.*, 7.12.1912, *H. H. Haines* 2958 (DD).

var. *glabrescens* Bhandari & Bhansali, var. nov.

Leaves 1.0—1.5 × 0.5—1.0 cm, alternate, glabrous above, woolly tomentose beneath, rounded at base, obtuse or acute at apex.

Type : *Sin. loc.*, 7.12.1912, *H. H. Haines* 2958 (DD).

Fls. & Frtis. : Jan.—Oct.

Distrib. : INDIA : Andhra Pradesh, Karnataka, Punjab, Tamil Nadu.

Exsicc. : Andhra Pradesh : Hyderabad, 1857, *Coll.* (?) s.n. (MH); Karnataka, Belgaum Dt., 11.3.1898, *W. A. Talbot* 3942 (BSI), Dharwar, 720 m, April 1918, *L. J. Sedgwick* 3893 (CAL). Punjab : Doushi Hills, 22.1.1959, *N. A. Ansari* 47235 (BSI). Tamil Nadu : Kurunathanakanpatty, Ramnad Dt., 15.3.1953, *G. H. Maduram* 21938 (MH); Tinneveely Dt., 24.5.1899, *C. A. Barber* 289 (MH).

12. *Ziziphus oenoplia* (Linn.) Mill., Gard. Dict. ed. 8 : 3. 1768; Roxb., Fl. Ind. 2 : 360. 1824 et 1 : 611. 1832; Lawson in Hook. f., Fl. Brit. India 1 : 634. 1875; Gamble, Fl. Pres. Madras 1 : 220. 1918 (Repr. ed. 1 : 158. 1957) & Man. Ind. Timb. 183. 1922; Cooke, Fl. Pres. Bombay 1 : 242. 1902 (Repr. ed. 1 : 242. 1958); Sant., Fl. Saurashtra 98. 1962. *Rhamnus oenoplia* Linn., Sp. Pl. 194. 1753.

Fig. 25

Local names : Makoh Makhora, Shiakol, Shyakul (Bengal); Makai (Hindi) Ling-kermrang (Tripura); Barokoli (Oriya); Paranu, Pariki (Tel.); Kottei (Tom.); Mulli (Mal); Burgi (Mar.).

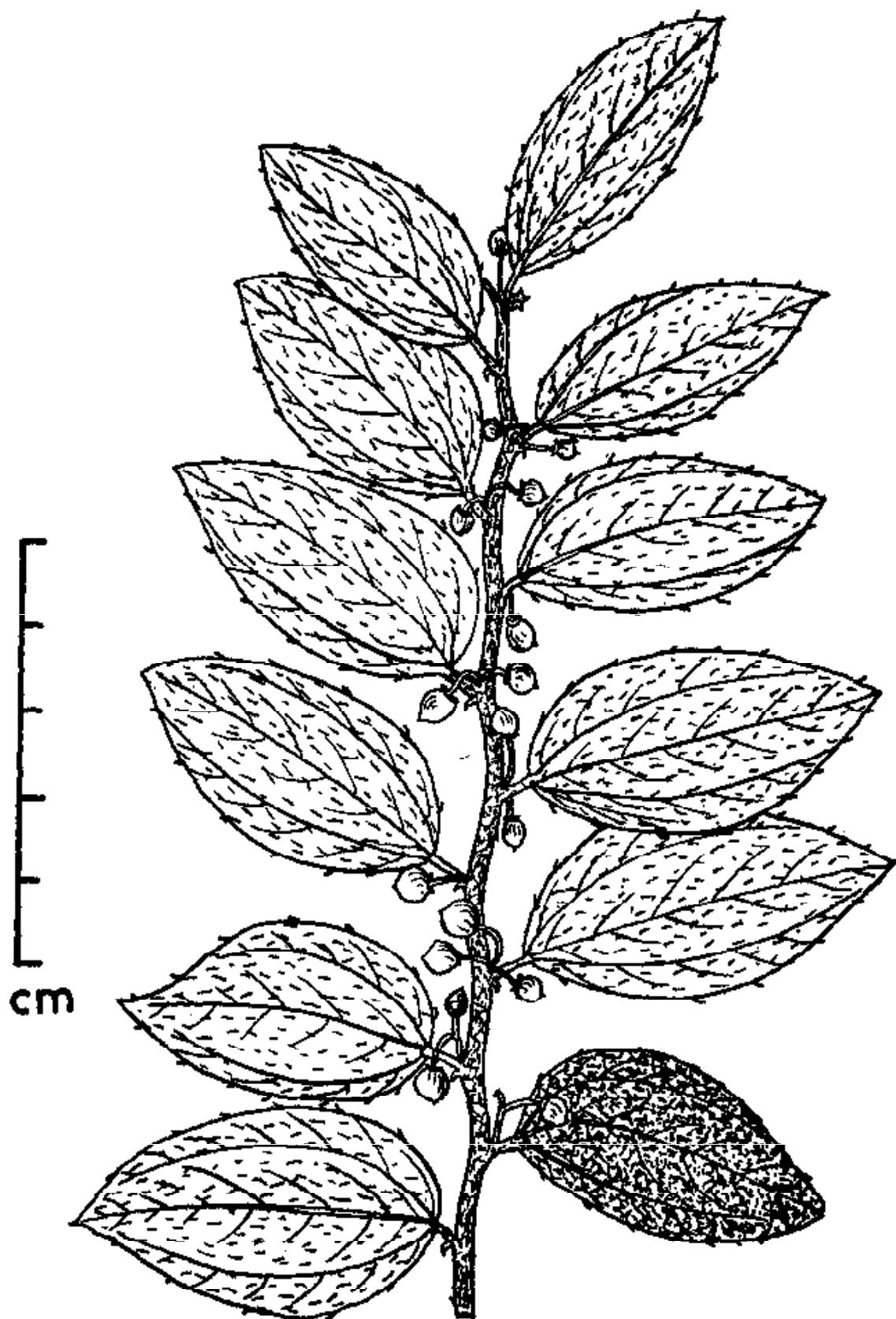


Fig. 25. *Ziziphus oenoplia* (Linn.) Mill.

Straggling or climbing shrubs; branchlets strigose, often densely rusty tomentose, fluted; nodes slightly enlarged around the leaf scars. Leaves basally 3–4-nerved, primary nerves campylodromous. Calyx lobes 1.5–2.0 mm long, margins thickened, glabrous inside, brownish, apparently hairy without. Petals 0.8–1.0 mm long, emarginate. Stamens 0.7–0.9 mm long. Disc 10-lobed, pitted or grooved, glabrous, lobes opposite each calyx lobe, emarginate. Ovary glabrous; style 2-cleft, united above the middle; stigma obtuse. Drupes 0.7 mm in diam., 1.5 cm long, 1–3 together on slender pedicels, globose or ovate, black and shining when ripe, with mealy acrid pulp, 1 (–2)-celled. Seeds 1–2, 1 cm long.

KEY TO THE VARIETIES

- 1a. Leaves fluvous-tomentose above ... var. *oenoplia*
 - 1b. Leaves sparsely ferruginous hairy or glabrescent above :
 - 2a. Branchlets fasciculate ... var. *fasciculata*
 - 2b. Branchlets not fasciculate :
 - 3a. Flowers borne in axillary fascicles ... var. *pallens*
 - 3b. Flowers borne in pedunculate cymes var. *pedicellaris*
- var. *fasciculata* Bhandari & Bhansali, var. nov.

Differ a varietate *oenoplia* spinis geminatis, una recta, 4–5 mm longa, altera recurvata; ramis glabris vel leviter pubescentibus, fasciculatis; follis 1–2.8 × 0.2–1.6 cm parum pubescentibus, vetustioribus glabris, ad marginem integris 1–2 mm longis.

Typus : Moholia, Singhbhom, Chotanagpur, 1500 m, 26.11.1883, C. B. Clarke 34391 (CAL).

var. *fasciculata* Bhandari & Bhansali, var nov.

Thorns paired, one straight 4–5 mm long, other recurved; branches glabrous or slightly pubescent, fascicled. Leaves 1.0–2.8 × 0.2–1.6 cm, slightly pubescent, glabrous with age, margin entire; petioles 1–2 mm long.

Type : Moholia, Singhbhom, Chotanagpur, 1500 m, 26.11.1883, C. B. Clarke 34391 (CAL).

Fls. : Aug.—Jan.

Distrib. : INDIA : Kerala, Tamil Nadu, Uttar Pradesh.

Exsicc. : Kerala : Travancore, 26.8.1913, C. C. Calder and M. S. Ramaswami 195, 1590 (CAL). Tamil Nadu : Aduthirudi Karadu, Coimbatore, 780 m, 13.8.1929, V. Narayanswamy 18789 (CAL). Uttar Pradesh : Parduni, Dehra Dun, 22.1.1918, R. S. Hole 1704 (DD); Pilibhit Dt., 5.6.1898, Inyat 21700 (DD).

var. *oenoplia*

Fig. 25

Spines solitary or paired, mostly recurved, rusty-tomentose at base. Leaves $2.5-6.5 \times 1.2-2.9$ cm, acute, ventrally pubescent with golden appressed hairs; petioles 3-6 mm long. Cymes axillary, pedunculate, 20-30-flowered, 3-4 mm across; peduncles 2 mm long; pedicels up to 3 mm long, silky villous.

Distrib. : INDIA : Almost throughout; SRI LANKA, PAKISTAN, MALAYSIA, AUSTRALIA.

Ecol. : Almost throughout India, especially in dry forest localities and open bushy places. Most common in the teak forest in Assam.

Uses : The sweet, somewhat acidic fruit is commonly eaten. The branches used for fencing fields and is often grown as hedge plant.

var. *pallens* Bhandari & Bhansali, var. nov.

Differet a varietate *oenoplia* foliis $3-8 \times 1.5-3.8$ cm, alternis, supra glabris, infra leviter pilosis tantum in nervis, acuminatis, oblique ovatis vel ellipticis.

Typus : *Wall. Cat. no. 4247 (CAL)*.

var. *pallens* Bhandari & Bhansali, var. nov.

Leaves $3-8 \times 1.5-3.8$ cm, alternate, glabrous above, slightly hairy beneath only on the nerves, acuminate, obliquely ovate or elliptic.

Type : *Wall. Cat. no. 4247 (CAL!)*.

Fls. : Jun.-Oct.

Distrib. : INDIA : Andaman, Assam, W. Bengal.

Exsicc. : Andaman : Tusonabad Hill jungle, S. Andaman, 11.6.1892, King s. n. (CAL); Andaman, May 1918, C. E. Parkinson 589 (CAL); S. Andaman, S. Kurz s. n. (CAL); Mizoram : Mizo Hills, R. N. Dutta 33310 (CAL); W. Bengal : Chandannagore, 16.9.1902, A. Hosein 28 (CAL).

Chr. No. : $n = 10, 12, 13$ (Srinivasachar in Proc. Ind. Acad. Sci. 11B : 10, 1940).

Notes : There is a single Wallichian sheet in CAL identified as *Z. pallens* Wall. The leaves of this specimen as well as the other specimens cited above are all glabrous on both the surfaces which is not the case in *Z. oenoplia*. It should therefore, be treated as a distinct taxon. However, it comes very close to a specimen from Burma collected by G. G. Rogers no. 888 (Yamethin Dist., 3.8.1917, rambling shrub, under 1000 ft.) which was identified as *Z. oenoplia* var. *glabrescence*. The name '*pallens*' has been preferred to '*glabrescence*' due to the paler colour of leaves. It is, therefore, being described as a new variety of *Z. oenoplia*.

var. pedicellaris Bhandari & Bhansali, *var. nov.*

Differt a varietate *oenoplia* foliis 2.0—3.4 × 0.9—2 cm, alternis, acutis, glabris vel leviter pubescentibus supra pilis ferrugineis, pedicellis 5—6 mm longis. Inflorescentia multo evoluta et ramosa, cymis axillaribus, pedunculis 6 cm longis ramosis, fulvitomentosis.

Type : Wall Cat. No. 4243 (Holo, CAL, K).

var. pedicellaris Bhandari & Bhansali, *var. nov.*

Z. pedicellaris Wall. Cat. 4243. 1828 *nom. nud.*

Leaves 2.0—3.4 × 0.9—2.0 cm, alternate, acute, glabrous or slightly pubescent above with ferruginous hairs; pedicels 5—6 mm long. Inflorescence much developed and branched axillary cymes; peduncles 6 mm long, branched, fulvous tomentose.

Type : Wall. Cat no. 4243 (CAL).

Notes : Wallich sheet no. 4243, identified as *Z. pedicellaris* or *Z. oenoplia* var. *pedicellaris* has cymes well developed on branched peduncles. This specimen though quite similar to *Z. oenoplia* in other respects, is markedly different from it in the character of the peduncle.

13. *Ziziphus oxyphylla* Edgew. in Trans. Linn. Soc. 20 : 43. 1846; Brandis, For. Fl. 85. 1874 & Ind. Trees 71. 1971 (Repr. ed.); Lawson in Hook. f., Fl. Brit. India 1 : 634. 1875; Gamble, Man. Ind. Timb. 183. 1922 (Repr. ed.); Kanjilal, For. Fl. 123. 1901 (Repr. ed.).

Local names : Beri, Amnia, Amdai, Kokan-ber, Pitni, Shamor, Giggar (Punj.).

Deciduous shrubs or small trees, 7—9 m high; branches purple, appressed golden pubescent, glabrous with age; spines in pairs, 0.8—1.0 cm long, one straight and other more or less curved. Leaves basally 3-nerved, the middle nerve with 2—4 prominent lateral nerves, which are cAMPtodromous; petioles 4—8 mm long, glabrous. Pedicels 1—3 mm long in flower, 10—20 mm long in fruit; bracts 1—2 mm long, brown, subulate, pubescent. Calyx lobes 2—3 mm long, thickened along margin. Petals 2 mm long, clawed, obovate. Stamens equalling the petals; anthers dorsifixied. Disc 5-lobed, thin, thickened around the ovary. Ovary bilocular, glabrous; style 2-cleft, united below the middle. Drupes 8 mm in diam., ovoid, pendulous, red or black when ripe, 2-celled, fleshy, stone thin and crustaceous, flattened. Seeds 2, 4—5 mm long, testa brown, shining.

KEY TO THE VARIETIES

- 1a. Leaves serrulate. Inflorescence axillary
fascicles... *... var. oxyphylla*

- 1b. Leaves crenate. Inflorescence axillary
 cymes... var. *pedicellaris*
var. *oxyphylla*

Branches alternate. Leaves $1.5-3.8 \times 1.1-3.1$ cm, obliquely ovate, acuminate, broadly rounded or subcordate at base, glabrescent, serratures tipped with deciduous glandular mucro. Flowers 5-6 mm across, 10-20 in fascicles, only 2-3 develop into fruits.

Type : Himalaya, alt. 4000-7000 ft, *Edgeworth* 43 (K).

Fls. : May-Jun; *Frt.* : Oct-Nov.

Distrib. : INDIA : Himachal Pradesh, Kashmir, Punjab, Uttar Pradesh; PAKISTAN.

Chr. No. : n = 12 (Mehra & Sarin in *Taxon* 18 : 433-442. 1969).

Uses : Yields white and moderately hard wood. It is often planted in hedges and also for its acrid fruit which tastes like tamarind.

Notes : Fruits are generally 2-celled, 2-seeded and not always 1-celled, 1-seeded as described by Lawson (*op. cit.*).

var. *pedicellaris* Bhandari & Bhansali, var. nov.

Differ a varietate *oxyphylla* ramis fasciculatis foliis $2.3-3.2 \times 1.6-3$ cm glabris, late ovatis, apice subacutis; basi obliquis, crenatis; floribus in cymis axillaribus pedunculatis, pedunculis ramosis 4-5 mm longis, glabris.

Type : Domi cultus, Dehra Dun, 10.9.1944, A.C. *Hastless* s. n. (DD).

var. *pedicellaris* Bhandari & Bhansali, var. nov.

Branches fascicled. Leaves $2.3-3.2 \times 1.6-3.0$ cm, glabrous, broadly ovate, apex obtusely acute, base oblique, crenate. Flowers in axillary pedunculate cymes; peduncles branched, 4-5 mm long, glabrous.

Type : Domi cultures, Dehra Dun, 10.9.1944, A. C. *Hastless* s. n. (DD).

Chr. No. : n = 12 (Mehra & Sareen in *Taxon* 18 : 433-442. 1969)

14. *Ziziphus rugosa* Lam., Encycl. 3 : 319. 1789; Wight, Ic. 2 : 339. 1840-1843; Brandis, For. Fl. 89. 1874; Lawson in Hook. f., Fl. Brit. India 1 : 636. 1875; Gamble, Man. Ind. Timb. 184. 1922 (Repr. ed.) et Fl. Pres. Madras 1 : 221. 1918 (Repr. ed. 1 : 58. 1957); Cooke, Fl. Pres. Bombay 1 : 243. 1902 (Repr. ed. 1 : 243. 1958); Sant., Fl. Saurashtra 95. 1962.

Local names : Bon-boguri (Asm.), Bhand, Ber, Churna, Suran (Hindi); Chunu-koli (Ori.); Charai (Tam.); Thodali (Mali); Turani (Mar.).

Straggling, evergreen shrubs or small trees, 3–6 m high, young parts fulvous tomentose; bark dark grey or nearly black, deeply cracked into thick rectangular scales; spines solitary, recurved, tomentose except the tips; internodes 1.5–3.5 cm long. Leaves dark-green, closely serrate, seratures with callous points, basally 3-nerved; petioles 0.5–0.7 mm long, tomentose. Panicles terminal or axillary, up to 30 cm long, rusty tomentose, sometimes one-sided; peduncles densely tomentose. Flowers 5–6 mm across, yellowish-green; pedicels 5–7 mm long, densely tomentose. Calyx lobes 5, 1.5–2.0 mm long, pubescent without. Stamens 1–2 mm long; anther lobes broadly ovate. Disc 5-lobed, glabrous. Ovary bicarpellary, 2-celled; style 2-cleft, united below the middle, curved. Drupes 6–12 mm long, 10 mm thick, ovoid to globose, fleshy. Seeds 2 (—1), compressed, black.

Notes: Wallichian specimens no. 4240, 4241 and 4242 which were named as *Z. latifolia*, *Z. paniculata* and *Z. glabra* respectively, do not have their leaves fulvous tomentose beneath. These have, therefore, been excluded from the synonymy of *Z. rugosa*. *Z. horsfieldii*, having different fruits and glabrous leaves, has also been excluded from the synonymy of *Z. rugosa*.

KEY TO THE VARIETIES

- 1a. Leaves tomentose beneath ... var. *rugosa*
 - 1b. Leaves glabrous except a few hairs on nerves beneath :
 - 2a. Ovary villous ... var. *globrescens*
 - 2b. Ovary glabrous ... var. *glabra*
- var. *glabra* Bhandari & Bhansali, var. nov.

Differ a varietate *rugosa* foliis utrinque glabris, pilis paucis exceptis in nervis infra, serratis, apice acutis; disco ovarioque glabro.

Typus: Maharashtra, Matheran, 12.2.59, N.A. Irani 2891 (BLAT).

var. *glabra* Bhandari & Bhansali, var. nov.

Leaves glabrous on both surfaces except a few hairs on nerves beneath, serrate, apex acute. Disc and ovary glabrous.

Type: Maharashtra, Matheran, 12.2.1959, N. A. Irani 2891 (BLAT).

Fls. & Frts.: Jan.—Feb.

Distrib.: Maharashtra.

Exsicc.: Maharashtra : Vicinity of Central dairy and behind V. 29 and 30, Aarey Milk Colony, Goregaon, 13.2.1918, S. C. Tavakari 742

(BLAT); Khandala, Lon. Hone soldiers Cr. Field, 4.3.1944, *H. Santapau* 3618 (BLAT).

var. glabrescens Bhandari & Bhansali, *var. nov.*

Differ a varietate *rugosa* foliis 7.5—13.5 × 5.5—7.4 cm ovato-ellipticis, apice acutis, utrinque glabris, pilis paucis in nervis infra; fructo glabro, stamine 1, compresso, nigro.

Typus: Kerala, Malabar, Kannoth 9.12.1923, Collector? s. n. (MH).

var. glabrescens Bhandari & Bhansali, *var. nov.*

Z. latifolia Wall. Cat. no. 4240 K 1828 nom. nud. *Z. paniculata* Wall. Cat. no. 4241 Z 1828 nom. nud.

Leaves 7.5—13.5 × 5.5—7.4 cm, ovate-elliptic, apex acute, glabrous on both surfaces, few hairs on nerves beneath. Fruit glabrous.

Type: Kerala, Malabar, Kannoth 9.12.1913, Collector?, s. n. (MH).

Fls. : Jan—Apr.

Distrib. : INDIA : Assam, Karnataka, Kerala, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh.

var. rugosa

Leaves 5.0—12.5 × 3—7 cm, elliptic or ovate, glabrous above, fulvous-tomentose beneath, apex rounded or slightly emarginate, mucronate. Ovary villous. Drupes white when ripe, pubescent.

Distrib. : INDIA : Andhra Pradesh, Assam, Gujarat, Karnataka, Kashmir, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, W. Bengal; SRI LANKA, BURMA.

Ecol. : Grows in dry deciduous forest up to 1800 m on hills.

Uses : Yields reddish and moderately hard wood, but susceptible to insects. Used chiefly as fuel. The fruits are eaten and the leaves are lopped for fodder. The bark, powdered and mixed with ghee, is applied to the swelling in the cheek caused by toothache; also given for ulcers in the mouth.

15. *Ziziphus truncata* Blatt. & Halib. in Journ. Bombay Nat. Hist. Soc. 26 : 234. 1918.

Local name : Borti (Raj.).

Small shrubs with divaricate branches; young parts chestnut coloured, downy; stipular spines 2, up to 1 cm long, tomentose at base, one straight and shorter, the other recurved. Leaves alternate, coriaceous, 1.5—3.5 × 1.0—2.5 cm, orbiculate, subcordate, glabrous above, downy beneath,

3-nerved from base, apical truncate portion up to 10 mm broad and irregularly dentate, nerves extending up to apex, midrib with 2–3 equal secondary veins; petioles 5 mm long. Cymes axillary, sessile, tomentose. Flowers 4–5 mm across; buds hemispherical; pedicels up to 4 mm long. Calyx lobes 2.0–2.5 mm long, deltoid, acute, pubescent without, glabrous within. Petals 1.5–1.8 mm long, cucullate, spatulate, rounded at apex. Stamens 1.2–1.6 mm long; filaments acicular. Disc 10-lobed with 10-furrows, glabrous. Ovary bicarpellary, superior; styles 2, connate up to the middle, divergent near the apex. Fruits globose, yellow when ripe. Seeds 1–2, compressed, black.

Type : Rajasthan, *Blatter* 5203 (BLAT).

Fls. : Oct.–Nov.; *Frt.* : Jan.–Mar.

Distrb. : INDIA : Rajasthan.

Ecol. : On rocks near Kailana, Jodhpur.

Exsicc. : Rajasthan : Kailana-Jodhpur, *M. M. Bhandari* 747, 748, 783 (JAC).

Notes : *Z. truncata* Blatt. & Hallb. is closely allied to *Z. mummularia* (Burm. f.). Wight & Arn., but differs in shape, size and texture of the leaves. The type sheet (*Blatter* 5803) is not traceable at present.

16. *Ziziphus williamii* Bhandari & Bhansali, sp. nov.

Ziziphus trinervia Roxb. *valde affinis*.

Arbor, usque ad 4 m alta, ramis rectis, flavis, sulcatis, spinae geminae, una recta, saepe nulla, altera recurva. Folia 3.0–5.0 × 1.5–3.7 cm, alterna, ovata vel elliptica, utrinque glabra, apice acuta vel obtusa, mucronata, crenata, quoque dente mucrone glandulari nigro deciduo ornato, basi trinervia, nervis secundariis divergentibus a costa ad angulos, 40°–60° prope marginem camptodromis; petioli 8.7–15.0 mm longi, glabri. Flores dispositi in fasciculii axillaribus, 25–30 floris, 4 mm diam, pedunculis 2–4 mm longis, pubescentibus, pedicellis 3–5 mm longis, pubescentibus. Sepala 1.5 mm longa, acuta, deltoidea, apice incrassata, usque ad medium carinata, intus glabra, extus pubescentia, cupula hemisphaerica. Petala 1 mm longa, manifeste unguiculata, obovata, profunde cucullata, stamina inclusa. Stamina petalis fere aequilonga; discus 5-lobus, rare 10-lobus, lobi sepalis oppositi, glabri, emarginati. Ovarium bicarpellare, biloculare, glabrum, a disc fere occultum, stylus usque ad medium bifurcatus, recurvatus. Fructus obovoideus, 8 mm diam., glaber bilocularis, loculis monospermis. Semina 2, compressa, nigra, 5 × 6 mm.

Typus : Okha, Saurashtra, 13.10.1953, *H. Santapau* 16671 (BLAT).

Ziziphus williamii Bhandari & Bhansali, sp. nov.

Trees, up to 4 m high, branches straight, yellow, glabrous, fluted; spines in pairs, one straight often wanting, the other recurved. Leaves alternate, 3.0–5.0 × 1.5–3.7 cm, ovate or elliptic, glabrous, apex acute or obtuse, mucronate, crenate, each crenation glandtipped with deciduous, black mucro, rounded or slightly tapered at base, basally 3-nerved; secondary veins diverging from the midvein at an angle of 40°–60°, camptodromous near the margin; petioles 8.7–15.0 mm long, glabrous. Flowers in axillary, 25–30-flowered fascicles, 5-merous, 4 mm across; peduncles 2–4 mm long, pubescent; pedicels 3–5 mm long, pubescent. Calyx lobes 1.5 mm long, acute, deltoid, thickened at the apex, keeled up to the middle, glabrous within, pubescent without. Petals 1 mm long, markedly clawed, obovate, deeply cucullate, enclosing stamens. Stamens about as long as petals. Disc 5–10-lobed, lobes opposite the calyx lobes, emarginate, glabrous. Ovary bicarpellary, bilocular, nearly hidden by the disc. Fruits obovate, 8 mm in diam., glabrous, 2-celled. Seeds 2, black, 6 × 5 mm, compressed.

Type : Saurashtra, Okha, 13.10.1953, H. Santapau 1667I (BLAT!).

Distrib : INDIA : So far known only from Gujarat and Maharashtra.

Fls. & Frts. : Nov.—Mar.

Ecol. : This species is found predominantly growing near the sea coasts.

Exsicc. : Gujarat : Ahmedabad, 12.11.1892 Coll. (?) s. n. (CAL); Madh Island, near Ergal, 4.11.1957, G. L. Shah 9484 (BLAT); Broach, opposite bank of river, 5.1.1955, G. L. Shah 1548 (BLAT); Rudramata, Kutch, 19.10.1958, S. K. Jain 46860 (BSI); Beyt, Shankkodyar Island, Saurashtra, 13.10.1953, M. B. Raizada 23901 (DD); Surat, 9.1.1908, H. B. Chibber (BSI); Maharashtra : Dahej, Coast of Bombay, 8.5.1957, S.K. Jain 17625 (BSI).

17. *Ziziphus xylopyra* (Retz.) Willd., Sp. Pl. 1 : 1104. 1797; Roxb. Fl. Ind. 2 : 361. 1824 et Fl. Ind. 1 : 611. 1832; Lawson in Hook. f., Fl. Brit. India 1 : 634. 1875; Gamble, Fl. Pres. Madras 1 : 220. 1918 (Repr. ed. 1 : 158. 1957) et Man. Ind. Timb. 183. 1922 (Repr. ed.); Cooke, Fl. Pres. Bombay 1 : 242. 1902 (Repr. ed. 1 : 242. 1958); Kanjilal, For. Fl. 124. 1969 (Repr. ed.); Brandis, Ind. Trees 171. 1971 (Repr. ed.). *Rhamnus xylopyrus* Retz. Obs. 2 : 11. 1781. Fig. 26

Local names : Goto (Or.); Got (Tel.); Kotteri (Tami); Kotta (Mal.); Bhander, Gunt, Beri, Kath Ber, Chittonia, Chont, Gotaha, Goti, Kakor, Sitaber (Hindi); Ghoti, Karkat (Santali).

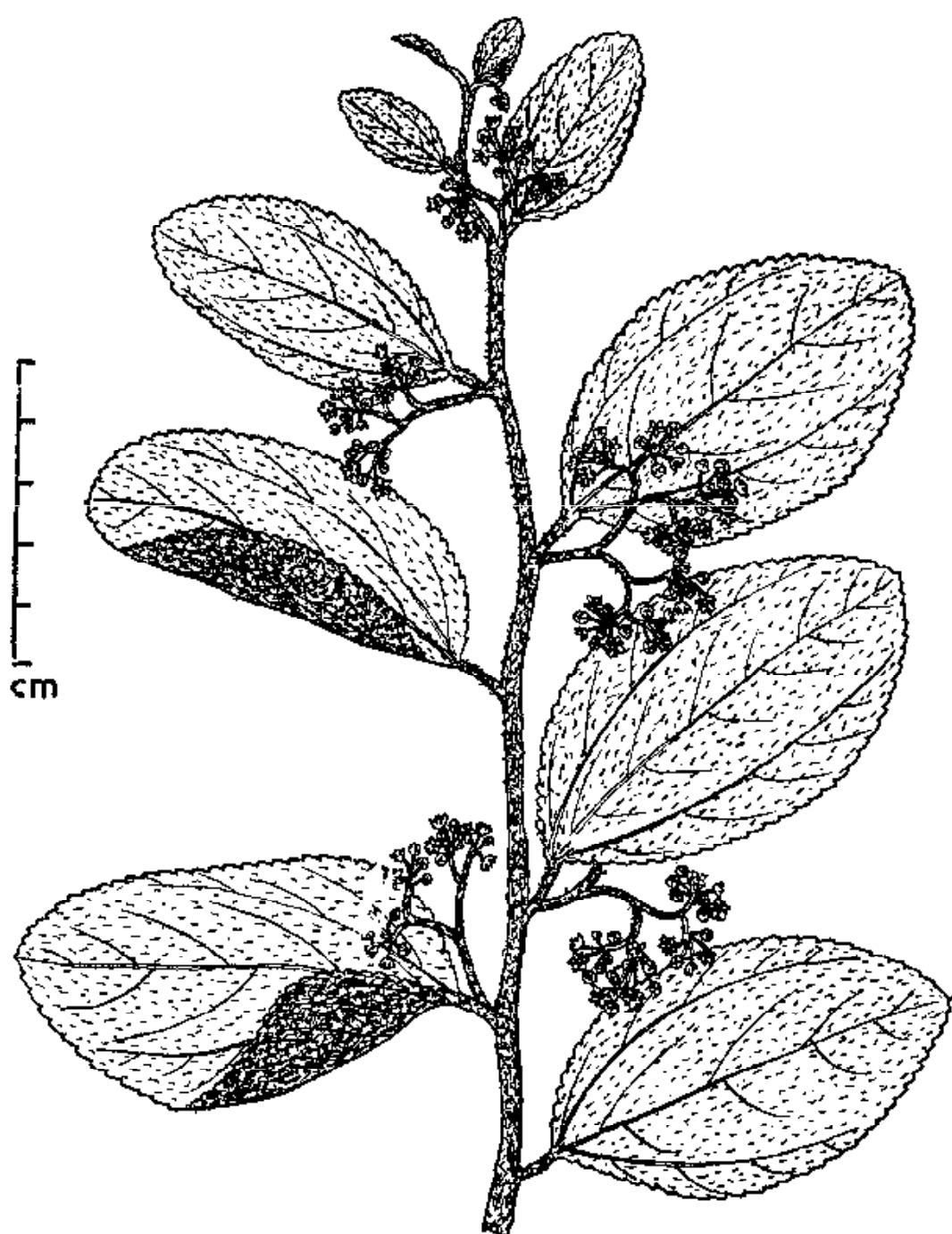


Fig. 26. *Ziziphus xylopyra* (Retz.) Willd.

Large straggling shrubs or small trees 7.5–12.0 m high, often gregarious; young shoots rusty tomentose; spines in pairs on younger branches, one straight, the other curved; internodes 1.5–3.5 cm long, nodes swollen at the leaf scars. Leaves 2.5–7.5 × 1.5–6.5 cm, broadly elliptic or orbicular, rarely ovate, obliquely subcordate, obtuse with mucro at apex, yellowish antrorse hairy beneath, serrate, each serration marked by a deciduous glandular mucro, basally 3–4-nerved; primary lateral nerves prominent, campylodromous, secondary nerves cAMPYLODROMOUS, diverging at angle of 40°–60°, tertaries transversely reticulate; petioles 2–7 mm long, fulvous tomentose. Inflorescence dense axillary, dichotomous cymes; peduncles 2.5–4.0 mm long. Flowers 4–6 mm across, yellowish-green, buds ovoid, densely pubescent; pedicels 3–4 mm long, tomentose. Calyx lobes 2.0–2.5 mm long, keeled up to the middle, thickened at apex, glabrous within, pubescent without. Petals 1.5–2.0 mm long. Stamens equal to petals. Disc 10-lobed, pitted or grooved, rarely 5-lobed, glabrous. Ovary tricarpellary, 3-celled, rarely 2 or 4-celled, globose, nearly hidden by the disc; style cleft up to half to two-third of the length. Drupes 1.8–2.5 cm in diam., globose, woody, slightly rugose; stone thin and hard. Seeds 3, 1.2 × 1.0–1.5 mm, compressed, black.

Fls. : Apr.—Jul.; *Frt.s.* : Nov.—Jan.

Distrib. : INDIA : Throughout except E. India; NEPAL, SRI LANKA.

Ecol. : Generally grows in dry deciduous forests, but sometimes also found in 'Sal' forests.

Chr. no. : n = 12. (Mehra & Sareen in Taxon 18 : 433–442. 1969).

Uses : Yields yellowish-brown hard and durable wood; it is also commonly used as fuel. The fruits and the bark are used for tanning and the leaves as fodder. The kernel of the fruit is eaten but not the pulp.

SABIACEAE

Blume, Mus. Bot. Lugd.-Bat. 1 : 368. 1851.

M.P. Nayar & S.C. Majumdar*

Trees, shrubs or climbers. Leaves simple or imparipinnately compound, exstipulate. Inflorescence terminal or axillary, pedunculate cymes or panicles, rarely a simple raceme. Flowers bisexual, small. Sepals 4—5-partite, imbricate, persistent. Petals 4—5, mostly free, equal or unequal, antisepalous, imbricate. Stamens as many as petals, equal or unequal, all or only 2 larger, fertile, rest staminodial, anther 2-locular, connective thick. Disc angular or cupular, dented or lobed. Carpels 2—3, syncarpous, ovary superior, 2—3 locular, each locule with 2 semianatropous ovules on axile placentation; styles 2—3, free or united, stigma simple or 2—3-lobed. Fruits drupaceous, subglobose, 1—2-locular, 1-seeded. Seeds with or without endosperm; embryo large.

4 genera and c. 46 species distributed in South East Asia, China and Japan and Mexico to Brazil. 2 genera and 11 species in India.

The family has been treated under Sapindales by Bentham and Hooker, f. (Gen. Pl. 1 : 413. 1862), Engler (Syll. der. Pflanzenfam. 2 : 285. 1964, Rev. ed.) Hutchinson (Evoln. & Phyl. Fl. Pl. 409. 1963) and Takhajan (Fl. Pl. Orig. Disp. 226. 1969), under Ranunculales by Cronquist (Evoln. Class. Fl. Pl. 153. 1968).

KEY TO THE GENERA

- 1a. Scandent shrubs or climbers. Sepals and petals equal. Stamens 4-5, equal, all fertile ...*Sabia* 2.
- 1b. Small to large trees. Sepals and petals unequal. Stamens 5, unequal, outer 3 staminodial, inner 2 fertile. ...*Meliosma* 1

1. MELIOSMA

Blume, Cat. 32. 1823; Benth. & Hook. f., Gen. Pl. 1 : 414. 1862; Warb. in Engl. & Prantl., Pflanzenfam. ed. 3.5 : 371. 1895; Beus. in Blumea 19 : 429. 1971 & in Dissanayake & Fosberg, Rev. Handb. Fl. Ceylon 3 : 379. 1981. *Millingtonia* Roxb., Fl. Ind. 1 : 102. 1820.

Trees, bud scales absent. Leaves alternate, simple or imparipinnate; leaflets subopposite. Inflorescence terminal, sometimes axillary panicles. Flowers numerous, small, bisexual, irregular. Sepals distinct, sometimes surrounded by several persistent small bracts, indistinguishable, altogether

*Botanical Survey of India, P-8, Brabourne Road, Calcutta 700001.

(4) 5—13. Petals 5, outer 3 larger, convex, inner 2 smaller, entire or bifid, opposite and more or less adherent to base of fertile stamens. Disc smaller, annular, more or less irregularly 5-dentate. Stamens 5; 3 staminodial, 2 fertile; anthers large, globose. Ovary 2-locular, each locule with 2 superposed ovules; styles and stigmas simple. Fruits drupaceous, oblong to globose, 1-loculed, 1-seeded. Seeds exalbuminous.

Type species : Meliosma lanceolata Bl.

Distrib. : c. 20-25 species, c. 15 of which in South East Asia and c. 10 species in Central South America; BANGLADESH, BHUTAN, BURMA, CHINA, INDIA, JAPAN, JAVA, NEPAL, PAKISTAN, SRI LANKA, INDONESIA, THAILAND, VIETNAM. 5 species in India, distributed mainly in the Himalayan region.

Ecol. : In primary and secondary forests, in lowlands, in hills and mountains upto 3300 m. Majority of the species prefer everwet to moist, tropical to subtropical countries; these are deciduous and grow flash-wise.

KEY TO THE SPECIES

- 1a. Leaves simple :
- 2a. Nerves straight ... *M. dilleniifolia* 1
- 2b. Nerves curved :
 - 3a. Inner petals bifid ... *M. simplicifolia* 4
 - 3b. Inner petals entire ... *M. henryi* 2
- 1b. Leaves compound :
 - 4a. Leaflets glabrous or pubescent, dentate; inner petals 0.5-1 mm, always distinctly and deeply bifid; ovary glabrous or pubescent ... *M. pinnata* 3
 - 4b. Leaflets glabrous, entire; inner petals 0.5-2 mm, emarginate to retuse, ovary glabrous ... *M. sumatrana* 5
- 1. *Meliosma dilleniifolia* (Wall. ex Wight & Arn.) Walp. Rep. 1 : 423. 1842 (*dilleniaefolia*; Hook. f., Fl. Brit. Ind. 2 : 4. 1876; Brandis Ind. Trees 195. 1906; Hara, Fl. East. Himal. 194. 1966. Recd. in Blumea, 19 : 439. 1971. *Millingtonia dilleniifolia* Wall. ex Wight et Arn. in Ed. inb. New. Phil. Journ. 15 : 179. 1833. Fig. 27

Local names : Gwep or Gweb, Gulpha, Goguna, Goi, Shapra, Bakarshang (Hindi); Lekh gogun, Rani gogun, Maigoza (Nep.); Kanna, Karkon (Punj.).

Small trees, c. 10—15 tall. Leaves obovate or elliptic to oblong, 7—30 × 4—15 cm, cuneate, acute or attenuate at base, closely and finely dentate along margins, sparsely to densely pubescent, nerves 13—27 pairs. Panicles

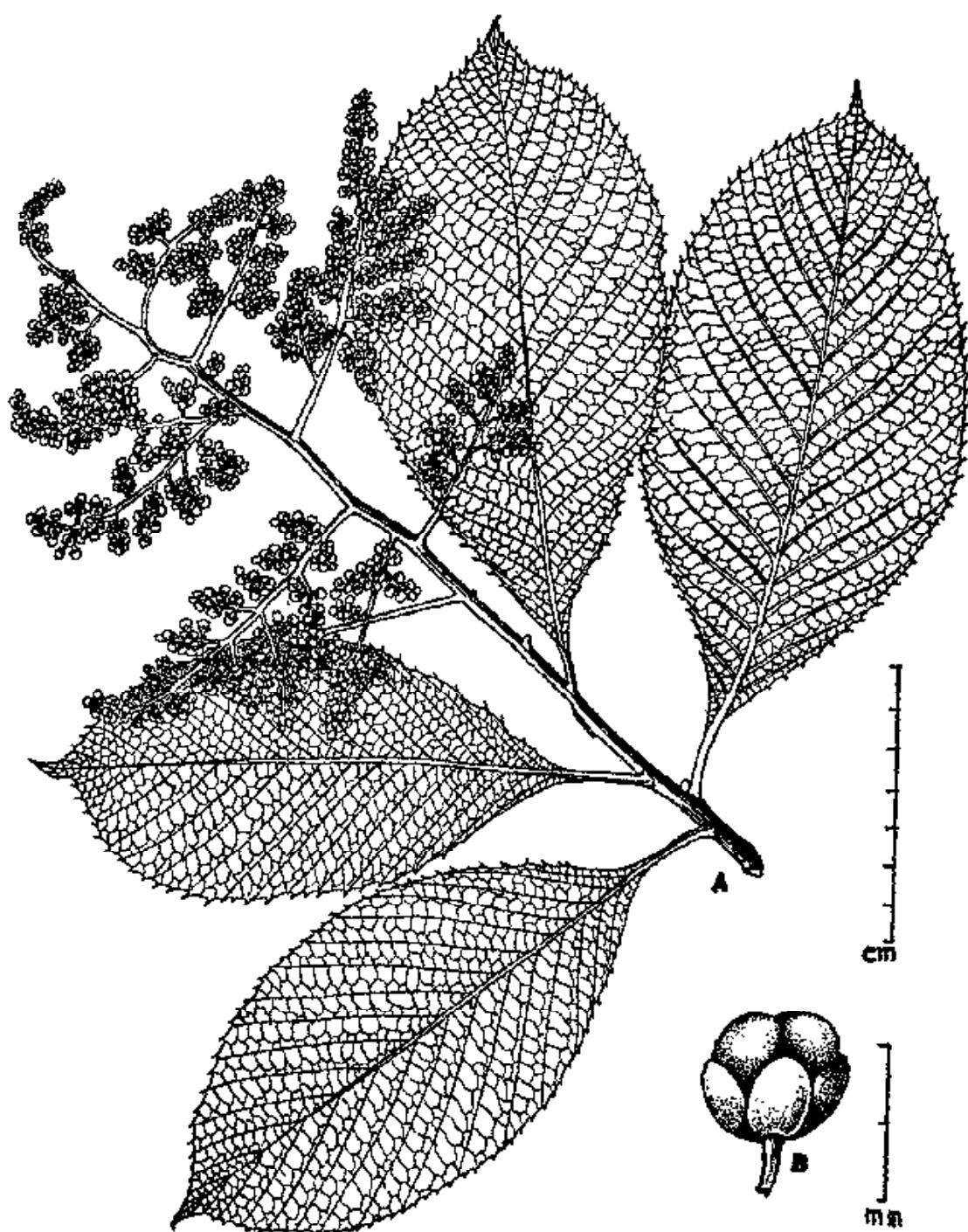


Fig. 27. *Meliosma dilleniifolia* (Wall. ex Wight & Arn.) Walp.
A. Flowering twig. B. Flower.

erect, 14 to 28 cm with straight main and lateral axes. Sepals 5 or 4, broadly ovate, more or less unequal, outer 2 or 1 usually smaller, often very minute. Petals 5, outer ones glabrous, inner ones c. half way bifid, lobes acute, glabrous. Stamens 5, 2 fertile, 3 staminodial. Ovary 0.5–0.7 mm, glabrous.

Type : Nepal, Wallich 8116 (K-W, Photo!)

Fls. : May—July; *Frts.* : Aug—Oct.

Distrib. : INDIA : Himalayan region from Himachal Pradesh to Arunachal Pradesh; NEPAL, N. BURMA.

Exsicc. : Uttar Pradesh, Kumaon, 7500', 27.7.1913, N. Gill 686 (CAL); West Bengal, Darjeeling, 2600 m, 7.6.1960 H. Hara et al. 7652 (CAL).

Pollen grains : Prolate, semicircular in Polar view, P/E = 1.12-1.29, tectum 0.75 μm thick, columella 0.5 μm thick, endexine 0.5–0.75 μm thick, ectoaperture slit like, endoaperture lalongate, margin of the endoaperture indistinct at equator. (Mondal et Mitra in Geophytology 12(2) : 172-173. 1982).

Ecol. : In evergreen forests at 2000-2300 m altitude. Reported to be found in thickets by streams and in shady forested ravine.

Uses : Small ornamental trees. The leaves are used as fodder.

2. *M. henryi* Diels. spp. *mannii* (Lace) Beus in Blumea 19 : 451. 1971.
M. manni Lace in Kew Bull. 113. 1915; Calder et al. in Rec. Bot. Surv. India 11 : 89. 1926.

Trees, upto 15 m tall. Lenticells are scattered on stem. Leaves ovate-oblong, sometimes oblong, 18 × 6 cm, base acute or somewhat attenuate, apex acuminate to subacute, glabrous, sometimes with feeble domatia in axils of nerves beneath, nerves 10–18 pairs; petioles slender. Panicles terminal, 15–25 cm long, flowers crowded, sessile or short pedicelled. Sepals 4, unequal, hairy. Petals glabrous, outer 3 orbicular, concave, 2.5 mm long inner 2 lanceolate, entire, c. 2 mm long. Ovary glabrous. Fruit drupaceous, ovoid, 4–6 mm across.

Type : India, Meghalaya : Khasi Hills, 2000-3000, Mann 260 (Lecto K, Photo!).

Fls. : Jun. *Frts.* : Jul.

Distrib. : INDIA : Meghalaya (Khasi Hills); NORTH BURMA, CHINA.

Exsicc. : Assam Govt. Gardens, Shillong, 3.7.1972, L. Ruse s. n. (CAL); Khasi and Jaintia Hills, above Barapani, 17.11.1934, S. R. Sharma 10889 (ASSAM).

Notes : The specimens collected from Maymyo Plateau (*Lace* 5282) differs from the specimens collected from Khasi Hills (*Mann* 260) in having entire leaf margin, whereas the specimens from Assam and Khasi Hills show distantly dentate leaf margin.

3. *M. pinnata* (Roxb.) Maxim. in Bull. Acad. Sci. St. Pet. 12 : 64 in obs. 1867. *Millingtonia pinnata* Roxb. Fl. Ind. 1 : 103. 1820. *Meliosma rhoifolia* Maxim. spp. *burbulata* Cufod., Oest. Bot. Z. 88 : 254. 1939.

Small to large trees, up to 42 m tall. Flowering twigs glabrous to densely pubescent. Leaves 3—11-jugate, leaflets ovate, elliptic or obovate, sometimes lanceolate, often asymmetric; nerves 3—15 pairs. Panicles terminal, erect, profusely branched. Sepals usually 5, rarely 4, ovate, unequal, inner 3 or 4 bigger. Petals 5, outer glabrous or pubescent, inner more or less deeply bifid and glabrous. Filaments c. 1 mm long. Ovary 0.5—1 mm long, glabrous to densely pubescent. Fruit globose to ovoid, 4—10 mm across when ripe.

KEY TO THE SUBSPECIES

- 1a. Ovary glabrous. Leaves 6—11-jugate,
glabrous ...ssp. *pinnata*
 - 1b. Ovary densely pubescent. Leaves 3—7-
jugate, pubescent ...ssp. *burbulata*
- ssp. *pinnata*

Millingtonia pinnata Roxb., Fl. Ind. 1 : 103. 1820; Wight, Ill. Ind. Bot. 1 : 144. 1840. *Meliosma pinnata* (Roxb.) Maxim. in Bull. Acad. Sci. St.—Pet. 12 : 64. 1867; Hook. f., Fl. Brit. India 2 : 6. 1876; Prain, Beng. Pl. 1 : 246. 1903 (Repr. ed. 1 : 246. 1963); Gamble, Fl. Pres. Madras 1 : 256. 1918 (Repr. ed. 1 : 183. 1957); Kanjilal *et al.*, Fl. Assam 1 : 329. 1936; Beus. in Blumea 19 : 494. 1971; Sutton in Hara & Williams, Enum. Fl. Pl. Nepal 2 : 99. 1979.

Local names : Banpasola, Hingoni, Hengnua, Mamori, Seonia (Asm.); Bativa (Beng.); Balmichik, Gopenda (Garo); Dieng-soh-naior (Kh.); Dabdabe, Dhabdabia, Dagdakti (Lep.).

Trees, up to c. 15 m tall. Leaves 6—11-jugate; leaflets lanceolate, sometimes oblong, c. 20 × 5 cm., acute, somewhat dentate, without domatia. Panicles erect, lax. Sepals and petals glabrous. Ovary glabrous.

Type : Roxburgh Icon. 2104 (CAL, ined.).

Fls. : Apr.—Jun.; *Frt.s.* : Aug.—Sept.

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

Exsicc. : Assam, Kamrup, 25.5.1957, G. Panigrahi 9592 (CAL); Meghalaya, Khasia Hills, Umling, 4800, 4.6.1914, U. Kanjilal 4024 (ASSAM).

Pollen grains : Prolate-spherical, subangular in polar view, P/E = 1.37—1.52, tectum 1.0 μm thick, columella 0.5 μm thick, heads of the columella distinct at poles, endexine 0.5 μm thick, finely reticulate, lumina 0.5—1.0 μm diam., ectoaperture slit like, endoaperture Ialongate (Mandal et Mitra in Geophytology, 12(2) : 172—173. 1982).

Ecol. : In tropical rain and hill forest, at rather low altitudes, usually upto c. 1000m, occasionally up to c. 1500 m.

Use : In Assam young leaves cooked with fish are eaten by Miris. Timber is used in house construction. Fruits are edible.

ssp. *barbulata* (Cufod.) Beus. in Dassanayake & Fosberg, Rev. Handb.

Fl. Ceylon 3 : 384. 1981; *Meliosma rhoifolia* Maxim. ssp. *barbulata* Cufod. in Oest. Bot. Zeit. 88 : 254. 1939. *M. arnottiana* (Wight) Walp., Rep. 1 : 423. 1842; Hook. f., Fl. Brit. India 2 : 6. 1876; Brandis, Ind. Trees 195. 1906; Gamble, Fl. Pres. Madras 1 : 256. 1918 (Repr. ed. 1 : 183. 1957). *Millingtonia arnottiana* Wight, Ill. Ind. Bot. 1 : 144. t. 53. 1840. *Meliosma rhoifolia* Maxim., Diagn. Pl. Nov. Jap. Mandsh 4 & 5 : 262. 1867. *M. wallichii* Planch. ex Hook. f., Fl. Brit. India 2 : 6. 1876. *M. pinnata* spp. *arnottiana* (Wight) Beus. in Blumea 19 : 499. 1971, *nom. illeg.*

Fig. 28

Local names : Massivala (Kan.); Dieng-sngit (Kh.); Kalavi (Mal.); Kusavi, Thagari, Huli-makai, Koli (Tam.).

Evergreen trees, up to 20 m tall. Leaves 3—7-jugate, leaflets ovate to ovate-oblong or lanceolate, more or less increasing in size towards leaf top, up to 15 × 5 cm, entire to dentate, moderately pubescent beneath and on midrib above, often with domatia in axils of nerves beneath. Panicles spreading, densely flowered, sessile. Sepals (4) 5, ovate, more or less unequal, glabrous or outer ones sparsely hairy, ciliolate along margin. Inner petals deeply bifid. Ovary densely pubescent. Fruit globose, 4—6 mm across.

Type : China, Handel-Mazzetti 12235 (A).

Fls. : May—Jul.; *Frt.s.* : Aug.—Sept.

Distrib. : INDIA : South Western Ghats and Eastern Himalaya : Assam, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Nagaland,



Fig. 28. *Meliosma pinnata* (Roxb.) Maxim. ssp. *barbulata* (Cufod.) Beus.
 A. Flowering twig, B. Flower, C. Stamen with gynoecium,
 D. Stamen-front view, E. Stamen-back view, F. Gynoecium,
 G. L. S. of gynoecium.

Sikkim, Tamil Nadu, West Bengal; UPPER BURMA, CHINA, THAILAND, JAPAN.

Exiscc. : Tamil Nadu, Kanyakumari, 19.1.1978, A. N. Henry 52435 (CAL); Khasi and Jaintia Hills, Umlog Valley 1600 m, 20.10.1914, U. Kanjilal 4646 (ASSAM).

Pollen grains : Prolate-spherical, lobate in polar view, P/E = 1.21–1.5, tectum 1.0 μm thick, columella 0.25 μm thick, endexine 0.5 μm thick, finely reticulate, lumina 0.5–1.0 μm diam., ectoaperture slit-like, endoaperture Ialongate, tapering at equator. (Mandal et Mitra in Geophytology 12 (2) : 172–173. 1982).

Uses : The timber is used for making rafters, clogs and boxes. The young leaves are sometimes eaten and are also used as fodder for pigs.

4. *M. simplicifolia* (Roxb.) Walp., Rep. 1 : 103. 1842. *Millingtonia simplicifolia* Roxb., Pl. Corom. 3 : 50, t. 254. 1820. *Millingtonia pungens* Wall. ex Wight & Arn. in Arn., Edinb. New Phil. Jour. 15 : 178. 1833; *Meliosma pungens* (Wall. ex Wight & Arn.) Walp., Rep. 1 : 423. 1842. *M. thomsonii* King ex Brandis, Ind. trees 195. 1906.

Evergreen trees up to c. 20 m tall. Leaves elliptic to lanceolate or ovate-lanceolate to obovate-oblong, 3–50 \times 1–18 cm, entire or dentate, glabrous or pubescent, sometimes with domatia, nerves 7–25 pairs. Panicles terminal, very rarely axillary, usually profusely branched, sparsely pubescent to densely tomentose, many-flowered. Flowers sessile. Sepals 4–5, empty bracts 11 (–13), ovate, more or less unequal, inner ones 0.8–2 mm, outer ones smaller, often minute, glabrous to pubescent, entire, margin usually ciliolate. Outer petals glabrous; inner ones shallowly to deeply bifid, 0.6–1.5 mm, glabrous, sometimes ciliolate. Ovary 0.5–0.75 mm, glabrous. Fruit globose, 4–10 mm across when ripe.

KEY TO THE SUBSPECIES

- 1a. Sepals 4–5. Empty bracts 4–6 :
- 2a. Leaves of flowering twig oblong to lanceolate, usually entire, rarely dentate.
Empty bracts 4–6. *ssp. pungens*
- 2b. Leaves of flowering twig oblong to oblong-lanceolate, usually dentate rarely entire.
Empty bracts 1–3 :
- 3a. Leaves 7–32 cm long, midrib distinctly pubescent above *ssp. thomsonii*

- 3b. Leaves 3—15 cm long, usually glabrous ssp. *yunnanensis*
 1b. Sepals 4—5. Empty bracts absent. ssp. *simplicifolia*

ssp. *pungens* (Wall. ex Wight & Arn.) Beus. in Blumea 19 : 466. 1971 et in Dassanayake & Fosberg, Rev. Handb. Fl. Ceylon 3 : 382. 1981; *Millingtonia pungens* Wall. ex Wight & Arn. in Edinb. New Phil. Jour. 15 : 178. 1833. *Meliosma pungens* (Wall. ex Wight & Arn.) Walp., Rep. 1 : 423. 1842 p.p. *M. wightii* Planch. ex Brandis, For. Fl. 116. 1874; Hook. f., Fl. Brit. India 2 : 4. 1876; Gamble, Fl. Pres. Madras 1 : 256. 1918 (Repr. ed. 1 : 182. 1957).

Local names : *Tode, Toudet* (Tam.)

Leaves oblong, sometimes lanceolate, with or without some distant teeth, acute to rounded at base, acute to acuminate at apex, pubescent on midrib and sometimes on nerves above, pubescent beneath, domatia in axils of nerves, nerves 7—18 pairs. Panicles lax to dense, densely short tomentose. Flowers crowded in dense glomerules. Bracts 4—6 per flower. Sepals 5. Inner petals c. 1 mm, faintly bifid; lobes divergent, glabrous.

Type : Peninsular India, Wight 945 (Lecto, E)

Fls. : May—Jul.; *Frt.s.* : Aug.—Sep.

Distrib. : INDIA : South Western Ghats; Karnataka, Kerala, Tamil Nadu; SRI LANKA, INDONESIA.

Exsicc. : Tamil Nadu, Nilgiri, 1800 m, 26.7.1957, K. M. Sebastian 4024 (CAL).

Pollen grains : Prolate, lobate in polar view; P/E = 1.28—1.40, tectum 1.0 μm thick, columella 0.5 μm thick, endexine 0.5 μm thick, reticulate, lumina 1—2 μm diameter, ectoaperture broad, slit-like, endoaperture elongate, colpal membrane provided with single row of granules. (Mandal et Mitra in *Geophytology* 12 (2) : 172-173. 1982).

Ecol. : In tropical hill forest, from c. 1500 to 2100 m altitude.

Notes : It is commonly called "Hill-mango".

ssp. *simplicifolia*

Millingtonia simplicifolia Roxb. [Hort. Beng. 3. 1814] Pl. Corom. 3 : 50, t. 254. 1820 & Fl. Ind. 1 : 103. 1820; *Meliosma simplicifolia* (Roxb.) Walp., Rep. 1 : 423. 1842; Hook. f., Fl. Brit. India 2 : 5. 1876; Prain, Beng. Pl. 1 : 246. 1903 (Repr. ed. 1 : 246. 1963); Duthie, Fl. Upp. Gang. Pl. 1 : 184. 1903. (Repr. ed. 1 : 172. 1960); Gamble, Fl. Pres. Madras 1 : 256. 1918 (Repr. ed. 1 : 182. 1957); Haines, Bot. Bih. Or. 2 : 218. 1921 (Repr. ed. 1 : 226. 1961); Kanjilal et al., Fl. Assam 1 : 327. 1936.

Fig. 29

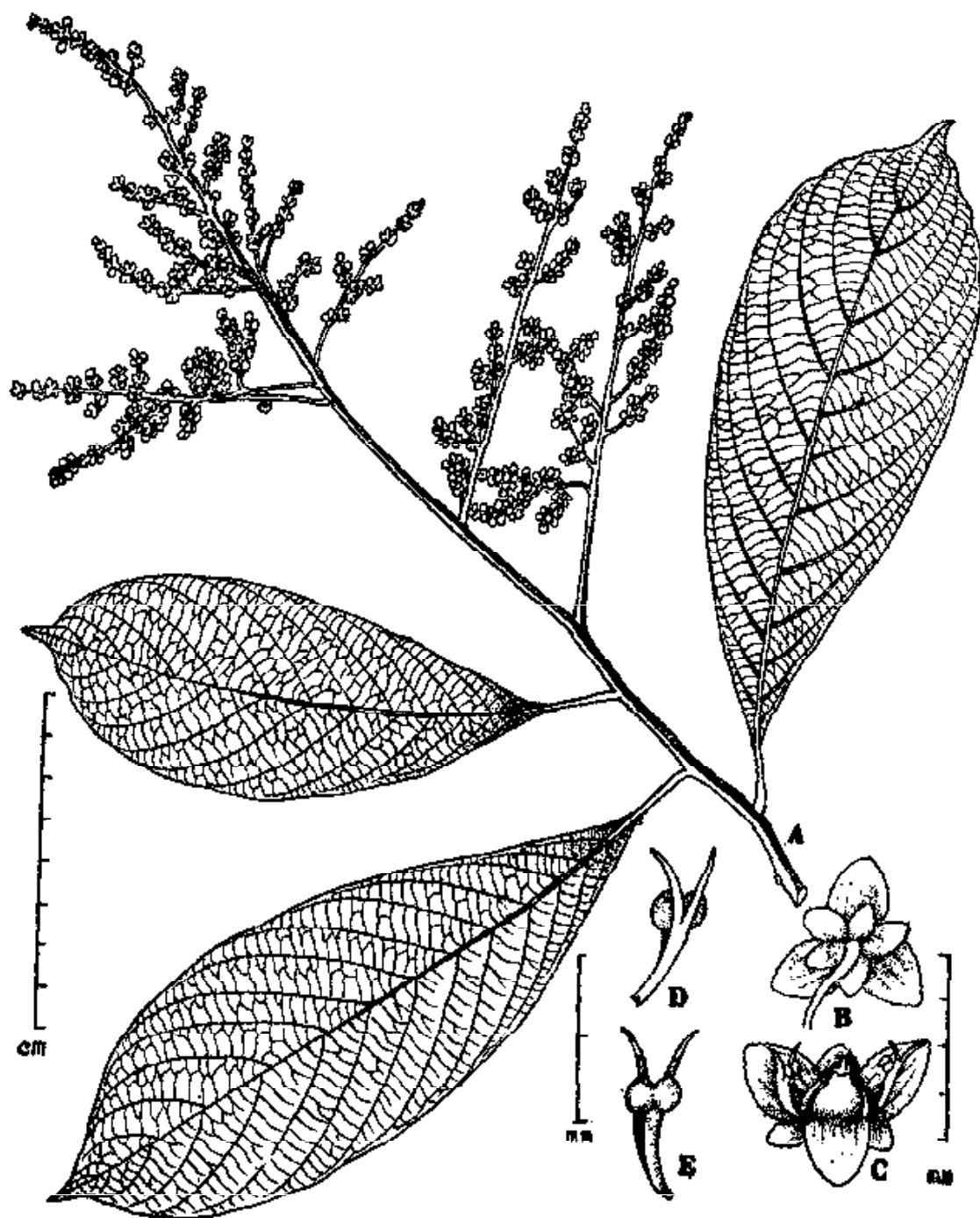


Fig. 29. *Meliosma simplicifolia* (Roxb.) Walp. ssp. *simplicifolia*. A. Flowering twig. B. Flower showing calyx. C. Flower. D. Stamen with adhering inner petal-ventral view. E. Stamen with inner petal-dorsal view.

Local names : Hengunia, Thowthowa, Pichala, Larubandha (Asm.); Patpati, Dantrangi, Dibru (Beng.); Barbetbipa (Garo); Koaso (Naga); Kosru, Churii, Swrtalahara (Nep.); Chembaru, Kallavi (Tam.)

Leaves ovate-oblong to obovate-lanceolate, up to c. 50×18 cm, base long cuneate to acute, apex short cuspidate, entire, glabrous above, sparsely pubescent beneath, nearves 8–23 pairs. Panicles lax, sparsely to densely pubescent. Flowers more or less crowded, sessile. Sepals 4–5, empty bracts absent. Petals 5, outer 3 orbicular, entire, inner 2, 0.6–0.75 mm long, usually over half way bifid, lobes more or less divergent, narrow, glabrous. Stamens adnate to petals. Ovary glabrous. Drupes subglobose 6–8 mm in diameter, black.

Type : Roxb. Ic. 2104 (CAL! ined.)

Fls. : Nov.—Feb.; *Frts.* : Mar.—Jun.

Distrib. : INDIA : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Karnataka, Kerala, Manipur, Meghalaya, Nagaland, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal; BANGLADESH, BHUTAN, BURMA, CHINA, INDONESIA, NEPAL, SRI LANKA, THAILAND, VIETNAM.

Exsicc. : Karnataka, Hassan Dist., 27.12.1978, C.J. Saldanha 5492 (CAL); Assam, Lakhimpur, Gornur, alt. 90 m, 15.3.1914; U. Kanjilal 3606 (ASSAM).

Ecol. : In primary and secondary moist evergreen tropical forests from sea level to c. 1200 m, exceptionally up to 1500 m.

Pollen grains : Prolate-sphaeroidal, subangular in polar view, P/E = 1.10–1.58, tectum 1.0 μm thick, columella 0.5 μm thick, endexine 0.5 μm thick, reticulate, lumina 1.0 μm diameter, ectoaperture broad slit-like, endoaperture lalongate, colpal membrane provided with single row of granules. (Mandal et Mitra in Geophytology 12 (2) : 172-173. 1982).

Uses : Flowers and young leaves are eaten. The timber is used for various purposes.

ssp. *thomsonii* (King ex Brandis) Beus. in Blumea 19 : 469. 1971.

Meliosma thomsonii King ex Brandis, Ind. Trees 195. 1906. *M. pungens* (Wall. ex Wight & Arn.) Walp., Rep. 1 : 423. 1842, p.p.; Brandis, For. Fl. 116. 1874.

Local name : *Sinduri dabdebi* (Nep.)

Leaves oblong or obovate-oblong to lanceolate, 7–32 × 2–16 cm, with many coarse teeth, rarely entire, pubescent on midrib and nerves above, densely pubescent beneath, nerves 7–22 pairs. Panicles usually densely short pubescent to tomentose. Flowers crowded, sessile;

empty bracts 1--3. Inner petals c. 1 mm long, slightly bifid, lobes divergent. Ovary glabrous, sometimes pubescent.

Type : India, Darjeeling, alt. 5000', J.S. Gamble 9704 (K, Photo!)

Fls. : Jun.—Jul.; *Frts.* : Aug.—Sep.

Distrib. : INDIA : Assam, Nagaland, Himachal Pradesh, Sikkim, Uttar Pradesh; BHUTAN, N. BURMA, CHINA, NEPAL, N. VIETNAM.

Exsicc. : Sikkim Himalaya, 2000', 5.7.1876, G. King s.n. (CAL); Uttar Pradesh, Nainital 6500', 7.6.1958, C.M. Arora 1416 (CAL).

Ecol. : In evergreen forests, often found near streams, in open thickets, road sides and ravines.

ssp. *yunnanensis* (Franch.) Beus. in Blumea 19 : 471. 1971. *M. yunnanensis* Franch. in Bull. Soc. Bot. Fr. 33 : 465. 1886; Cufod. in Oest. Bot. Zeit 88 : 262. 1939.

Local names : Gogua, Gugua, Busha, Bushkua, Bekesh, Kapper (Hindi); Koda Khebabe (Nep.); Gogsha, Charcharyia Ghogsa (Punj.)

Leaves obovate-oblong to lanceolate, 3—15 × 1—6 cm, base acute, to cuneate, apex cuspidate to subcaudate, usually remotely spinously dentate especially towards apex, sometimes entire, glabrous or very sparsely puberulous, nerves 7—14 pairs. Panicles lax to dense, 4—20 cm, often narrow, suspended by normal to small leaves. Sepals 5. Inner petals 1—1.5 mm, slightly bifid, lobes divergent.

Type : China, Yunnan, Delavay 877 (K, Photo !)

Fls. : Apr.—Jun.; *Frts.* : Sep.

Distrib. : INDIA : Arunachal Pradesh, Assam, North-East Punjab, Sikkim, Uttar Pradesh; BHUTAN, N. BURMA, CHINA, NEPAL, TIBET.

Exsicc. : Uttar Pradesh, Mussoorie, May 1895, P. W. Mackinnon s.n. (CAL); Arunachal Pradesh, Kameng, 2000 m, 4.6.1957, R. S. Rao 8045 (CAL); Dehra Dun, Ramgarh, 5.6.1893, Durga Dutta 178 (ASSAM).

5. *M. sumatrana* (Jack) Walp. in Ann. Bot. Syst. 1 : 135. 1848; Hook. f., Fl. Brit. India 2 : 6. 1876; Beus. in Blumea 19 : 484. 1971. *Millingtonia sumatrana* Jack, Mal. Misc. 2(7) : 30. 1822. *Meliosma lanceolata* auct. non Bl., Rao & Chakravorty in Jour. Econ. Tax. Bot. 6 : 453. 1985.

Evergreen trees. Flowering twigs terete, glabrous. Leaves 2—5-jugate, glabrous with distinctly swollen base; leaflets usually elliptic to lanceolate, sometimes ovate to ovate-lanceolate, 5—35 × 3—15 cm, apex acuminate to

caudate, entire, glabrous above, slightly pubescent along nerves beneath, domatia absent, midrib very prominent beneath, nerves 7–13 pairs, ascending, reticulate, distinctly swollen at base. Panicles usually terminal, puberulous, many-flowered. Flowers crowded. Sepals 4 or 5, ovate, unequal, inner glabrous, ciliolate along margins. Inner petals reduced, adnate to 2 fertile stamens, 1–1.5 mm long. Ovary 0.5–1 mm, glabrous; styles 0.5–1 mm long, glabrous.

Type : Sumatra, Pulo Nias, Jack s. n. (n. v.).

Fls. : Oct.; *Frts.* : Nov.—Dec.

Distrib. : INDIA : Great Nicobar; MALESIA.

Exsicc. : Great Nicobar, 14.10.1979, D. K. Hore 7209 (CAL).

Ecol. : Mixed evergreen tropical rain forest. Found in dense to open forests, by streams as well as on hill tops and ridges.

Use : The triturated bark and leaves are reported to be in use as a medicine applied for wounds, to soothe itchy skin or charred and mixed in water to treat tympanities. The fruits are reported to be edible (Beus. in Blumea 19 : 489. 1971).

Notes : Chakraborty and Rao (l.c.) identified the specimen D. K. Hore 7209 (CAL, PBL) as *Meliosma lanceolata* Bl. but the characters of the above specimen agree well with those of *Meliosma sumatrana* and differ from *Meliosma lanceolata* Bl. in having glabrous ovary, rounded inner petals and obscurely veined leaves.

The occurrence of *Meliosma sumatrana* in the Great Nicobar island is phytogeographically interesting as it is an extension of its westward distribution.

SABIA

Coleb. in Trans. Linn. Soc. London 12 : 355, t. 14. 1818; Wall. in Roxb., Fl. Ind. 2 : 308. 1824; Hook. f. & Thoms., Fl. Ind. 1 : 209. 1855; Benth. & Hook. f., Gen. Pl. 1 : 414. 1862; Hook. f. in Hook. f., Fl. Brit. India 2 : 1.1876; Warburg in Engl. & Prantl, Nat. Pflanzenfam. 3, 5 : 367. 1895; Chen. in Sargentia 3 : 1–75. 1943; v. d. Water in Blumea 26 : 1-64. 1980.

Deciduous or evergreen woody climbers or scandent shrubs with persistent bud scales at base of branches. Leaves alternate, simple, ovate or elliptic to lanceolate, entire, petiolate, exstipulate. Inflorescence an axillary cyme, rarely a panicle or a raceme, sometimes flowers solitary. Flowers small, 5-merous, actinomorphic. Sepals 5–7, equal, basally connate, somewhat orbicular-ovate, persistent. Petals 5, equal, imbricate. Disc 5-lobed. Stamens 5, all fertile, inserted on disc and adnate to petals at base, anthers globular. Carpels 2, ovary ovoid or conical, 2-loculed; styles

2, united. Fruit of 1 or 2, almost free, reniform or subglobose drupelets, endocarp pitted or reticulate, bony. Seeds reniform, testa brittle.

Distrib. : c. 19 species mainly confined to South East Asia. 6 species in India. Only *S. limoniacea* occurs in S. India.

Type : *Sabia lanceolata* Colebr.

KEY TO THE SPECIES

- 1a. Flowers solitary ...*S. campanulata* 1.
- 1b. Flowers few to many :
 - 2a. Inflorescence few-flowered, simple cyme ...*S. purpurea* 6.
 - 2b. Inflorescence many-flowered, compound cyme :
 - 3a. Petals 3.5–5 mm long ...*S. lanceolata* 2.
 - 3b. Petals 2–3 mm long :
 - 4a. Inflorescence 10–20-flowered, shorter than leaves ...*S. parviflora* 5.
 - 4b. Inflorescence many-flowered, longer than leaves :
 - 5a. Lateral cymes simple, glabrous ...*S. limoniacea* 3.
 - 5b. Lateral cymes compound, pubescent ...*S. paniculata* 4.
 - 1. ***Sabia campanulata*** Wall. in Roxb., Fl. Ind. 2 : 311. 1824; Walp., Rep. 1 : 557. 1842; Hook. f. & Thoms., Fl. Ind. 1 : 209. 1855; Hook. f., Fl. Brit. India 2 : 1. 1876; Gamble, Man. Ind. Timber 102. 1881 (Rev. ed. 204 : 1902); Parker, For. Fl. Punjab 108. 1924; Banerjee in Rec. Bot. Surv. Ind. 19 : 36. 1965; v. d. Water in Blumea 26 : 25. 1980. *Sabia leptandra* Hook. f. & Thoms., Fl. Ind. 1 : 209. 1855; Hook. f., Fl. Brit. India 2 : 2. 1876.

Local names : Bakalpata, Lohari (Hindi); Payongrik (Lep.); Simali (Nep.).

Woody climbers or scandent shrubs, young shoots pubescent. Leaves 3–10(–15) × 1–3.5 cm, oblong or oblong-ovate to lanceolate, acuminate, acute at base, nerves 4–6 pairs; petioles 5–12 mm long, pubescent. Sepals 5, united at base, c. 3 mm long. Petals 5, free, subrotund to obovate, 8–12 mm long, obtuse. Stamens 5, filaments somewhat dilated towards base. Carpels 2, ovary bilobed, each lobe unilocular, biovulate. Drupes 1 or 2 lobed, reniform, 5–6 mm in diameter, wrinkled.

Pollen grains : Prolate, subangular in polar view, P/E = 1.25–1.40, tectum 0.75 μm thick, columella 0.25 μm thick, endexine 0.50 μm thick, finely reticulate, lumina 0.50–1.0 μm diameter, ectoaperture slit-like, endoaperture latelongate, colpa constricted at equator. (Mandal et Mitra in Geophytology 12(2) : 172-173. 1982).

KEY TO THE VARIETIES

- 1a. Flowers longer (33 mm long), petals sub-rotund to obovate, $6-10 \times 4-7$ mm; stamens shorter than petals ...var. *campanulata*
- 1b. Flowers shorter (14 mm long), petals ovate to oblong, $3.0-3.5 \times 2.0-2.5$ mm; stamens longer than petals ...var. *kingiana*

var. *campanulata*

Type : Nepal, Wallich 1002 (CAL! K-W).

Fls. : Mar.-May; *Frt.s.* : May-Jun.

Distrib. : INDIA : Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Punjab, Sikkim, Uttar Pradesh, West Bengal; BHUTAN, BURMA, CHINA, NEPAL, TAIWAN.

Exsicc. : Sikkim, Kalabokree, 3000 m, 18.5.1876, G. King s. n. (CAL); Uttar Pradesh, Garhwal, 2500 m, 25.5.1972, B. D. Naithani 47967 (CAL).

Ecol. : Commonly grows between 1500 and 3000 m altitude.

var. *kingiana* Nayar & Majumder in Bull. Bot. Surv. India 24 : 219. 1982.

This variety differs from var. *campanulata* in having stamens longer than petals, smaller flowers and ovate to oblong petals.

Type : Sikkim Himalaya, G. King s. n. (Holo, CAL).

Fls. : Mar.

Distrib. : INDIA : Sikkim Himalaya.

Exsicc. : Sikkim Himalaya, about 1600 m, 3.3.1876, King's collector s. n. Acc. No. 97401 (CAL).

2. *S. lanceolata* Colebr. in Trans. Linn. Soc. London 12 : 355. 1818; Wall. in Roxb., Fl. Ind. 2 : 309. 1824; Hook. f. & Thoms., Fl. Ind. 1 : 210. 1855; Hook. f., Fl. Brit. India 2 : 2. 1876; Kanjilal et al., Fl. Assam 1 : 325. 1937; Sengupta in Bull. Bot. Soc. Bengal 22 : 2. 196.1968 et Rec. Bot. Surv. India 20, 2 : 64. 1973; v. d. Water in Blumea 26 : 41. 1980. *Sabia tomentosa* Hook. f. in Hook. f., Fl. Brit. India 2 : 3. 1876.

Local names : Sajba-lat, Soobja (Beng.); Miri, Mandri (Garo); Samtameh (Kh.)

Evergreen woody climbers or scandent shrubs. Twigs glabrous or pubescent. Leaves $5-22 \times 1.5-8.0$ cm, elliptic-oblong to lanceolate, base acute to obtuse or rounded, apex acute, nerves 7-12 pairs, petioles up to

2.5 cm long. Cymes solitary or in thyrses, axillary, 15–30-flowered; pedicels up to 13 mm. Flowers greenish-white. Sepals ovate, sometimes oblong-ovate, $0.75 - 1.25 \times 0.7 - 1.5$ mm. Petals oblong-ovate to oblong, $3 - 5.5 \times 1.5 - 2$ mm. Stamens 1.5–2 mm, filaments flattened; anther globular to ellipsoid. Disc crown-shaped. Pistil 1.25–1.75 mm, ovary glabrous. Druplets distinctly obovoid to oblong-obvoid, somewhat compressed, with or without persistent petals and stamens at base.

Pollen grains : Prolate, circular in polar view, $P/E = 1.21 - 1.63$, tectum 0.5 μm thick, columella 0.25 μm thick, indistinct, endexine 0.25 μm thick, \pm psilate, ectoaperture slit-like, endoaperture lalongate (Mandal et Mitra in Geophytology 12(2) : 172–173. 1982).

KEY TO THE VARIETIES

- 1a. Leaves glabrous beneath. Inflorescence glabrous ...var. *lanceolata*
- 1b. Leaves sparsely to laxly pubescent beneath. Inflorescence pubescent ...var. *siamensis*

var. *lanceolata*

Type : Bangladesh, Silhet, Colebrooke (K, n. v.).

Fls. : Oct.–Jan.; *Frts.* : Jan.–Apr.

Distrib. : INDIA : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Uttar Pradesh; BANGLADESH, BHUTAN, N. BURMA.

Exsicc. : Assam, Burnihat 70 m, 20.10.1915, U. Kanjilal 6070 (ASSAM); Meghalaya, Khasi Hills, Cave Forest, 1400 m, 14.10.1983, S. C. Majumder 16312 (CAL).

Ecol. : Occurs between 200 and 1500 m altitude.

Uses : The leaves are used by the Garos for fomenting in cases of swellings and pain on the ankle and wrist (Kanjilal *et al.* l.c.).

var. *siamensis* v.d. Water in Blumea 26 : 43. 1980.

Flowering twigs pubescent. Leaves oblong $7 - 22 \times 3 - 10$ cm, herbaceous, sparsely to laxly pubescent beneath especially on midrib and nerves; base acute to cuneate; nerves 5–7 pairs. Cymes pubescent. Sepals ovate, $0.8 - 1.2 \times 0.6 - 1$ mm. Petals ovate to oblong-ovate $3.5 \times 1.4 - 1.8$ mm.

Type : Thailand, Kao Lung, Prachuap, alt. c. 700 m., 4.7.1926, A.F.G. Kerr 10809 (Holo, L; Iso K, Photo! BM).

Fls. : Jul.

Distrib. : INDIA : Arunachal Pradesh; THAILAND.

Exsicc. : Arunachal Pradesh, Jankimukh, 16.11.1911, *I. H. Burkitt* 37176 (CAL).

Ecol. : Occurs between 200 and 700 m altitude.

Notes : *S. lanceolata* var. *siamensis* was described from Thailand. This is the first report of its occurrence from India.

3. *S. limoniacea* Wall. ex Hook. f. & Thoms., Fl. Ind. 1 : 210. 1855; Hook. f., Fl. Brit. India 2 : 3. 1876; Kurz in Jour. Asiat. Soc. Bengal 45 : 204. 1876, excl. syn. Prain, Bengal Pl. : 246. 1903 (Repr. ed. 1 : 246. 1963); Kanjilal et al., Fl. Assam 2 : 326. 1936; Biswas, Pl. Darj. Sikkim Himal. 1 : 261. 1966; v. d. Water in Blumea 26 : 44. 1980, *Sabia malabarica* Bedd., Ic, Pl. Ind. Or. 1 : 39. 1874; Hook. f., Fl. Brit. India 2 : 2. 1876.

Evergreen woody climbers, up to 10 m. Leaves oblong-ovate to oblong-lanceolate, 4—18 × 1.5—6.5 cm, base acute to rounded, apex acute, nerves 5—9 pairs, glabrous to sparsely pubescent. Panicles 7—15 cm long, often subtended by small leaves, axillary, solitary, glabrous, many-flowered. Sepals 5, glabrous, broad-ovate to elliptic, 0.7—1.2 × 0.6—1 mm, margin ciliolate. Petals 1.75—2.5 × 1.25—2 mm, elliptic to ovate, 5-nerved. Stamens 5, unequal, 1.5—2 mm, filaments somewhat flattened. Ovary ovoid or conical, glabrous; styles 0.5 mm long; stigmas minute. Druplets globular to obovoid.

Type : Bangladesh, Sylhet, R. Brown in Wall. Cat. 1000 (K-W, CAL).

Fls. : Sep.—Jan.; *Frts.* : Dec.—Apr.

Distrib. : INDIA : Assam, Kerala, Meghalaya, Nagaland, Sikkim, Tamil Nadu, Tripura, West Bengal; BANGLADESH, BHUTAN, BURMA, CHINA, HONGKONG, INDONESIA, LAOS, MALAY PENINSULA, THAILAND, VIETNAM.

Exsicc. : Nagaland, Naga Hills, Jan. 1899, Prain's Collector 626 (CAL); Tripura, Betlingshib, 3000', 30.1.1962, D. B. Deb 27298 (ASSAM).

Pollen grains : Prolate-sphaeroidal, subangular in polar view, P/E = 1.31—1.73, tectum 0.75 μm thick, columella 0.25 μm thick, endexine 0.5 μm thick, finely reticulate, lumina 0.5—1.0 μm diameter, ectoaperture slit-like, endoaperture lalongate, colpa constricted at equator (Mandal et Mitra in Geophytology 12(2) : 172-173. 1982).

Ecol. : Occurs mainly in thickets and woods from 300—1200 m altitude.

4. *S. paniculata* Edgew. ex Hook. f. & Thoms., Fl. Ind. 1 : 211. 1855; Hook. f., Fl. Brit. India 2 : 3. 1876; Gamble, Man. Ind. Timb. 102. 1881 (Revs. ed. 204. 1902); Duthie, Fl. Upp. Gang. Pl. 1 : 183. 1903

(Repr. ed. 1 : 171. 1960); Burkill in Rec. Bot. Surv. Ind. 4 : 103. 1910; Haines, Bot. Bih. Or. 2 : 218. 1926 (Repr. ed. I : 226. 1961); Kanjilal *et al.*, Fl. Assam 2 : 326. 1936; v. d. Water in Blumea 26 : 47. 1980.

Local name : Bakalpata (Hindi).

Evergreen woody climbers. Leaves oblong or oblong-ovate to sub lanceolate, 8—22 × 2.5—8 cm, glabrous, base acute to rounded, apex acute; nerves 5—7 pairs, petiole up to 2.5 cm. Cymes solitary, axillary but often arranged in a thyrsoid inflorescence. Sepals ovate, 1—1.3 × 0.7—1 mm, densely pubescent, ciliolate. Petals 2.25—3.0 × 0.75—1.25 mm, oblong, sometimes oblong-ovate, obtuse. Stamens 1.5—2.75 mm, filaments flattened, 1—1.75 mm long. Pistil 1.5—1.75 mm, ovary glabrous. Druplets globular to obovoid.

Type : North Western India, Dehra Dun, 1844, P. K. Edgeworth 388 (K, n. v.).

Fls. : Jan.—Apr.; *Frt.s.* : Mar.—Aug.

Distrib. : INDIA : Assam, Arunachal Pradesh, Bihar, Nagaland, Sikkim, Uttar Pradesh, West Bengal; BURMA, NEPAL.

Exsicc. : Assam, Kamrup, Goruchara, 24.1.1915, U. Kanjilal 5050 (ASSAM); West Bengal, Jalpaiguri, North Bholka, J.K. Sikder 4178 (CAL).

Ecol. : In shady and swampy localities, mainly between 250 and 1400 m alt.

Pollen grains : Prolate, subangular in polar view, P/E = 1.40—1.53, tectum 0.75 μm thick, columella 0.25 μm thick, endexine 0.50 μm , thick, reticulate, reticulations firm towards aperture, lumina (0.5—) 1.0—1.5 μm diameter, ectoaperture slit-like, endoaperture lalongate, heterobrochate (Mandal *et al.* in Geophytology 12 (2) : 172—173. 1982).

5. *S. parviflora* Wall. in Roxb. Fl. Ind. 2 : 310. 1824; Hook. f. & Thoms., Fl. Ind. 1 : 210. 1855; Hook. f., Fl. Brit. India 2 : 1. 1876; Kanjilal *et al.*, Fl. Assam 2 : 325. 1936; Biswas, Pl. Darj. Sikkim Himal. 1 : 261. 1966; Sengupta in Bull. Bot. Soc. Bengal 22 196. 1968 & in Rec. Bot. Surv. Ind. 2 : 65. 1973; v. d. Water in Blumea 26 : 48. 1980.

Evergreen climbers or scandent shrubs, upto 6 m tall. Leaves oblong or sometimes oblong-ovate to lanceolate, 3—12 × 1—5 cm, base acute to rounded, apex acute to acuminate, margin elegantly waved; nerves 6—9 pairs, patent, straight or curved, petiole up to 1.5 cm. Cymes solitary, axillary, 2—8 cm long, 10—20-flowered; sometimes widely spreading, up to 35-flowered. Sepals broad-ovate to ovate, 0.7—1.5 × 0.5—1 mm, acute to rounded,

glabrous to pubescent, ciliolate. Petals 2—3 × 0.7—1.3 mm, acute to obtuse; oblong to lanceolate, nerves upto 7 pairs. Stamens 1.2—2.25 mm, filaments flattened. Ovary globular to subreniform, glabrous. Druplets globular to ovoid.

Type : Nepal, Wallich 1001 p.p. (K-W, microf. !).

Fls. & Frts. : Probably throughout the year.

Distrib : INDIA : Assam, Arunachal Pradesh, Meghalaya, Sikkim, Uttar Pradesh, West Bengal; BHUTAN, BURMA, CHINA, INDONESIA LAOS, NEPAL, THAILAND, VIETNAM.

Exsicc. : Sikkim, Nagri, 1000 m, 4.5.1862, *T. Anderson* 116 (CAL); Sikkim, Singtam 140 m, 15.5.1967, *N.C. Majumder & R.M. Dutta* 382 (CAL).

Ecol. : On road sides; in thickets and forests, between 140 and 2000 m altitude.

Pollen grains : Prolate, subangular in polar view, P/E = 1.45—1.52, tectum 1.0 μm thick, columella 0.5 μm thick, endexine 1.0 μm thick, reticulate, heterobrochate, reticulate, coarser at poles, lumina 1.0—1.5(—2.5) μm diameter, ectoaperture slit-like, endoaperture Ialongate (*Mandal et Mitra in Geophytology* 12(2) : 172—173. 1982).

6. *S. purpurea* Hook. f. & Thoms., Fl. Ind. I : 209. 1855; Hook. f., Fl. Brit. India 2 : 2.1876; Osmaston, For. Fl. Kumaon 132. 1927; Kanjilal *et al.*, Fl. Assam 2 : 124. 1936; v. d. Water in Blumea 26 : 52. 1980.

Local names : Jermineirang-Chhai (Asm.), Dieng-Jermeri (Kh.).

Shrubs or climbers, upto 4.5 m. Leaves 3—12 × 1.5—4.5 cm, oblong, oblong-ovate to sublanceolate, nerves 4—6 pairs. Cymes solitary, axillary, up to 4.5 cm, 3—6-flowered, glabrous. Sepals unequal up to 1.5 mm. Petals 5, ovate or elliptic to oblong-ovate, 3.0—4.5 × 1.25—2.25 mm. Stamens 5, 1.5—1.75 mm. Pistil 1.3—1.7 mm; styles narrowly conical to conical, ovary ovoid, glabrous. Druplets globular to somewhat ovoid.

Type : Meghalaya, Khasia, alt. 1200—1800 m, *Hooker f., & Thomson s.n.* (K, Photo!)

Fls. : Feb.—Apr.; *Frts.* : Apr.—Jun.

Distrib : INDIA : Assam, Meghalaya, Sikkim, Uttar Prasdesh, West Bengal; BURMA, NEPAL, THAILAND.

Exsicc. : Meghalaya, Khasia Hills, 4.4.1894, *G.A. Gammie* 338 (CAL), Meghalaya, Nongstoin 19.6.1958, *G. Panigrahi* 16461 (ASSAM).

Chr. No. : n = 24(*Malla et al.*, Taxon 26 : 561. 1977)

Pollen grains : Prolate, \pm circular in polar view, P/E = 1.21—1.60, tectum 0.50 μm thick, columella 0.25 μm thick, indistinct, endexine 0.5 μm thick, finely reticulate, lumina 0.5—1.0 μm diameter, ectoaperture slit-like, endoaperture \pm circular (Mandal et Mitra in Geophytology, 12 (2) : 172-173. 1982).

Ecol. : Occurs in thickets and forests between 1200 and 2100 m altitude.

STACHYURACEAE

J.G. Agardh, Theor. Syst. Pl. Fam. Phan.: 152. 1858 (as 'Stachyureae')

S. Singh & D. C. S. Raju*

Small trees or shrubs. Leaves alternate, serrate, membranous, exstipulate. Inflorescence axillary, racemes or spikes, pendulous; bracteoles 2, connate. Flowers bisexual, tetramerous. Sepals 4, imbricate. Petals 4, free, imbricate. Stamens 4 + 4, hypogynous, anthers versatile, bilocular. Ovary superior, syncarpous, tetralocular; placentation axile, ovules indefinite; style simple. Berry erect, seeds small, endosperm fleshy, arillate, embryo straight, cotyledons elliptic.

Distrib. : Monotypic, subtropical to temperate regions of India (Eastern Himalayas), Nepal, Bhutan, N. Burma, W. & C. China, Japan, and Taiwan. 7-8 species in the world, 1 in India.

Notes : Agardh (1858) separated this genus under a monotypic family Stachyuraceae, while Bentham & Hooker (Gen. Pl. 1 : 184. 1862) treated this under tribe Sauraueae of the family Ternstroemiaceae of Guttiferales and was followed by Dyer (in Hooker's Fl. Brit. India 1 : 288. 1872). Hutchinson (*I.c.*), based on the wood anatomy and ranunculaceous type of stomata, accorded the systematic position of the family under the order Hamamelidales instead of Guttiferales.

STACHYURUS

Sieb. & Zucc., Fl. Jap. 42, t. 18. 1835; Benth. & Hook. f., Gen. Pl. 1 : 184. 1862; Engl. & Prantl, Nat. Pflanzenfam. 3, 6 : 192. 1893; Hutch., Gen. Fl. Pl. 2 : 105. 1967.

Generic characters as of family.

Type : *S. praecox* Sieb. & Zucc.

Stachyurus himalaicus Hook. f. & Thoms. ex Benth. in Journ. Linn. Soc. Bot. 5 : 55. 1861, in adnota; Dyer in Hook. f., Fl. Brit. India 1 : 288. 1874.

Shrubs or small trees, much branched from base; branches straggling, gland-dotted, ribbed, reddish-purple. Leaves glabrous, membranous to subcoriaceous, lamina 6—13 × 3.2—5.5 cm, lanceolate to ovate-lanceolate to elliptic, base rounded, apex acuminate, margin serrate and thickened, reticulation distinct; petioles 8—12 mm long, curved at base. Spikes

*Botanical Survey of India, Sikkim-Himalaya Circle, Gangtok.

axillary, solitary, 5—11 cm long, pendulous, peduncles curved. Flowers subsessile; bracts leafy, bracteoles 2, opposite, 2.0—3.5 × 2.5—3.0 mm, ovate, cucullate, glabrous, coriaceous, connate at base, reddish-brown. Sepals 4, imbricate, 4.5—5.5 × 3—4 mm, ovate, thick, cucullate, greenish-yellow, margin thin. Petals 4, 6.5—7.5 × 4—5 mm, obovate, cucullate, purplish-pink becoming greenish-yellow, thick, margin thin. Stamens 8, diplostemonous, filaments outer 5—6 mm long and inner 1.5—2.5 mm long, thick at base. Ovary subglobose; styles 2.5—3.0 mm long, persistent; stigma globose. Berry 5—6 mm diam., globose.

Type : India, Sikkim, Lachen-Lachung, 1500-2500 m, *J.D. Hooker s.n. (K, Photo!)*

Fls. & Frs. : Mar.—Jul.

Distrib. : INDIA : Eastern Himalayas, W. Bengal (Darjeeling), Arunachal Pradesh, Sikkim, Nagaland, Manipur; NEPAL, BHUTAN, S. TIBET, N. BURMA, W. & C. CHINA.

Ecol. : Grows in open valleys in temperate zone.

Exsicc. : INDIA : Arunachal Pradesh, Kameng District, 5. 4.1957, *Panigrahi* 15975 (CAL); Rabung, 5,900 ft. (c. 1800 m), 15.5.1957, *R.S. Rao* 7431 (CAL); Manipur Khongui, 4,000 ft., (c. 1250 m), 26.4.1882, *G. Watt* 6741 (CAL); Nagaland, Naga hills, *F. Kingdon-Ward* 11116 (CAL); Sikkim, Chungthang, 5180 ft. (c. 1,700 m), *K. Biswas* 6824 (CAL); West Bengal, Singalila Range, Rithu Block, 8,000 ft (c. 2,400 m), 23.3.1900, *B. Singh & C.G. Rogers* s.n. (CAL).

SYMPLOCACEAE

Desfontaines in Mem. Mus. Hist. Nat. Paris 6 : 9. 1820 (Symploceae)

D. K. Hore*

Shrubs to large evergreen trees. Leaves simple, alternate or spirally arranged, petioled, rarely almost sessile. Flowers in spikes, racemes or panicles, mostly from upper leaf axils, sometimes condensed to clusters, rarely solitary, supported by 1 bract and 2 bracteoles, actinomorphic, bisexual, rarely unisexual, mostly fragrant. Calyx with a very short tube or often elongate above the inferior ovary, 3—5-lobed, imbricate or valvate, persistent. Corolla sympetalous, divided halfway up to the base, whitish, bluish or purplish. Stamens monadelphous or pentadelphous; filaments cylindrical or flattened; anthers globose, longitudinal dehiscing, introrse. Ovary inferior or semi-inferior, 2—5-loculed with complete septa; ovules 2—4 in each locule, pendulous, anatropous; style 1; stigma capitate. Drupes, crowned by the persistent calyx-lobes. Stone often ribbed, rarely smooth. Seeds straight or curved with copious endosperm. Embryo straight or curved.

Pollen : Subtriangular, triangular or rarely rectangular; aperture generally angular; 3(—4)-porate or calporate; pores non-annulate or sometimes rims enveloping the pores; colpi much smaller, insignificant in contrast to ora, mostly circular or elongate; sexine psilate, obscure and granulate; sexine and nexine equithick or sexine slightly thicker than nexine (Gupta and Sharma in Geophytology 7(2) : 147-159. 1977).

Distrib. : The only genus *Symplocos* N. Jacq. with c. 250 species (Nooteboom, Rev. Symplocac. 36. 1975) in the tropics of Indo-Australia and the New World, particularly America, extending to Mexico, SE United States and Brazil; absent in Africa; 33 species in India of which 13 taxa belonging to 10 species are endemic.

Notes : De Candolle (Prod. 8 : 244. 1844), Bentham & Hooker f. (Gen. Pl. 2. 2 : 668. 1876) and Clarke (Hook. f. Fl. Brit. India 3 : 572. 1882) included the genus *Symplocos* under the family Styraceae. But Desfontaines (*I. c.*) first used the term Order "Symploceae" and later D. Don (*Symplocineae*-Prod. Fl. Nepal. 144. 1825 excl. *Schoepfia* Schreb.) regarded it as a family. Subsequently several taxonomists accepted D. Don's view. Nooteboom in his monograph (*I.c.*) established it as a distinct monogeneric family. The family Symplocaceae is distinguished from

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Styracaceae by fasciculate (adelphous) stamens with globose to ovoid-sub-globose anthers, semi-inferior to inferior ovaries with 2—5 locules and drupaceous fruits with persistent calyx-lobes.

SYMPLOCOS

Jacquin, Enum. Pl. Carib. 5 : 24. 1760; Benth. & Hook. f., Gen. Pl. 2. 2 : 668. 1876; Clarke in Hook. f., Fl. Brit. India 3 : 572. 1882; Brand in Engl. Pflanzenr. Heft 6 : 13. 1901; Hutch. Gen. Fl. Pl. 2 : 39. 1968; Nooteboom, Rev. Symplocac. 33. 1975 *et al* in Fl. Males. I. 8(2) : 205. 1977 *et al* in Rev. Handb. Fl. Ceylon 3 : 454. 1981; Hore in Ind. Forester 109(4) : 246. 1983.

Characters as of the family.

Ecol. : All are evergreen except *Symplocos paniculata* (Thunb.) Miq., which is deciduous. A few are restricted to lowlands, otherwise mostly occur on the hills and in mountain forests of the Himalayas, Western Ghats and Andaman and Nicobar Islands.

Notes : Based on stamen character the genus was subdivided by Brand (*I. c.* 25. 1901) into four subgenera i.e. *Epigenera*, *Hopea*, *Microsymplocos* and *Eusymplocos*. When all morphological characters are considered the genus can be divided only into two subgenera viz., subgen. *Symplocos* and subgen. *Hopea*. This is further supported by palynology (Meijden in Pollen et Spores 12(4) : 513—551. 1970).

KEY TO THE SUBGENERA

- 1a. Flower buds clavate. Petals distinctly connate into a tube, often to above the middle, adherent to the staminal tube and then abruptly expanded. Stamens monodelphous, filaments adnate to tubular corolla
...subgen. *Symplocos* 1.
- 1b. Flower buds subglobose. Petals connate at the very base only, spreading. Stamens mostly pentadelphous (except in *S. oligandra*), filaments slender, adnate to corolla base
...subgen. *Hopea* 2

KEY TO THE SPECIES

Subgen. 1. *Symplocos*

- 1a. Leaves 8—9 × 3—4 cm, base cuneate. Inflorescence 1—4-flowered, pendulous. Calyx-tube 5—6 mm, infundibuliform. Fruit obovate to cylindric
...*S. pendula* 24

- 1b. Leaves 5—6 × 1.5—2.0 cm, base abruptly attenuate. Inflorescence erect. Calyx-tube 2.5—3.0 mm, cupular. Fruits cylindric or club-shaped ...*S. sessilis* 29

KEY TO THE SPECIES

Subgen. 2. *Hopea* (Linn.) C. B. Clarke in Hook. f., Fl. Brit. India 3 : 572. 1882. *Hopea* Linn. Mant. 1 : 105. 1767.

- 1a. Plants deciduous. Fruits obliquely ovoid or globose, deep blue when ripe ...*S. paniculata* 23
- 1b. Plants evergreen. Fruits otherwise, never deep blue when ripe :
- 2a. Stamen bundles always in pairs ...*S. oligandra* 21
- 2b. Stamens always more than 2 in a bundle, mostly pentadelphous :
- 3a. Flowers in racemes or panicles (rarely spikes as in *S. macrophylla*) :
- 4a. Twigs hairy at least when young :
- 5a. Stamens more than 70 in a flower (rarely 40 as in *S. macrophylla* ssp. *rosea*) ...*S. macrophylla* 17
- 6a. Racemes upto 10 cm long. Leaf margins dentate
- 6b. Racemes up to 7 cm long. Leaf margins serrate or dentate :
- 7a. Lamina elliptic to elliptic-oblong with 7—12 pairs of secondary nerves : ...*S. anomala* 2
- 8a. Bracts and bracteoles persistent; calyx-tube tomentose
- 8b. Bracts and bracteoles caducous; calyx-tube glabrous ...*S. kurgensis* 13
- 7b. Lamina obovate-lanceolate with 5-6 pairs of secondary nerves ...*S. wynadense* 33
- 5b. Stamens always less than 60 in a flower :
- 9a. Lamina 12 cm long or less, sometimes as short as 3 cm, 3—10 pairs of pinnate secondary veins : ...*S. sessilis* 29
- 10a. Floral disc glabrous :

- 11a. Petioles usually 10—15 mm long; lamina coriaceous; nerves usually 10 pairs ...*S. sumuntia* 30
- 11b. Petioles short, 2—7 mm long; lamina membranous or chartaceous; nerves 3—7 pairs
- 12a. Inflorescence 1—2 cm long. Fruits ampulliform ...*S. viridissima* 32
- 12b. Inflorescence 2.5—3.0 cm long. Fruits ovoid-cylindric ...*S. caudata* 3
- 10b. Floral disc hairy :
- 13a. Fruits rounded or ovoid ...*S. theaefolia* 31
- 13b. Fruits ampulliform ...*S. fasciculata* 7
- 9b. Lamina 14—20 cm long with 14—16 pairs of pinnate secondary veins ...*S. dryophila* 6
- 4b. Twigs glabrous when young :
- 14a. Styles always glabrous :
- 15a. Lamina more than 16 cm. Stamens about 80; floral disc hairy ...*S. hookeri* 11
- 15b. Lamina upto 16 cm long. Stamens 25—60; floral disc always glabrous
- 16a. Stamens about 25. Lamina with 10—15 pairs of secondary veins ...*S. glomerata* 10
- 16b. Stamens 40—60. Lamina with 5—10 pairs of secondary veins :
- 17a. Lamina 8—13 cm long, acuminate. Flowers 6—7, in racemes ...*S. ramosissima* 28
- 17b. Lamina 2.5—4.8 cm long, obtuse to sub-obtuse. Flower solitary
- 18a. Bracts present, bracteoles persistent. Stamens nearly 40 ...*S. monantha* 18
- 18b. Bracts absent, bracteoles caducous. Stamens nearly 60 ...*S. anamallayana* 1
- 14b. Styles hairy or rarely glabrescent :
- 19a. Calyx lobes ovate, margins hairy but surface glabrous. Fruits ovoid to ellipsoid or flask-shaped :

- 20a. Fruits ovoid to ellipsoid :
- 21a. Pedicels 1—1.5 mm long. Stamens about 40 ...*S. oxyphylla* 22
- 21b. Pedicels 1—3 mm long. Stamens 50—100 ...*S. racemosa* 27
- 20b. Fruits flask-shaped ...*S. odoratissima* 20
- 19b. Calyx lobes triangular to lanceolate, margins glabrous, apical surface hairy. Fruits cylindric ...*S. pyrifolia* 26
- 3b. Flowers in spike :
- 22a. Styles glabrous :
- 23a. Fruits cylindric :
- 24a. Leaves cuneate. Sepal margins glabrous ...*S. foliosa* 8
- 24b. Leaves attenuate. Sepal margins minutely hairy :
- 25a. Petioles 2—3 mm long. Styles constricted at the middle ...*S. huegeliana* 12
- 25b. Petioles 8—14 mm long. Styles not constricted at the middle ...*S. obtusa* 19
- 23b. Fruits ellipsoid to ovoid-ellipsoid, globose or ampulliform :
- 26a. Spikes usually tripartite below. Stamens 40—50 ...*S. cochinchinensis* 4
- 26b. Spikes never tripartite below. Stamens 25—35 ...*S. lancifolia* 14
- 22b. Styles hairy at least at the base :
- 27a. Bracts tomentose but apex glabrous :
- 28a. Leaves forming a crown at the branch tips; lamina margins revolute, surface glabrous ...*S. complanata* 5
- 28b. Leaves not forming any crown at the branch tips; lamina margins not revolute, surface tomentose to pubescent at least along the midrib :
- 29a. Leaves 21—26 cm long with 12—16 pairs of nerves. Fruits subcylindric, 1.3—1.5 × 0.4—0.6 cm ...*S. glauca* 9
- 29b. Leaves 12.0—16.5 cm long with 5—11 pairs of nerves. Fruits cylindric, 2.5—3.0 × 1.1—1.3 cm ...*S. macrocarpa* 16

- 27b. Bracts glabrous but margins hairy :
- 30a. Leaves glabrous, margin revolute. Racemes or spikes compactly flowered ...*S. lucida* 15
- 30b. Leaves villous or fulvous-hirsute, margin not revolute. Spikes 1—3-flowered ...*S. pulchra* 25
1. **Symplocos anamallayana** Bedd., For. Man. Bot. 150. 1872 et Ic. t. 116. 1874; Clarke in Hook. f., Fl. Brit. India 3 : 581. 1882; Gamble, Fl. Pres. Madras 5 : 784. 1923 (Repr. ed. 2 : 551. 1957); Shetty & Vivekananthan in Bull. Bot. Surv. India 14 : 21. 1975 (1972); Nooteboom, Rev. Symplocac. 124. 1975. *S. uniflora* Bedd. in Trans. Linn. Soc. 25 : 219. 1866 non Benth. (1841).

Small trees; branchlets glabrous; bark with longitudinal striations. Leaves 2.5—4.8 × 2.0—2.8 cm, broadly elliptic, subobtuse, margins crenulate, incurved, midrib slightly depressed, nerves 6—7 pairs, base cuneate to rounded, glabrous, chartaceous; petioles 1.5—3.0 mm. Flowers solitary, axillary; pedicels 0.8—1.5 cm, glabrous; bracts absent, bracteoles caducous, margins pilose. Calyx lobes obovate, obtuse, hirtellous along the margins and apical region. Corolla 5—6 mm, ovate. Stamens c. 60 pentadelphous; anthers oblong. Styles 1.8 mm, glabrous; stigmas flat. Disc glabrous. Fruits not seen.

Type : India, Anamallay Hills, Beddome 4930 (BM, Photo !).

Fls. : Mar.—May.

Distrib. : INDIA : Tamil Nadu, Kerala; endemic.

Pollen : Isopolar, 3-colporate, elliptic in meridional view and triangular in polar view, ectoaperture small, narrow, margin not differentiated, axine tectate, tectum verrucate. Some grains are 2-colporate (Vasanthy in Trav. Sect. Sc. Tech., Inst. Fanc. Pond. Tome 15. 37—38. Pl. 34, fig. 588—591. 1976).

2. **Symplocos anomala** Brand in Bot. Jahrb. 29 : 529. 1900; Nooteboom, Rev. Symplocac. 126. 1975 et in Fl. Males. I, 8(2) : 239. 1977. *S. nagensis* Fischer in Kew Bull. 38. 1940.

Shrubs or small trees; twigs densely brown tomentose or glabrescent. Leaves 5—10 × 2—3 cm, elliptic-oblong, acuminate, cuneate, midrib prominent below, nerves 7—8 pairs; petioles 3—5 mm, hairy, winged, slightly compressed. Racemes 2.0—3.5 cm long, lax, tomentose to appressedly pubescent; bracts and bracteoles ovate, persistent, appressed pubescent outside. Calyx 2.8 mm long, tomentose, lobes semiorbicular. Corolla lobes c. 4 mm long, ovate, obtuse, cream-coloured. Stamens over 100, pentadelphous. Disc cylindrical, tomentose or hairy. Ovary 2-loculed; style glabrous. Fruits 10 × 6 mm, ellipsoid.

Type : China, Szechwan, *Henry* 7094 (E).

Fls. : Sep.—Nov.; *Frts.* : Nov.—Dec.

Distrib. : INDIA : Nagaland; BURMA, THAILAND, SUMATRA, BORNEO, MALAY PENINSULA, CHINA, VIETNAM, TAIWAN, JAPAN.

3. **Symplocos caudata** Wall. ex G. Don, Gen. Syst. 4 : 3. 1837; Clarke in Hook. f., Fl. Brit. India 3 : 577. 1882; Cowan & Cowan, Trees N. Beng. 87. 1929; Kanjilal *et al.*, Fl. Assam 3 : 213. 1939; Banerji in Rec. Bot. Surv. India 19(2) : 64. 1966.

Large shrubs or trees, 3—18 m. Leaves 5.0—7.5 × 2.5—3.0 cm, lanceolate, caudate, cuneate, lower half subentire, upper half serrulate, chartaceous; nerves 6—7 pairs, prominent on the lower surface; petioles 2.0—2.5 mm. Racemes lax, 2.5—3.0 cm, villose or fulvous, subhirsute; pedicels 0.8—1.2 mm; bracts 1.2 × 1.0 mm, woolly; bracteoles 0.8 × 0.5 mm, lanceolate, acuminate, margin silky hairy. Calyx lobes 1.5 × 0.8—1.0 mm, ovate, subacute to obtuse, margin hairy. Corolla lobes 3.5—4.0 × 1.5—2.0 mm, oblong-lanceolate, yellowish. Stamens c. 25, pentadelphous. Disc glabrous; ovaries 5-loculed; styles c. 4.5 mm; stigmas rounded to capitate. Fruits c. 7.0 × 3.8 mm, ovoid-cylindric, crowned with enlarged calyx teeth, brown.

Type : India, Mont. Silhet, *H. Bruce-Wall.* Num. List No. 4413 (K-W, Photo !).

Fls. : Mar.—Apr.; *Frts.* : Jul.—Sep.

Distrib. : INDIA : Sikkim, West Bengal, Meghalaya, Nagaland; NEPAL, BANGLADESH, BURMA, JAPAN.

Ecol. : Tropical to temperate Eastern Himalayas between 1000 m and 2500 m, particularly found in evergreen hilly jungles.

Pollen : 3-colporate, rarely 4-colporate, brevi-colpate. Oblate (22.5 × 32.5 μm), range 20—25 × 30—35 μm , aspidate. Amb triangular. Colpi small, ends pointed and membrane psilate. Ora ± circular with thickened margins. Ora membrane psilate. Exine thickness c. 2 μm . Sexine as thick as nexine. Pattern finely reticulate-tectate (Gupta & Sharma in Geophytology 7(2): 153. 1977).

Notes : The species is closely allied to *Symplocos sumuntia* Buch.-Ham. ex D. Don. and Nooteboom (*I.c.*) has treated the two as conspecific. It can be distinguished from the latter by (i) shorter length of petiole and lamina, lesser number of nerves and also caudate type of leaf apex; (ii) margins of sepals hairy; (iii) number of stamens 25. Anatomy of petiole also reveals the distinction between the two species. In *S. caudata*,

the median vascular bundle is 'V'-shaped and unbranched throughout the entire length of the petiole; crystals do not occur in the ground tissue whereas in *S. sumuntia* the median vascular bundle is semilunar in shape and gives off 1—2 lateral traces from the middle to distal region of the petiole; crystals found in the ground tissue.

4. *Symplocos cochinchinensis* (Lour.) S. Moore in Journ. Bot. 52 : 148. 1914; Guillaumin in Bull. Soc. Bot. Fr. 71 : 277. 1924; Merr. in Trans. Amer. Phil. Soc. (N. S.) 24 : 304. 1935; Nooteboom, Rev. Symplocac. 141. 1975 et in Fl. Males. I. 8(2) : 245. 1977. *Dicalix cochinchinensis* Lour., Fl. Cochinch. I : 663. 1790. *Myrtus laurinus* Retz., Obs. Bot. 4 : 26. 1786. *S. laurina* Wall. ex G. Don, Gen. Syst. 4 : 3. 1837.

Small shrubs to large trees. Leaves 6—20 × 2.5—6.0 cm. Spikes or panicles, tripartite below, 4—15 cm long. Flowers sessile, white to yellowish-white. Stamens 40—50. Fruits ovoid or ampulliform, ribbed. Seeds and embryo curved. Very variable species.

KEY TO THE SUBSPECIES

- 1a. Nerves 12—15 pairs. Calyx-lobes villose on the margin, often enlarged in fruit, forming a conical beak ...ssp. *cochinchinensis*
- 1b. Nerves 6—9 pairs. Calyx lobes glabrous, not enlarged in fruit ...ssp. *laurina*

ssp. *cochinchinensis*

Dicalix javanicus Bl., Bijdr. 1117. 1826. *S. ferruginea* Roxb., Fl. Ind. 2 : 542. 1832; *S. ferruginea* Roxb. var. *polystachya* Clarke in Hook. f., Fl. Brit. India 3 : 575. 1882.

Local Names : Mota Bhomroti, Sangram (Asm.); Bhaurlu (Garh.) Fulinazur (Kh.); Bhumroti (Nag.);

Fig. 30

Shrubs or trees, 6—18 m; stems pubescent. Leaves 10—20 × 3.8—5.5 cm, apex acuminate, base cuneate, serrulate to serrate often with blunt glandular teeth, densely villose; lateral nerves 12—15 pairs, prominent on abaxial surface, villose; petioles 0.5—1.5 cm. Spikes 4—8 cm, tripartite below, 1.5—2.0 × 1.2—2.0 mm, villose on the margin, whitish to light yellow. Flowers sessile. Calyx lobes 1.5—2.2 × 1.2—1.4 mm, hairy. Corolla 2.0—3.5 × 1.2—1.5 mm. Stamens 40—50, pentadelpous; filaments slender. Styles glabrous; stigmas capitate. Fruits 6 × 5 mm, ovoid, beaked, faintly ribbed.

Type : Cochinchina, Loureiro s. n. (BM, Photo !).

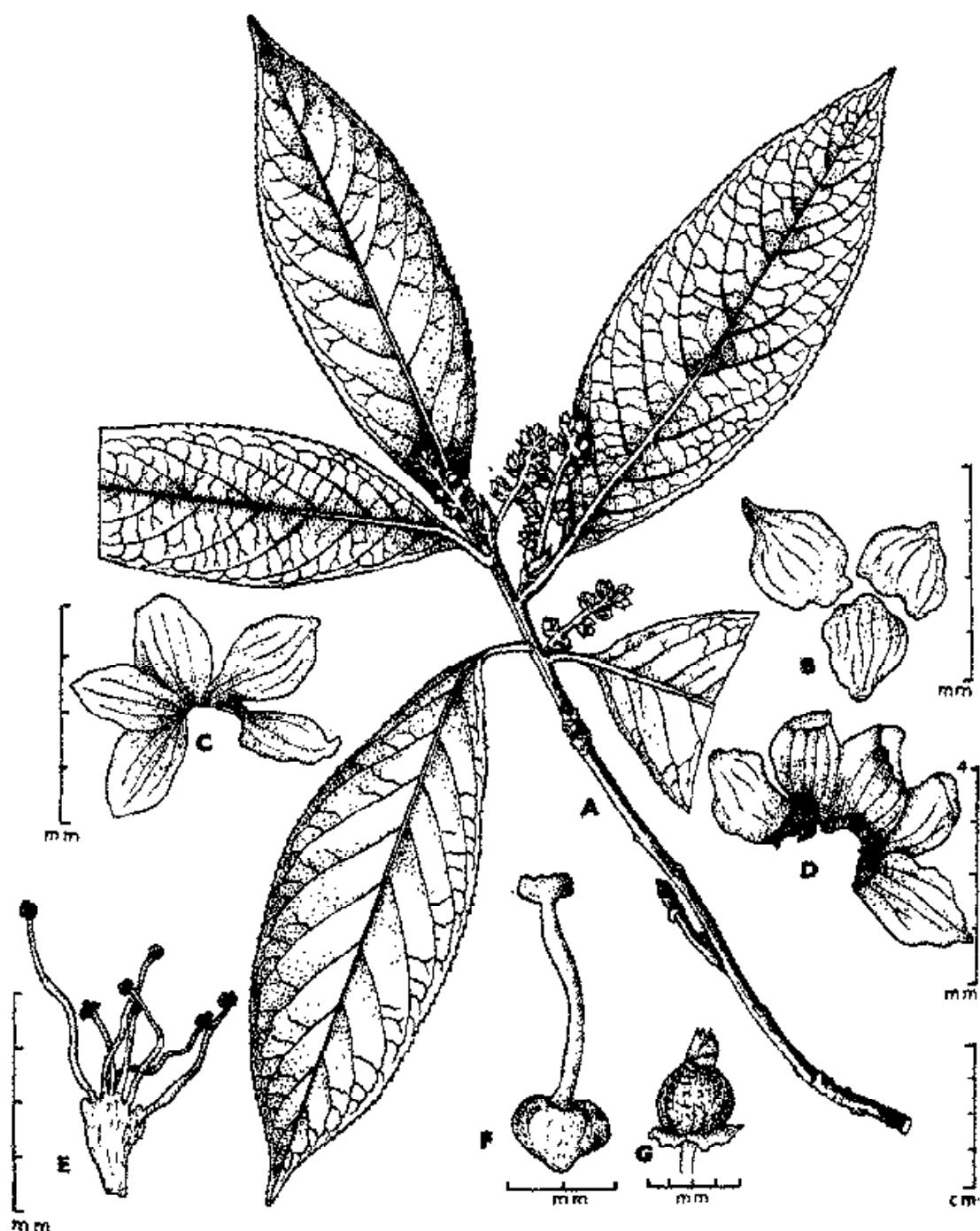


Fig. 30. *Symplocos cochinchinensis* (Lour.) S. Moore ssp. *cochinchinensis* A. Flowering twig. B. Calyx lobes. C. & D. Corolla. E. Stamens. F. Pistil. G. Fruit.

Fls. : Jan.—Mar.; *Frt.s.* : Apr.—Jun.

Distrib. : INDIA : Uttar Pradesh, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Mizoram, Tripura; NEPAL, BURMA, THAILAND, MALESIA, CHINA, TAIWAN, JAPAN.

Ecol. : Temperate regions of the Himalayas between 400 m and 1800 m; occurs along the margin of dense jungle, low wet ground and sometimes in open jungle of small hills.

Uses : Wood used for house posts and furniture in the Garo region. Rosaries are made from the dry fruits.

Notes : There are 4 varieties under the subspecies *cochinchinensis* occurring in the Old World (Nooteboom, *I.c.*). Out of these, var. *cochinchinensis* is found in India.

ssp. *laurina* (Retz.) Nooteboom, Rev. Symplocac. 156. 1975 *et in Fl. Males.* I.8 (2) : 248. 1977 *et in Dassanayake & Fosberg*, Rev. Hanbd. Fl. Ceylon 3 : 458. 1981; Ramamoorthy in Saldanha & Nicholson, Fl. Hassan Dist. 198. 1976. *Myrtus laurinus* Retz., Obs. Bot. 4 : 26. 1786. *Drupatris cochinchinensis* Lour., Fl. Cochinch. 1 : 314. 1790. *S. spicata* Roxb., Fl. Ind. 2 : 541. 1832; Clarke in Hook. f., Fl. Brit. India 3 : 573. 1882. *S. attenuata* Wall. ex DC., Prod. 8 : 256. 1844. Fig. 31

Local names : Bholia (Hindi); Bhumroti (Asm.); Buri, Bhongri (Beng.); Boothganni (Kan.); Diengpi (Kh.); Gyong (Lep.); Kholme (Nep.); Kambli-vetti (Tam.).

Shrubs to trees, 2—18 m. Leaves 6—15 × 2.5—6.0 cm, lanceolate, acuminate, serrulate to crenate, base attenuate to cuneate, nerves prominent, 6—9 pairs, thick, glaucous; petioles 0.8—1.4 cm. Spikes 5—15 cm long, tripartite below; flowers sessile, lax, white to yellowish-white; bracteoles 0.8 × 1.2 mm, softly hairy along the margin. Calyx-lobes 0.7—1.2 × 0.6—1.0 mm. Corolla lobes 2.4—4.0 × 1.0—2.2 mm. Stamens 45—50; filaments exceed the length of petals, flat. Styles filiform; stigmas capitate. Fruits 4.5 × 4.0 mm, ovoid, ribbed, green when young, bluish when ripe.

Type : Sri Lanka (Ceylon), *J. Burmann*, Thes. Zeyl. t. 62. 1737.

Fls. : Jan.—Mar.; *Frt.s.* : Apr.—Jun.

Distrib. : INDIA : Himachal Pradesh, Uttar Pradesh, Sikkim, West Bengal, Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland, Bihar, Maharashtra, Karnataka, Tamil Nadu, Kerala, Andaman Islands; NEPAL, BANGLADESH, BURMA, SRI LANKA, INDONESIA, MALAY PENINSULA, CHINA, JAPAN, PACIFIC ISLANDS.

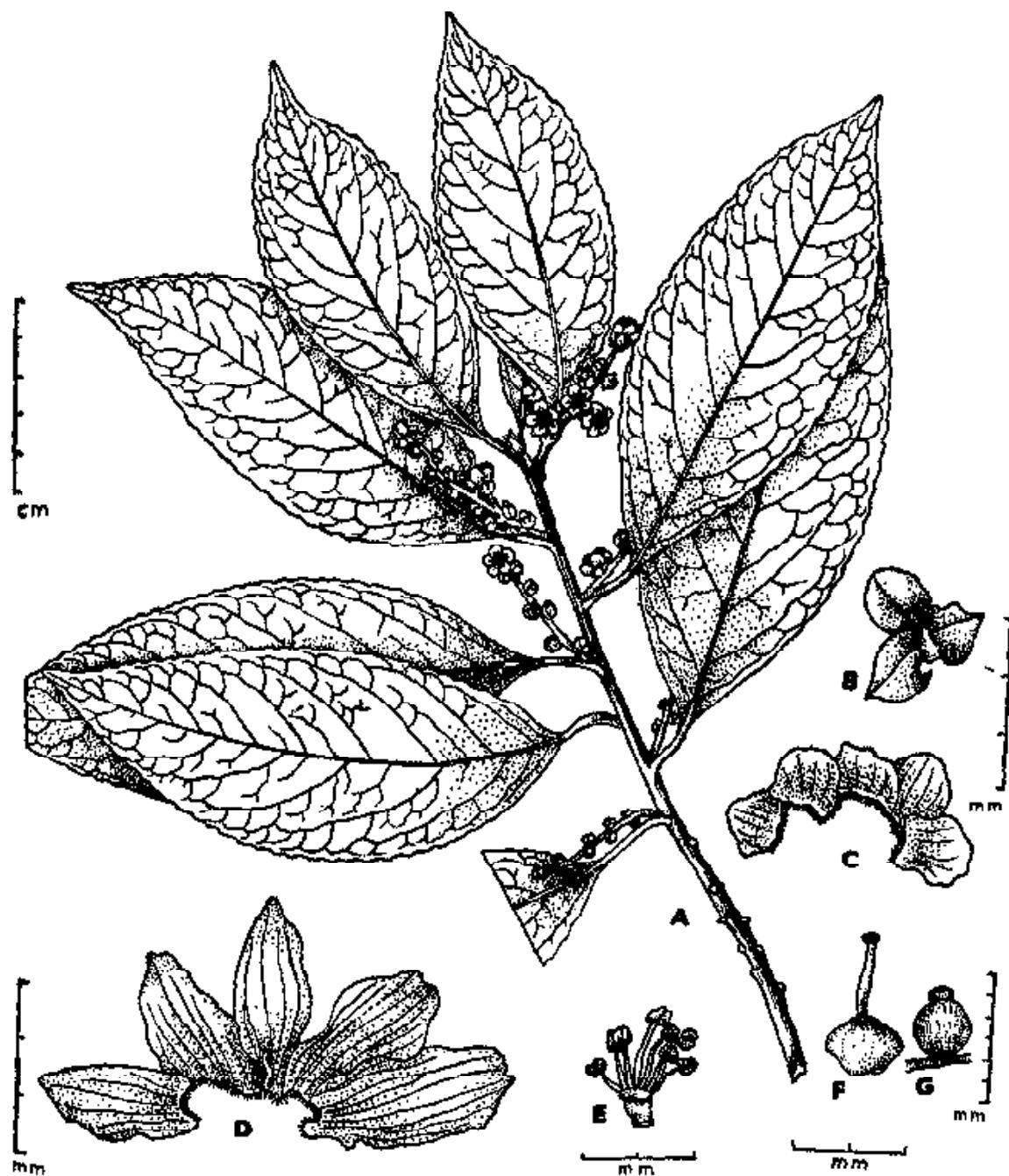


Fig. 31. *Symplocos cochinchinensis* (Lour.) S. Moore ssp. *laurina* (Retz) Nootb.
 A. Flowering twigs. B. Bracteoles. C. Calyx. D. Corolla. E. Stamens.
 F. Pistil. G. Young fruit.

Ecol. : Grows in evergreen, mixed evergreen and wet deciduous forests, particularly near water courses and margins of jungles on hills. In South Indian hills they are generally found in 'Sholas'.

Uses : The leaves impart a yellow dye used as a mordant. The decoction of leaves is valued in Indian medicines. Powdered bark is given with honey to cure biliousness, haemorrhage, diarrhoea, gonorrhoea and diseases of the eyes. The seeds are used as beads and in Kerala the people use to put them round children's neck to avert evil. The wood is used for fuel.

Chr. No. : $2n = 22, 22 + 1 = 2B$ (Nooteboom, Rev. Symplocac. 17. 1975).

Pollen : Suboblate, 3-porate, pore circular, c. $5 \mu\text{m}$ in diameter, mesoporum c. $15 \mu\text{m}$. Exine c. $2 \mu\text{m}$ thick. Sexine slightly thicker than nexine. Spinules present, c. $1.5 \mu\text{m}$ in length. Pattern granulate (Gupta & Sharma in Geophytology 7(2) : 151. 1977).

5. *Symplocos complanata* Brand in Engl. Pflanzenr. Heft 6 : 50. 1901; Brandis, Ind. Trees 440. 1906; Nooteboom, Rev. Symplocac. 294. 1975; Hore in Journ. Econ. Tax. Bot. 3 : 315. 1982.

Trees, twigs glabrous. Leaves condensed at branch apex, $7.5-9.0 \times 3.5-4.0 \text{ cm}$, elliptic to lanceolate-oblong, apex rounded or somewhat truncate, nerves, 10-11 pairs, denticulate, revolute in the lower surface, glabrous; petioles subsessile to sessile. Spikes $2.5-4.0 \text{ cm}$ long, densely villous; bracts $5.0-5.2 \times 2.5-3.0 \text{ mm}$, spathulate, densely villous; bracteoles $2.3 \times 2 \text{ mm}$. Flowers sessile. Calyx lobes 5, enclosed about half the length of the flower, hairy. Corolla lobes $5-6, 4.5-6.0 \times 2-3 \text{ mm}$, glabrous. Stamens c. 80; filaments unequal, glabrous. Disc hairy. Styles 4.0-4.5 mm, base hairy; stigmas flat or oblique. Fruit unknown.

Type : Asia, *Hugel* 3472 (WI).

Fls. : Feb.-Mar.; *Frt.s.* : Mar. onwards.

Distrib. : INDIA : Nilgiris; endemic.

Notes : Represented only by the type specimen.

6. *Symplocos dryophila* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 578. 1882; Cowan & Cowan, Trees N. Beng. 87. 1929; Kanjilal *et al.*, Fl. Assam 3 : 213. 1939; Yamazaki in Hara, Fl. E. Himal. 1 : 250. 1966; Nooteboom, Rev. Symplocac. 190. 1975.

Local name : Chillay-kharani (Nep.).

Trees, branches fulvous-hirsute. Leaves $14-20 \times 4.5-5.8 \text{ cm}$, lanceolate, shortly cuspidate, subentire, nerves 14-16 pairs; petioles $1.5-2.3 \text{ cm}$.

Racemes 9—10 cm long, lax, fulvous hirsute; pedicels 3.0×3.5 mm; bracts and bracteoles lanceolate, elongated, sometimes acicular, obtuse, villose at the apex and along the margin. Calyx-lobes 0.8×1.0 mm, entire with a few long hairs at apex. Corolla lobes $3.5-5.0 \times 2.5-3.0$ mm, lanceolate to ovate. Stamens c. 50, pentadelphous; filaments flat. Disc with a few hairs. Stylar base sometimes with small thorn-like projections. Fruits $7-8 \times 4$ mm, subglobose, reddish-brown.

Type : India, Sikkim, Herb. Ind. Or. Hook. fil. & Thomson, *Hooker* 53 (K, Photo!).

Fls. : Apr.—May; *Frt.s.* : Jul.—Oct.

Distrib. : INDIA : Sikkim, West Bengal, Manipur, Nagaland; NEPAL, TIBET, BURMA, THAILAND, CHINA, VIETNAM.

Pollen : Tricolporate, brevicolpate, anguloaperturate, oblate, colpi thin, small with acute apices, colpi membrane psilate. Ora circular c. $6 \mu\text{m}$ in diameter. Exine thickness c. $2 \mu\text{m}$. Sexine as thick as nexine. Pattern granulate (Gupta & Sharma, *Geophytology* 7(2) : 152. 1977).

6. *Symplocos fasciculata* Zoll., *Syst. Verz.* 2 : 136. 1854; Clarke in Hook. f., *Fl. Brit. India* 3 : 574. 1882; King & Gamble in *Journ. Asiat. Soc. Beng.* 74(2) : 235. 1906; Backer & Bakh. f., *Fl. Java* 2 : 205. 1965; Nootboom, *Rev. Symplocac.* 191. 1175 *et al.* in *Fl. Males. I.* 8(2) : 259. 1977.

Shrubs or trees, 3—13 m high; twigs hairy. Leaves alternately or spirally arranged, $8-12 \times 2-5$ cm, elliptic or lanceolate, apex acuminate to caudate, base acute to rounded, entire to serrulate, sparsely appressedly fine hairy beneath; petioles 2—8 mm. Racemes in axillary fascicles, sometimes branched, peduncle puberulous; bracts and bracteoles persistent; pedicels 2—4 mm; flowers light yellow to white, fragrant. Calyx lobes $0.8-1.5 \times 0.6-1.2$ mm, ovate, margin hirsute. Corolla lobes $2.0-2.8 \times 0.8-1.5$ mm. Stamens 12—35. Disc hairy. Styles hairy towards thickened base. Fruits $5-7 \times 3-4$ mm, broadly or narrowly ampulliform, belly globose.

Type : Java, *Blume* 2154 (L).

Fls. : Jun.—Jul.; *Frt.s.* : Jul.—Sep.

Distrib. : INDIA : Great Nicobar Island; INDONESIA, MALAY PENINSULA, PHILIPPINES, CELEBES, NEW GUINEA.

Uses : Bark is source of a red dye.

Ecol. : Grows usually in the inland hill forests, sometimes in low wet ground where the soil is clayey loam.

Notes : So far known only from one collection (*Balakrishnan* 3941 PBL) from Great Nicobar Island, India.

8. *Symplocos foliosa* Wight, Ic. 4 : 10, t. 1234. 1848; Clarke in Hook. f., Fl. Brit. India 3 : 582. 1882; Fyson, Fl. S. Ind. Hill. Stat. 1 : 271. 1915; Gamble, Fl. Pres. Madras 5 : 783. 1923 (Repr. ed. 2 : 550. 1957); Nooteboom, Rev. Symplocac. 194. 1975. Fig. 32

Local name : Pal-veloday (Tam.).

Tall trees, branchlets villose. Leaves 7—12 × 1.5—3.0 cm short acute or acuminate at apex, cuneate at base, margin glandular serrulate towards the base, nerves 9—10 pairs, subparallel, a few pilose hairs along the midrib underneath, petioles 1.0—1.5 cm. Spikes 2.0—5.5 cm, fulvous villous; bracts villose at margin and apex; flowers nearly sessile. Calyx lobes obovate to ovate, entire, glabrous. Corolla lobes 4.0—5.5 × 2—3 mm, lanceolate to ovate. Stamens 55—60, epipetalous at the base. Disc hairy. Styles glabrous, sometimes with minute projections on its surface. Fruits 1.2—1.4 × 0.5—0.6 cm, broadly cylindric, glabrous, reddish-brown.

Type : India, Nilgiris, Pykara, Wight s. n. (K, Photo).

Fls. : Oct.—Dec.; *Frts. :* Apr.—May.

Distrib : INDIA : Tamil Nadu, Kerala; endemic.

Ecol. : Common in the 'Shola' forests of the Western Ghats above 1500 m.

Pollen : Tricolporate, brevicolpate, oblate, 45 × 65 μm , colpi very thin, c. 20 μm in length and 1.5 μm in width, membrane psilate. Ora rectangular. Exine c. 4 μm , thick. Sexine thicker than nexine. Pattern granulate (Gupta & Sharma in Geophytology 7 (2) : 152. 1977).

9. *Symplocos glauca* (Thunb.) Koidz. in Bot. Mag. Tokyo 39 : 313. 1925; Nooteboom, Rev. Symplocac. 196. 1975; Naithani & Bahadur in Ind. Forester 107 : 722. 1981. *Laurus glauca* Thunb., Fl. Jap. 173. 1784. *S. pealii* King ex Das in Assam For. Rec. (Bot.) 1 : 19. 1934; Kanjilal *et al.*, Fl. Assam 3 : 214. 1939.

Local names : Gabri-sopa, Nagatota (Asm.); Thingjik (Lus.).

Small trees, 9—10 m high. Leaves 21—26 × 6.5—12.0 cm, oblong-elliptic, shortly acuminate or obtuse, cuneate and subentire towards the base, sometimes sparsely woolly hairy below, glandular-serrulate towards apex, midrib elevated, nerves 12—16 pairs, arcuate, coarse, petioles 2.5—3.5 cm long. Spikes branched; flowers white, fragrant; bracts and bracteoles persistent, tomentose. Calyx lobes elliptic to triangular, tomentose.

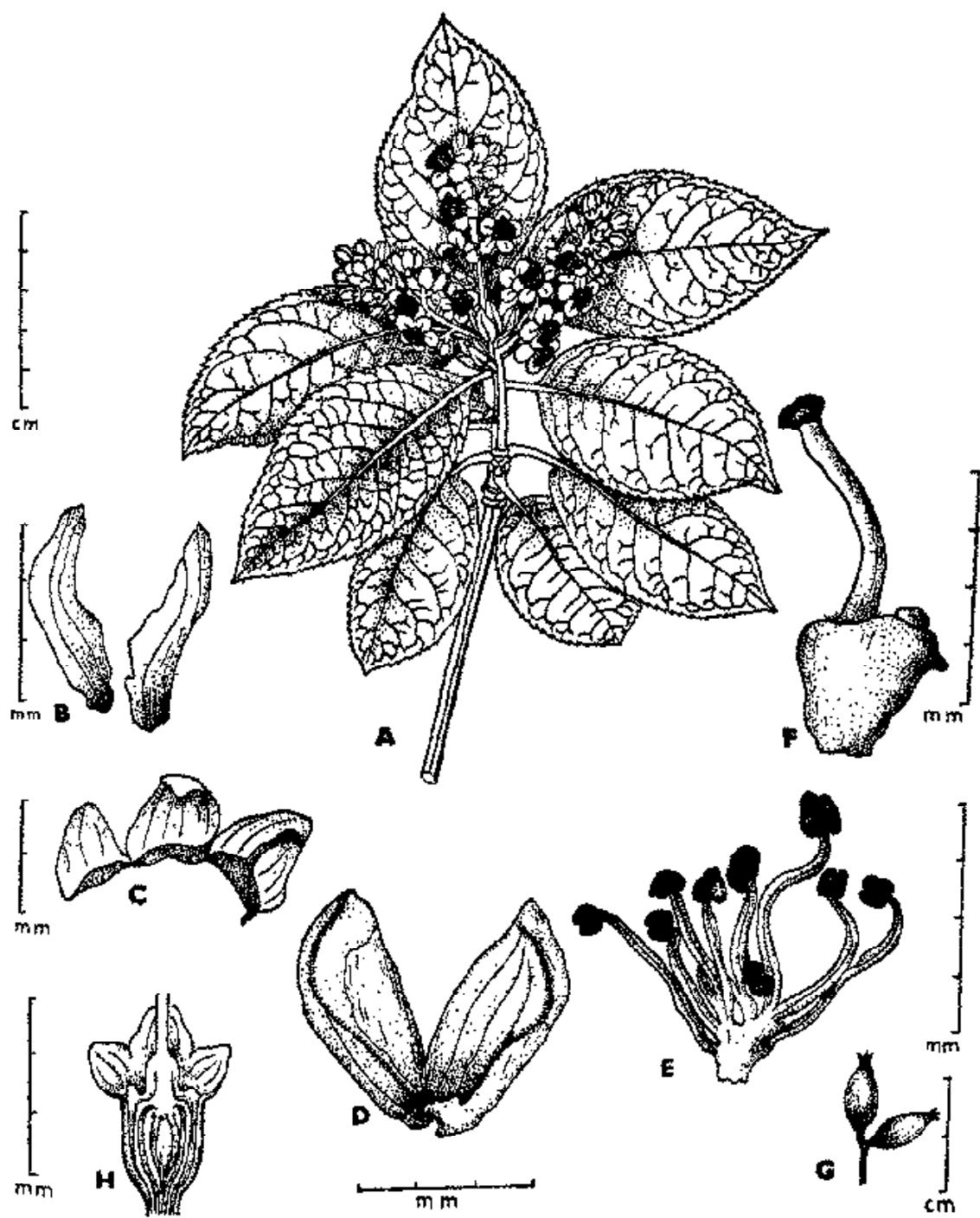


Fig. 32. *Symplocos foliosa* Wight
 A. Flowering twig. B. Bracteoles. C. Calyx. D. Corolla. E. Stamens.
 F. Pistil. G. Young fruits. H. L. S. of ovary.

Corolla lobes 3—5 mm. Stamens 20—60. Ovary 3-loculed. Disc rarely villose, surrounding style base. Fruits 1—3—1.5 × 0.4—0.6 cm, sub-cylindric, sparsely puberulous or glabrous, bluish-black.

Fls. : Jul.—Aug.; *Frt.s.* : Sep.—Oct.

Distrib. : INDIA : Assam; BURMA, CHINA, VIETNAM, TAIWAN, JAPAN.

Notes : The lower epidermal cells of the leaves are papillose, a characteristic feature which distinguishes the species from the rest of Indian *Symplocos*.

10. ***Symplocos glomerata*** King ex C. B. Clarke in Hook. f., Fl. Brit. India 3 : 577. 1882; Cowan and Cowan, Trees N. Beng. 86 : 1929; Kanjilal et al., Fl. Assam 3 : 210. 1939; Yamazaki in Hara, Fl. E. Himal. 1 : 250. 1966; Nooteboom, Rev. Symplocac. 199. 1975 et in Fl. Males. I. 8(2) : 260. 1977.

Local names : Jew-dieng pai-ong (Kh.); Khonne-kharani, Kholmekharani (Nep.).

Small trees, 4.5—6.0 m. Leaves 12.0—16.5 × 3.5—4.0 cm, elongate, lanceolate, apex acuminate, base attenuate to cuneate, margin glandular-serrate; nerves 10—15 pairs, distant and prominent beneath, veins sunk above forming a conspicuous intermarginal veins, petioles 1.0—1.8 cm. Flowers axillary, fascicled, yellow; bracteoles margin with woolly hairs. Calyx lobes 1.0—1.7 × 0.8—1.2 m, margin glandular hairy. Corolla lobes 2.5—5.5 × 1.2—3.0 mm, oblong-lanceolate, obtuse to rounded. Stamens c. 25, pentadelphous. Styles glabrous; stigmas lobed. Fruits 7—8 × 2 mm, cylindric, surface with fine longitudinal scars, brown, rarely dark-blue.

Type : India, Sikkim, Herb. Ind. Or. Hook. f. & Thomson, *Hooker* 55 (K, Photo !).

Fls. : Apr.—May; *Frt.s.* : Aug.—Sep.

Distrib. : INDIA : Sikkim, West Bengal, Arunachal Pradesh, Assam, Meghalaya, Manipur, Nagaland; NEPAL, BANGLADESH, BURMA, MALAY PENINSULA, CHINA, VIETNAM, LAOS, CAMBODIA.

Ecol. : Temperate regions of Eastern Himalayas from 1500 m to 3000 m altitude.

Chr. No. : n = 11 (Mehra & Bawa in Evolution 23 : 471. 1969).

Pollen : Prolate, spheroidal, 34 × 33 μm , triporate, exine scabrate (Hore, Ph.D. thesis, unpubl. Kalyani Univ. 1977).

Notes : Only the typical var. *glomerata* is represented in India.

11. *Symplocos hookeri* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 578. 1882; Kanjilal *et al.*, Fl. Assam 3 : 214. 1939; Nooteboom, Rev. Symplocac. 207. 1975.

Small trees. Stem glabrous, bark brownish. Leaves 16–28 × 7.5–10.0 cm, obovate to oblong, acute, cuneate, entire to finely serrulate, glabrous; nerves 8–11 pairs, curved upwards and meeting in an intramarginal vein, much elevated beneath; petioles 1.4–2.2 cm. Flowers in racemes, peduncles stout. Calyx lobes 1–2 mm, broadly triangular with rounded apex, glabrous. Corolla lobes 6–9 mm. Stamens c. 80. Disc hairy. Styles glabrous; stigma punctate. Fruits 1.7 × 0.5–0.6 cm, elongated-ellipsoid, stony, brown in colour.

Type : India, Khasia, Herb. Ind. Or. Hook. f. & Thomson, *Hooker & Thomson* 49 (K, Photo !).

Fls. : Feb.—Mar.; *Frt.s.* : Apr.—July.

Distrib. : INDIA : Assam, Meghalaya, Mizoram; BURMA, THAILAND, MALAY PENINSULA, CHINA, VIETNAM.

12. *Symplocos huegeliana* Brand in Engl. Pflanzenr. Heft 6 : 57. 1901; Brandis, Ind. Trees 439. 1906; Nooteboom, Rev. Symplocac. 294. 1975; Hore in Journ. Econ. Tax. Bot. 3 : 316. 1982.

Trees; twigs woody, glabrous. Leaves 4.5–5.5 × 1.5–2.3 cm, oblong-obovate, apex rounded or subretuse, base abruptly attenuate, glandular-denticulate, tendency to reflex in the lower surface, glabrous, nerves 5–7 pairs, prominent below; petioles 2–3 mm glabrous. Inflorescence a terminal or axillary spike, c. 3–4 cm, glabrous; flowers sessile; bract margin glabrous. Calyx 1.0–1.2 × 0.7–1.0 mm, margin pilose. Corolla lobes 5 or rarely 6, 4.5–6.0 × 2.5–3.0 mm, glabrous. Stamens 50; filaments 3–5 mm, slender. Disc glabrous. Styles 2.0–2.5 mm, constricted at the middle, glabrous; stigma flat. Fruits c. 9 mm long, cylindric, glabrous, brown.

Syntypes : Asia, Hugel 4365 (W !); Hugel 4421 (W, n. v.).

Fls. : Feb.—Apr.; *Frt.s.* : Apr.—onwards.

Distrib. : INDIA : Tamil Nadu (Nilgiris); endemic.

Notes : Represented only by the type specimens.

13. *Symplocos kurgensis* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 576. 1882; Brandis, Ind. Trees 441. 1906; Subba Rao & Gopalan in Journ. Bombay Nat. Hist. Soc. 78(1) : 191. 1981; Nooteboom in Rev. Handb. Fl. Ceylon 3 : 475. 1981. *S. hohenackeri* Clarke in Hook. f., Fl. Brit. India 3 : 582. 1882. *S. hebantha* Thw. ex Clarke in Hook. f., Fl. Brit.

India 3 : 586. 1882. *S. macrophylla* Wall. ex DC. var. *kurgensis* (C. B. Clarke) Nooteboom, Rev. Symplocac. 229. 1975.

Trees; twigs woody glabrescent at the tip. Leaves 13.5—15.0 × 4.5—5.5 cm, elliptic to elliptic-oblong, obtuse, base rounded; subdenticulate, minutely glandular, scabrous, villose beneath, nerves 7—12 pairs, petioles 1 cm, pubescent. Panicles 6—7 cm, axis with long soft hairs; bracts and bracteoles ovate, densely hairy, caducous; pedicels c. 1 mm with indumentum. Calyx tube c. 2 mm long. Corolla-lobes c. 5 mm. Stamens c. 80. Disc glabrous. Fruits 3.2 × 1.3 cm, elliptic to cylindrical, longitudinally grooved, reddish-brown.

Type : India, Coorg (Kurg), Herb. Ind. Or. Hook. f. & Thom., Thomson 31 (K, Photo !).

Fls. : Feb.—Mar.; *Frt.s.* : Mar.—May.

Distrib. : INDIA : Karnataka, Kerala; SRI LANKA.

Ecol. : Localised distribution, tropical rain forests of Coorg and Chandanathode in Kerala; very rare.

Notes : The species is closely allied to *Symplocos macrophylla* Wall. ex DC., but differs in leaf shape and apex and also in the number of stamens.

14. *Symplocos lancifolia* Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math.-Phys. Cl. 4 (3) : 133. 1846; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 577. 1882; Kanjilal *et al.*, Fl. Assam 3 : 215. 1939; Nooteboom, Rev. Symplocac. 214. 1975 *et al.* in Fl. Males. I.8 (2) : 263. 1977. *S. lancifolia* Sieb. & Zucc. var. *fulvipes* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 578. 1882.

Trees, 17—22 m high, d.b.h. 1.0—1.5 m, mostly glabrous; bark finely reticulately fissured. Leaves 7—9 × 2—3 cm, lanceolate, apex acuminate, base cuneate to rounded, crenate-serrulate, subcoriaceous to membranous, nerves 6—11 pairs, glabrous or sometimes fulvous-pilose hairs on midrib-appressed beneath, petioles 0.5—2.0 mm. Spikes 1—2 cm, pubescent to fulvous-pubescent; bracts hairy; bracteoles persistent, fulvous-villose; flowers subsessile to sessile. Calyx lobes 1.2—1.5 × 1.0—1.5 mm, margin glandular hairy. Corolla lobes 2.0—3.5 × 1.0—1.5 mm. Stamens 25—35, pentadelphous; anthers oblong to rounded. Disc and styles glabrous. Fruits 4—5 × 2—4 mm, ellipsoid to globose.

Type : Japan, Von Siebold s. n. (L).

Fls. : Oct.—Nov.; *Frt.s.* : Jan.—Feb.

Distrib. : INDIA : West Bengal, Assam, Meghalaya; BANGLADESH, BURMA, CHINA, VIETNAM, PHILIPPINES, JAPAN.

Pollen : Suboblate ($35 \times 40 \mu\text{m}$). Amb subtriangular. Pore circular c. $4 \mu\text{m}$ in diameter. Pore membrane psilate. Exine thickness c. $4 \mu\text{m}$. Sexine thinner than nexine. Pattern obscure (Gupta & Sharma, Geophytology 7 (2) : 151. 1977).

15. *Symplocos lucida* (Thunb.) Sieb. & Zucc., Fl. Jap. 1 : 55. Pl. 24. 1835 excl. syn. *Myrtus laevis*; Nootboom, Rev. Symplocac. 217. 1975. *Laurus lucida* Thunb., Fl. Jap. 174. 1784. *S. japonica* DC., Prodr. 8 : 255. 1844; *S. phyllocayx* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 575. 1882; *S. warburgii* Brand in Engl. Pflanzer. Heft 6 : 66. 1901.

Fig. 33

Local names : Chandan (Hindi); Bhauri (Beng.); Cashing (Bhut.); Dieng-pei (Kh.); Kharani (Nep.); Kharane, Lekh-kharane (Skm.).

Shrubs to trees, 4—20 m; stems sometimes marked with black patches. Leaves $9-14 \times 2.5-4.5$ cm, lanceolate to oblong or obovate, acuminate, cuneate, margin revolute entire or glandular-dentate, mostly glabrous, dark green above but yellowing with age; nerves 6—12 pairs, petioles 7—20 mm long. Flowers in dense racemes or condensed spikes, often tripartite below, sessile or subsessile; bracts and bracteoles 1.5—3.0 mm long, margins hairy. Calyx lobes $1.2-3.0 \times 1.3-2.5$ mm, margins glandular hairy. Corolla lobes $2.5-5.0 \times 1.7-3.0$ mm. Stamens 40—50. Disc hairy. Stylar base villose; stigmas capitate or discoid. Fruits $7-8 \times 4-5$ mm, ellipsoid to rarely orbicular.

Type : Japan : *Thunberg s. n.* (UPS).

Fls. : Dec.—Mar.; *Frts.* : Apr.—May.

Distrib. : INDIA : Sikkim, Assam, Arunachal Pradesh, Meghalaya, Tamil Nadu; BHUTAN, NEPAL, BANGLADESH, BURMA, THAILAND, MALAY PENINSULA, JAVA, SUMATRA, PHILIPPINES, CHINA, VIETNAM, JAPAN.

Ecol. : Common in temperate deciduous forests. Distributed in Eastern Himalayas, Nepal Himalayas and Nilgiris at an altitude ranging from 1220 m to 3050 m.

Uses : Tender leaves are boiled and decoction used as eye wash; mature leaves furnish an yellow dye. Wood used as fuel and as cheap house post. The grey wood, streaked with red, is ground into a paste and used in religious ceremonies.

Chr. No. : n = 11 (Mehra & Bawa in Evolution 23 : 471. 1969).

Pollen : Grains sub-oblate, $28 \times 34 \mu\text{m}$, triporate, sexine as thick as nexine, exine $2 \mu\text{m}$, sexine echinulate, spine c. $3 \mu\text{m}$, bulbous, tip obtuse (Hore, Ph.D. thesis, unpubl. Kalyani Univ. 1977).

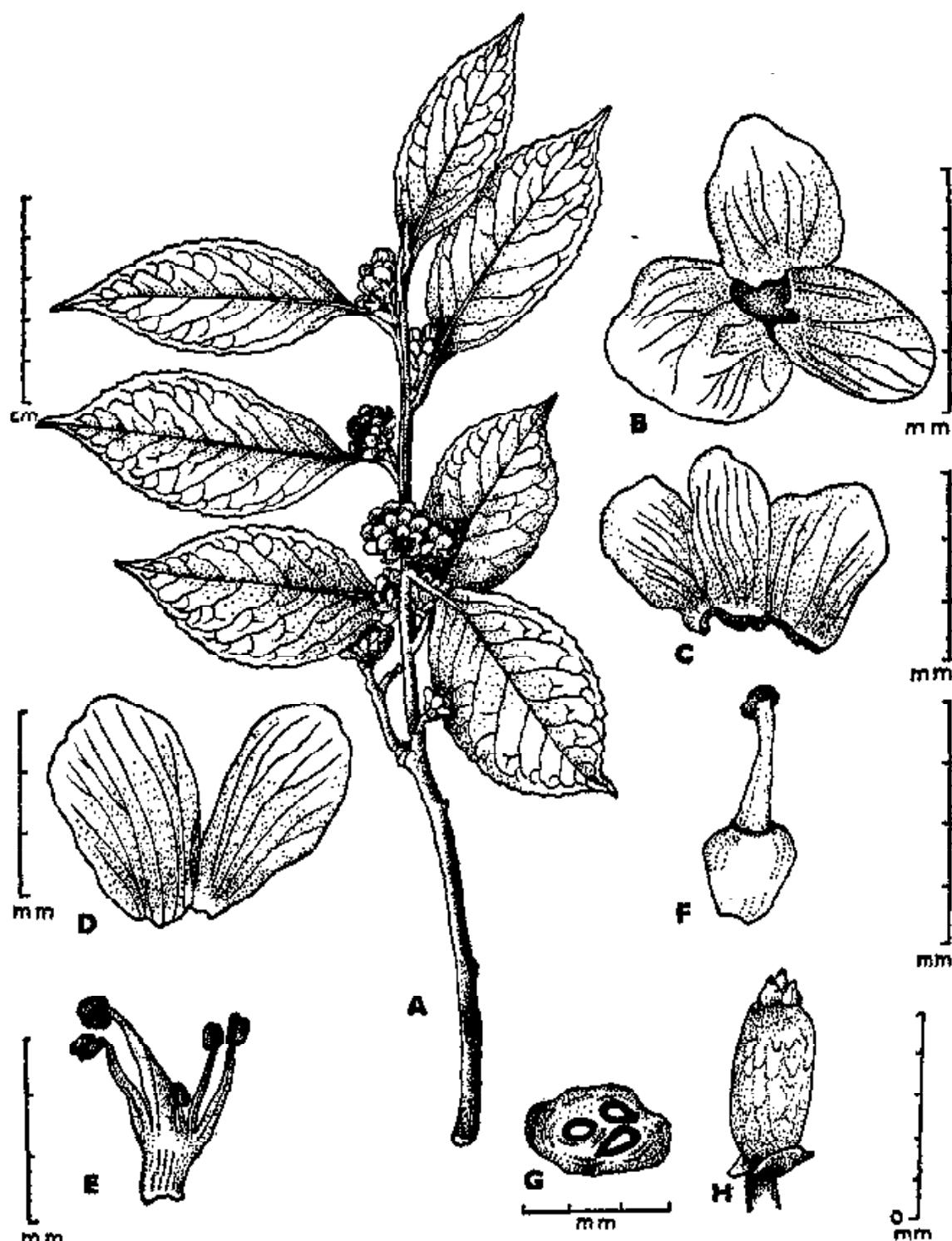


Fig. 33. *Symplocos lucida* (Thunb.) Sieb. & Zucc.
A. Flowering twig. **B.** Bracteoles. **C.** Calyx. **D.** Corolla lobes. **E.** Stamens.
F. Pistil. **G.** T. S. of ovary. **H.** Young fruit.

16. *Symplocos macrocarpa* Wight ex C. B. Clarke in Hook. f., Fl. Brit. India 3 : 582. 1882; Gamble, Fl. Pres. Madras 5 : 782. 1923 (Repr. ed. 2 : 549. 1957); Nooteboom, Rev. Symplocac. 220. 1975.

Small to medium-sized trees, 15—16 m; twigs brownish pubescent or glabrous. Leaves 12—16 5×4 —6 cm, elliptic, lanceolate to ovate-lanceolate, cuneate, serrulate or crenate, chartaceous; pilose on the midrib beneath, nerves 5—11 pairs, petioles 0.5—1.2 cm. Spikes 0.8—1.5 cm, stout, pubescent; bracts 3.5—5.0 \times 1.5—2.2 mm, spathulate, surface tomentellous. Calyx lobes 2.5—3.5 \times 1—2 mm, pubescent. Corolla lobes 3.5—4.0 \times 2.0 mm. Stamens c. 40. Disc shortly pilose. Styles erect, base hairy; stigma curved. Fruits 2.5—3.0 \times 1.1—1.3 cm, cylindric, sometimes rounded, calyx rim broad, teeth patent, brownish-yellow.

KEY TO THE SUBSPECIES

- 1a. Leaves lanceolate, serrulate, nerves 9—11 pairs. Dried fruits with longitudinal ridges scarcely seen ...subsp. *macrocarpa*
- 1b. Leaves ovate-lanceolate, crenate, nerves 5—6 pairs. Dried fruits with 6—8 longitudinal ridges ...subsp. *kanarana*

ssp. *macrocarpa*

Local Names : Malamparala (Mal.); Paralei (Tam.).

Type : India, Courtallum, Wight 467 (K, Photo!).

Fls. : Apr.—May; *Frts.* : Nov.—Jan.

Distrib. : INDIA : Tamil Nadu, Kerala; endemic.

Ecol. : Evergreen forests of South India.

Uses : Wood is very suitable for match boxes and splints.

Pollen : Tricolporate, brevissimicorporate, ora c. 2 μm , sexine tectate, psilate or \pm finely granulose (Hore, Ph. D. thesis unpubl. Kalyani Univ. 1977).

ssp. *kanarana* (Talbot) Nooteboom, Rev. Symplocac. 221. 1975. *S. kanarana* Talbot. in Journ. Bombay Nat. Hist. Soc. 11 : 238. 1897.

Type : India, North Kanara, Ecunbi, Talbot 3673 (BSI, K, Photo!).

Fls. : Mar.—Apr.; *Frts.* : May—Jul.

Distrib. : INDIA : Karnataka, Tamilnadu, Kerala; endemic.

Ecol. : Evergreen forests of Western ghats.

17. *Symplocos macrophylla* Wall. ex DC., Prodr. 8 : 257. 1844; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 578. 1882; Kanjilal *et al.*, Fl. Assam 3 : 212. 1939; Nooteboom, Rev. Symplocac. 222. 1975 *excl. syn.* *S. jucunda* var. *diversifolia* Alston in Trimen, Handb. Fl. Ceyl. Suppl. 6 : 187. 1931 *et* Nooteboom in Rev. Handb. Fl. Ceylon 3 : 477. 1981.

Shrubs or trees, terminal buds with hairy scales. Leaves 4—20 × 6—7 cm, very variable, narrowly elliptic, cuneate to rounded at base, acuminate to obtuse at apex, dentate, denticulate or minutely clavellate, midrib adpressed with pilose hairs beneath or glabrous, nerves 6—12 pairs, curved upwards; petioles 0.5—2.5 cm, hirsute. Flowers in fascicles, spikes or racemes, up to 10 cm long, densely pubescent; pedicels 1—4 mm; bracts and bracteoles persistent or caducous. Calyx tube c. 2 mm long, lobes 1.8—3.0 × 0.8—1.0 mm, glabrous or with indumentum. Corolla 2.5—8.0 mm. Stamens 40—100; filaments glabrous or pilose. Disc glabrous or hairy. Style glabrous or hairy at base. Fruits 13—20 × 2—8 mm, smooth or longitudinally grooved.

KEY TO THE SUBSPECIES

- 1a. Leaves 4.0—5.4 × 2.0—2.7 cm, nearly obtuse. Spikes less than 1 cm; flowers sessile; filaments pilose ...ssp. *microphylla*
- 1b. Leaves 12—20 × 3.5—7.0 cm, acuminate. Racemes 3—10 cm; flowers subsessile to pedicellate; filaments glabrous :

 - 2a. Leaves subentire. Racemes 6—10 cm; pedicels 2—4 mm; calyxtube always glabrous ...ssp. *grandiflora*
 - 2b. Leaves glandular denticulate. Racemes 3—5 cm; pedicels 1—2 mm. Calyx-tube glabrous to pubescent :

 - 3a. Leaf margin revolute. Corolla 4—8 mm. Stamens 60—100 ...ssp. *macrophylla*
 - 3b. Leaf margin not revolute. Corolla 2.5—3.2 mm. Stamens 40 ...ssp. *rosea*

ssp. *macrophylla* *S. gardneriana* Wight, Ic. 4 : 10. t. 1231. 1848. *S. ifsiiana* Fischer in Kew Bull. 37. 1940.

Local name : Sankan (Kan.).

Type : Bangladesh, Sylhet, Fr. De Silva-Wall. Num. List no. 4331 (G-DC).

Fls. : Nov.—Feb.; *Frt.s.* : Mar.—Apr.

Distrib. : INDIA : Meghalaya, Nagaland, Karnataka, Tamil Nadu, Kerala; BANGLADESH, SRI LANKA.

Ecol. : Medium-sized tree in evergreen forests, occurs between 1200 m to 2200 m altitude.

Uses : The leaves yield a dye.

ssp. *grandiflora* (Wall. ex DC.) Nooteboom, Rev. Symplocac. 234. 1975. *S. grandiflora* Wall. ex DC., Prodr. 8 : 257. 1844. *S. leiostachya* Kurz in Journ. Asiat. Soc. Beng. 42: 89. 1873. *S. subintegra* Chatterjee in Kew Bull. 62. 1948.

Local name : Bhumroti (Asm.).

Type : Bangladesh, Mont. Silhet, Fr. De Silva-Wall. Num. List No. 4421 (G-DC).

Fls. : Dec.—Jan.; *Frts.* : Jan.—Feb.

Distrib. : INDIA : Assam, Arunachal Pradesh, Meghalaya; BANGLADESH, BURMA, VIETNAM.

Ecol. : Temperate regions of North-eastern Himalayas.

Uses : The leaves are eaten by the Patpacka silkworms.

Pollen : 3-colporate, rarely 4-colporate, brevicelpate, oblate (22.5 × 35.0 μm), range 20—25 × 32.5—57.5 μm . Colpi thin, small, c. 8 μm long and 5 μm wide. Colpi membrane psilate. Ora lalongate (2.5 × 4.0 μm), membrane psilate. Exine thickness 2 μm . Sexine as thick as nexine or slightly thinner than nexine. Pattern granulate (Gupta & Sharma, Geophytology 7 (2) : 155. 1977).

ssp. *microphylla* (Wight) Nooteboom, Rev. Symplocac. 229. 1975.

S. microphylla Wight, Ic. 4 : 10. t. 1232. 1848; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 581. 1882.

Type : India, Nilgiris, Wight 1694 (K, Photo !).

Fls. : Feb.—Mar.; *Frts.* : Apr.—May.

Distrib. : INDIA : Tamil Nadu (Nilgiris); endemic.

Pollen : Tricolporate; triangular in polar view, ectoaperture small, narrow, margin not differentiated; exine tectate. Tectum areolate, fossulate or irregularly reticulate; some grains are 2—4 colporate, quadrangular in polar view (Vasanthy, in Trav. Sect. Sc. Tech., Ins. Fanc. Pond. 15 : 37-38. 1976 & pl. 595-599).

ssp. *rosea* (Bedd.) Nooteboom, Rev. Symplocac. 229. 1975. *S. rosea*

Bedd. in Trans. Linn. Soc. 25 : 219. 1866. *S. rosea* Bedd. var. *glabrior* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 583. 1882. *S. barberi* Gamble in Kew Bull. 219. 1921.

Local name : Malankuruvi (Mal.).

Type : India, Annamallays, *Beddome* 4935 (BM).

Fls. : Nov.—Dec.; *Frt.s.* : Mar.—Apr.

Distrib. : INDIA : Tamil Nadu, Kerala; endemic.

Ecol. : Restricted to the evergreen forests of South Indian hills.

Pollen : Oblate ($37.5 \times 52.5 \mu\text{m}$), aspidate. Amb triangular. Pore circular, c. $5 \mu\text{m}$ in diameter. Annular thickening c. $4 \mu\text{m}$. Pore membrane psilate. Exine thickness c. $3 \mu\text{m}$. Sexine and nexine equithick. Pattern granulate (Gupta & Sharma in Geophytology 7(2) : 151. 1977).

18. **Symplocos monantha** Wight, Ic. 4 : 10, t. 1236. 1848; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 581. 1882; Gamble, Fl. Pres. Madras 784. 1923 (Repr. ed. 2 : 551. 1957); Nooteboom, Rev. Symplocac. 240. 1975.

Shrubs; stem glabrous; bark rough, striate. Leaves $2.5—3.2 \times 1.5—1.8 \text{ cm}$, lanceolate to obovate, obtuse, serrate, base cuneate to rounded, nerves 5—6 pair; petioles 2—3 mm. Flowers axillary, solitary, subsessile; bracts several, bracteoles caducous. Calyx lobes $5, 1.3—2.0 \times 0.8—1.0 \text{ mm}$, obovate, obtuse, pilose along the margin, surface glabrous. Corolla lobes $5, 3—4 \times 1.6—2.0 \text{ mm}$, oblong-lanceolate. Stamens c. 40, pentadelphous; filaments flat. Disc glabrous. Style glabrous; stigma faintly bilobed, capitate. Fruits not seen.

Type : India, Sevagiri hills, *Wight* 3514 (K, Photo !).

Fls. : May—Jan.

Distrib. : INDIA : Tamil Nadu-endemic to Tirunellveli.

Pollen : Tricolporate, colpi brevissimicolligate, ora $2 \mu\text{m}$, exine $2.5 \mu\text{m}$, granulose, granules near the aperture are broad (Hore, Ph.D. thesis Unpubl. Kalyani Univ. 1977).

19. **Symplocos obtusa** Wall. ex G. Don, Gen. Syst. 4 : 3. 1837; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 583. 1882; Fyson, Fl. Nil. & Pul. Hills 1 : 273. 1915; Gamble, Fl. Pres. Madras 783. 1923 (Repr. ed. 2 : 550. 1957); Nooteboom, Rev. Symplocac. 243. 1975 et in Rev. Handb. Fl. Ceylon 3 : 465. 1981.

Trees. Leaves $5.5—8.0 \times 2—4 \text{ cm}$, oblong to obovate, apex rounded, base attenuate, subentire with finely glandular serrulate margin, recurved, 5—7 pairs of nerves; petioles $0.8—1.4 \text{ cm}$. Spikes $3—6 \text{ cm}$, glabrous; flowers sessile or subsessile; bracts $2.2 \times 0.7 \text{ mm}$, lanceolate, obtuse, entire, caducous, spreading. Calyx lobes $3.5—5.0 \times 1.5—3.0 \text{ mm}$. Stamens 50—70, pentadelphous. Disc mostly glabrous, rarely pilose. Styles

glabrous, base swollen; stigmas rounded. Fruits 11—12 × 4.5—5.0 mm, cylindric, glabrous, calyx-rim c. 2 mm, chocolate-coloured, faint striations on the surface.

Type : India. Nilgiri. Wall. Cat. no. 4424 (K-W).

Fls. : Mar.—Apr.; *Frt.s.* : May—Jun.

Distrib. : INDIA : Tamil Nadu; SRI LANKA.

Ecol. : Tropical mountain forest of Nilgiris, between 2100 m to 2600 m altitude.

Pollen : Oblate ($25.0 \times 33.5 \mu\text{m}$), range $24—26 \times 30—35 \mu\text{m}$, aspidate. Amb triangular. Pore circular, c. $2.5 \mu\text{m}$ in diameter with thickened margins. Pore membrane psilate. Exine thickness c. $3 \mu\text{m}$ (excluding papillae). Sexine thinner than nexine. Nexine much thicker towards the pores. Exine surface papillate, papillae c. $1 \mu\text{m}$ in length with swollen heads. Papillae more prominent towards pore. Pattern ± obscure (Gupta & Sharma, Geophytology 7 (2) : 150, 1977).

Notes : Thwaites (Enum. Pl. Zeyl. 185. 1860) described three varieties, two of which were later raised to specific level by Brand (Engl. Pfianzcnr. Heft 6 : 56, 1901) based on the size of the leaves. The author agrees with C.B. Clarke (*l. c.*) that the size of the leaves vary greatly and hence the varieties cannot stand on the basis of leaf characters.

20. *Symplocos odoratissima* (Bl.) Choisy ex Zoll., Syst. Verz. 136. 1854; Backer & Bakh. f., Fl. Java 2 : 205. 1965; Nooteboom, Rev. Symplocac. 245. 1975 et. in Fl. Males. I. 8 (2) : 266. 1977. *Dicalyx odoratissimus* Bl. Bijdr. 1116. 1826. *S. chengappae* Raiz. & Sahni in Ind. For. 85 : 190. 1959.

Small to large trees; bark whitish. Leaves 12—20 × 5.0—8.5 cm, oblong-elliptic, acuminate, at apex, cuneate at base, crenulate, glabrous, nerves 7—8 pairs; petioles 2.0—2.5 cm long. Panicles c. 7 cm long; bracts caducous, bracteoles tomentellous; flowers white, fragrant; pedicels c. 5 mm. Calyx-tube 1.5—2.0 mm long, lobes 1.5—2.0 × 1.4—1.6 mm, margin woolly. Corolla lobes 7—8 × 3—4 mm, margin pilose. Stamens more than 100, pentadelphous; anthers oblong. Disc pilose, ovary trilocular. Style c. 3 mm long, pilose. Fruits 10—11 × 6—7 mm, narrowly flask-shaped, glabrous.

Type : Java, Blume 1947 (L).

Fls. : Mar.—Apr.; *Frt.s.* : Aug.—Sept.

Distrib. : INDIA : Great Nicobar Island; JAVA, MALAY PENINSULA.

Ecol. : Infrequent in open areas, usually along the river banks in the interior dense mixed jungle where the soil is perpetually moist.

Uses : Young leaf-sheath is eaten raw or steamed as lalab and consumed with rice. It is also used as a medicine against tropical thrush.

Pollen : Grains oblate to peroblate, tricolporate. Colpi brevicolpate, surface reticulate. Sexine thicker than nexine. Exine c. 2 μm , granulose. Sexine departed from the nexine at the mouth of the ora (Hore, Ph.D. thesis, Unpubl., Kalyani Univ. 1977).

Notes : So far known from Great Nicobar by type collections only (*Sahni* 22990-DD).

21. ***Symplocos oligandra*** Bedd., For. Man. 150. 1872 et Ic. 65, t. 272. 1874; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 574. 1882; Gamble, Fl. Pres. Madras 782. 1923 (Repr. ed. 2 : 549. 1957); Nootboom, Rev. Symplocac. 248. 1975.

Small trees; branchlets minutely pilose. Leaves 10—11 \times 3.5 cm, oblong to obovate, subobtuse, serrate, base cuneate to obtuse, pilose adpressed along the midrib undersurface; nerves 7—8 pairs; petioles 3.5—5.0 mm. Racemes axillary, a few-flowered, minutely hairy; bracts 2.0 \times 1.4 mm, obovate, obtuse, clavellate margin intermingled with pilose hairs, bracteoles 1.5—1.8 \times 0.5—0.6 mm. Calyx lobes 1.8—2.3 \times 1.0—1.3 mm, oblong to obovate, obtuse, margin and apex with pilose glandular hairs. Corolla lobes 2.0—2.7 \times 1.2—1.5 mm, oblong to obovate. Stamens 10—14 in 5—7 pairs, 1.5—2.2 mm long; anthers oblong to globose. Disc with dense short pilose hairs. Styles glabrous; stigmas uneven. Fruits not seen.

Type : India, Tinnevelly Hills, *Beddome* 4963 (BM, Photo!).

Fls. : Sept.—Oct.; *Frtis.* : Oct.—Dec.

Distrib. : INDIA : Tamil Nadu, Kerala.

Ecol. : A rare species, endemic to southern India and occurring in the evergreen forests.

Pollen : Tricolporate, colpi brevissimicolporate, ora c. 1.5 μm , exine granulose, sexine departed from the nexine near the aperture (Hore, Ph. D. thesis, Unpubl. Kalyani Univ. 1977).

Notes : Pairing of stamens is the characteristic feature of this species by which it can be easily distinguished from the rest of the Indian *Symplocos* species.

22. ***Symplocos oxyphylla*** Wall. ex DC., Prod. 8 : 256. 1844; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 574. 1882; Kanjilal *et al.*, Fl. Assam 3 : 218. 1939; Nootboom, Rev. Symplocac. 257. 1975. *S. pedicellata*

Kurz in Journ. Asiat. Soc. Beng. 42(2) : 89. 1973; op. cit. 46(2) : 239. 1877. *S. ophirensis* Clarke spp. *perakensis* auct. non (King & Gamble) Nooteboom; Nair in Ind. Journ. For. 1 (2) : 132. 1978. syn. nov.

Local name : Mota Bhumroti (Asm.).

Large trees, 21—22 m; d.b.h. 1.2—1.3 m. Leaves 8—14 × 3.5—4.6 cm, margin little wavy to entire, apex obtuse, base attenuate; nerves 6—9 pairs, prominent on both surfaces; petioles 5—10 mm. Racemes up to 4 cm; bracteoles 0.7—0.8 × 0.3—0.4 mm; pedicels 1.0—1.5 mm. Calyx lobes 0.5—1.0 × 0.4—0.8 mm, obtuse, minute hairs along the margin, sometimes out of five lobes two are relatively small and placed alternately. Corolla lobes 3.0—3.5 × 1.5—2.4 mm. Stamens c. 40. Disc pilose. Styles slender, minutely hairy at the base. Fruits 8 × 5 mm, ovoid, glabrous.

Type : Bangladesh, Silhet, Fr. De Silva-Wall. Num. List No. 4430 (G-DC).

Fls. : Sept.—Dec.; *Frts.* : Jan.—Apr.

Distrib. : INDIA : Assam, Arunachal Pradesh, South Andaman Islands; BURMA, THAILAND.

Ecol. : Tropical to temperate Eastern Himalaya, ascending from 85 m to 1700 m.

Uses : Timber used for bridge constructions.

Pollen : Subulate, assymetric, 18 × 23 μm , triporoid, pore 2.5 μm , sexine as thick as nexine. Nexine bent inwards and the sexine outwards, striato-reticulate (Hore, Ph.D. thesis, Unpubl. Kalyani Univ. 1977).

Notes : Nair (*l. c.*) misidentified the plants [*King's Collector* 331, 416 (PBL)] as *S. ophirensis* C. B. Clarke ssp. *perakensis* (King & Gamble) Nooteboom, which does not occur in India.

23. *Symplocos paniculata* (Thunb.) Miq. in Ann. Mus. Bot. Lugd. Bat. 3 : 102. 1867; Ghafoor in Nasir & Ali, Fl. West Pak. Fasc. 63 : 3. 1974; Nooteboom, Rev. Symplocac. 258. 1975. *Prunus paniculatus* Thunb., Fl. Jap. 200. 1784. *Myrtus chinensis* Lour., Fl. Cochinch. 313. 1790. *S. chinensis* (Lour.) Druce in Rep. Bot. Exch. Fl. Brit. Isl. 4 : 650. 1917. *S. crataegoides* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 145. 1825; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 573. 1882.

Local names : Ludh (Hindi); Lodh (Garh.); Lodhra (Kashm. & Sans.); Diengiong (Kh.) Lodh Pathani, Loja (Punj.).

Large shrubs to small trees, 2.5—6.5 m, deciduous. Leaves 3.0—7.2 × 1.5—3.8 cm, lanceolate to obovate, denticulate, acuminate to obtuse, base rounded, abaxially pilose, nerves 6—10 pairs; petioles 2—3 mm. Panicles 4—12 cm, hairy, few flowers long pedicelled; bracts 0.7—1.0 mm, hirtellous,

linear, caducous. Calyx-lobes $0.5-1.7 \times 0.5-1.3$ mm, minutely serrated, hirsute. Corolla lobes $3.0-5.2 \times 1.2-3.8$ mm, entire to minutely denticulate. Stamens 40—60, filiform. Styles glabrous; stigmas capitate. Fruits 3—7 mm long, obliquely ovoid or globose, deep blue when ripe.

Type : Japan, *Thunberg s. n.* (UPS).

Fls. : May—Aug.; *Frt.s.* : Sept.—Oct.

Distrib. : INDIA : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Sikkim, Arunachal Pradesh, Meghalaya, Manipur, Nagaland; PAKISTAN, NEPAL, TIBET, BHUTAN, BANGLADESH, BURMA, EAST CHINA, KOREA, JAPAN.

Ecol. : Usually occur in the temperate Himalayas between 915 m and 2745 m attitude. Very common in woods, open jungle among *Pinus*, *Quercus*, *Picea* and *Rhododendrons*, sides of ravine, in dry soil on the slopes of mountains.

Uses : Leaves used for dyeing and also as cattle feed in the Himalayas. Bark is used medicinally in ophthalmia.

Chr. No. : $2n = 22$ (Mehra & Gill in *Taxon* 17 : 575. 1968).

Notes : The only deciduous species in the genus.

24. *Symplocos pendula* Wight, Ic. 4 : 10, t. 1237. 1848; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 587. 1882; Gamble, Fl. Pres. Madras 784. 1923 (Repr. ed. 2 : 551. 1957); Nooteboom, Rev. Symplocos. 40. 1975 et in Fl. Males I, 8(2) : 214. 1977 et in Dassanayake & Fosberg, Rev. Handb. Fl. Ceylon 3 : 452. 1981 excl. syn. *S. sessilis* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 587. 1882. *Cordyloblaste pendula* (Wight) Alston in Trimen, Handb. Fl. Ceylon Suppl. 6 : 188. 1931.

Local name : Irava (Tel.).

Small trees, 9—10 m, *d.b.h.* c. 15 cm. Leaves $8.0-9.0 \times 3.0-4.0$ cm, elliptic to narrowly obovate, obtuse at apex, cuneate at base, subentire; nerves 6—8 pairs, irregular; petiole 0.8—1.0 cm. Racemes 1—4-flowered, together on short peduncles, pendulous; bracts persistent, bracteoles minute; pedicels 2—4 mm. Calyx lobes $2.2-2.5 \times 3.0-3.5$ mm. Corolla tubular, 6—10 mm long, lobes connate halfway up. Staminal tube adnate to corolla except at the upper half; filaments constricted at apex into a short filiform part. Style 5.5—7.0 mm, glabrous; stigma discoid. Fruits $13-14 \times 5-6$ mm, obovate to cylindric, reddish-black when ripe.

Type : India, Pulney, *Herb. R. Wight* 2136 (K, Photo!).

Fls. : Mar.—Apr.; *Frt.s.* : May—June.

Distrib. : INDIA : Tamil Nadu, Kerala; SRI LANKA, MALAYSIA.

Ecol. : Temperate regions of South Indian hills from 1800 m to 2250 m altitude.

25. *Symplocos pulchra* Wight, Ic. 4 : 10, t. 1230. 1848; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 583. 1882; Gamble, Fl. Pres. Madras 5 : 784. 1923 (Repr. ed. 2 : 551. 1957); Nooteboom, Rev. Symplocac. 266. 1975.

Shrubs or trees, 6—10 m; twigs densely villose or fulvous hirsute, hairs 3—4 mm long. Leaves 14.0—16.5 × 3.5—5.5 cm, elliptic-lanceolate, acuminate, base cuneate to rounded, dentate to denticulate, often ciliate, brown villose or fulvous hirsute hairy on both surfaces, chartaceous, nerves 7—12 pairs; petioles 5—8 mm. Spikes 1—3 cm long, 1—3-flowered; pedicels 2—4 mm; bracts 3.5—6.0 × 1.0 mm, bracteoles 2.0—2.5 × 0.7—1.0 mm, linear, acuminate, margin hirsute. Calyx lobes 1.0—1.2 × 1.0—1.1 mm, margin glandular pilose. Corolla lobes 4—8 × 1.0—2.5 mm, white. Stamens 45—80. Disc glandular pilose. Stylar base pilose; stigma slightly notched. Fruits 13 × 5 mm, narrowly cylindrical.

KEY TO THE SUBSPECIES

- 1a. Spike more than 1-flowered. Stamens usually 80 ...ssp. *pulchra*
 - 1b. Spike 1-flowered. Stamens usually 45 ...ssp. *villosa*
- ssp. *pulchra*

Syntypes : India, Nilgiris, Hohenacker 1448 & Wight 1688 (K, Photo).

Fls. : Feb.—Mar.; *Frtis.* : Mar. onwards.

Distrib. : INDIA : Tamil, Nadu, Kerala; endemic and very rare.

Pollen : Triporate, pore distinct, exine granulose (Hore, Ph.D. thesis. Unpubl. Kalyani Univ. 1977).

ssp. *villosa* (Brand) Nooteboom, Rev. Symplocac. 268. 1975. *S. villosa* Brand in Engl. Pflanzenr. Heft 6 : 63. 1901.

Fls. : Sep.—Dec.; *Frtis.* : Jan.—Mar.

Distrib. : INDIA : Kerala; endemic and very rare.

Ecol. : Occurs in moist forest at an altitude between 915 m and 1070 m.

26. *Symplocos pyrifolia* Wall. ex G. Don, Gen. Syst. 4 : 3. 1837; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 579. 1882; Cowan & Cowan, Trees N. Beng. 87. 1929; Kanjilal *et al.*, Fl. Assam 3 : 212. 1939; Yamazaki in Hara, Fl. E. Himal. I : 250. 1966; Nooteboom, Rev. Symplocac. 270. 1975.

Local name : Dieng-ja-peh (Kh.).

Trees, 6.0—7.5 m. Leaves 10.0—13.5 × 3.0—4.5 cm, lanceolate to broadly lanceolate, acuminate at apex, cuneate at base, serrulate; nerves 10—11 pairs, subparallel, arcuate, midrib prominent beneath; petioles 1.2—2.0 cm. Racemes 2—3 cm, minutely hirsute; flowers subsessile, creamy-white; bracts 5.0 × 2.8—0.3 mm, enclosing 3/4th of the flowers, lanceolate, margin villose; bracteoles 3 × 1.0—1.2 mm, ensiform. Calyx lobes 1.0—1.5 × 0.8—1.0 mm, triangular to lanceolate, apex densely silky. Corolla lobes 4.5 × 1—2 mm. Stamens 25. Disc villose, enclosing style base. Fruits 6.5 × 3.0 mm, cylindric, somewhat curved.

Type : Bangladesh, Mont. Silhet, *Fr. De Silva* Wall. Num. List No. 4515 (K-W, Photol).

Fls. : Nov.—Dec.; *Frls.* : Jan.—Mar.

Distrib. : INDIA : Sikkim, West Bengal, Arunachal Pradesh, Meghalaya; NEPAL, BANGLADESH.

Ecol. : Tropical forests of E. Himalayas.

Pollen : 3-colporate, rarely 4-colporate, brevicolpate. Suboblate ($20 \times 25 \mu\text{m}$), range $17.5—22.5 \times 22.5 \times 27.5 \mu\text{m}$, aspidate. Amb triangular. Colpi very thin, c. $10 \mu\text{m}$, long, membrane psilate. Ora lalongate with thickened margins, membrane psilate. Exine c. $2 \mu\text{m}$ thick. Sexine as thick as nexine. Sexine margins wavy. Pattern ± obscure (Gupta & Sharma in Geophytology 7 (2) : 153. 1977).

27. *Symplocos racemosa* Roxb., Fl. Ind. 2 : 539. 1832; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 576. 1882; Prain, Beng. Pl. 1 : 655. 1903 (Repr. ed. 1 : 483. 1963); Duthie, Fl. Upper Gang. Pl. 2 : 20. 1911 (Repr. ed. 1 : 473. 1960); Haines, Bot. Bih. & Or. 4 : 521. 1922 (Repr. ed. 2 : 547. 1961); Parkinson, For. Fl. Andamans 201. 1923; Osmaston, For. Fl. Kumaon 327. 1927; Cowan & Cowan, Trees N. Beng. 87. : 1929; Kanjilal *et al.*, Fl. Assam 3 : 211. 1939; Nooteboom, Rev. Symplocac. 271. 1975; Chakraborty in Bull. Bot. Surv. India 21 : 10. 1979. *S. racemosa* Roxb. var. *khasiana* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 576. 1882. *S. khasiana* (C. B. Clarke) Brand in Engl. Pflanzen. Heft 6 : 58. 1901 excl. syn. *S. nicobarica* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 580. 1882. *S. candolleana* Brand in Engl. Pflanzen. Heft. 6 : 59. 1901. *S. stocksii* Brand in Engl. Pflanzer. Heft 6 : 59. 1901. *S. microtricha* auct. non Hand.-Mazz. *sensu* Chakraborty in Journ. Bombay Nat. Hist. Soc. 76 (1) : 213. 1979.

Local names : Lodh (Hindi, Beng.); Loah, Bhomroti, Tam-tingali (Assm.); Singyan (Bhut.); Lodar (Guj.); Manithristi (Kan.); Lapongdong (Kh.) Pachotti (Mal.); Lodbra, Hura, Kawla, Landa (Mar.); Chamiani (Nep.); Ludhu (Or.); Lodhra (Sans.); Velli-lethi (Tam.); Lodduga (Tel.).

Shrubs or trees, 4.5—15.0 m; d.b.h. 0.3—0.6 m. Leaves 9—16 × 2.5—5.5 cm, narrowly to broadly elliptic, acuminate to blunt, base cuneate to rounded, entire, undulate or serrulate, midrib with a few pilose hairs beneath, nerves 7—10 pairs; petioles 0.5—2.0 cm. Racemes 4—9 cm long, woolly or tomentose; bracts ovate, bracteoles nearly elliptic, appressedly hairy, caducous; pedicels 1—3 mm, hairy. Calyx lobes 1.8—2.3 × 1.0—1.5 mm, margin soft hairy. Corolla lobes 2.5—5.0 × 1.0—1.5 mm, white, mildly fragrant. Stamens 50—100. Disc woolly. Style glabrescent or hairs encircling style base; stigma knob-like. Fruits 8—12 × 3—5 mm, narrowly ellipsoid.

Type : India, Bengal, Burdwan & Midnapore, *Roxburgh s. n.* (P).

Fls. : Sept.—Oct.; *Frt.s.* : Jan.—Feb.

Distrib. : INDIA : Uttar Pradesh, Sikkim, West Bengal, Assam, Meghalaya, Nagaland, Manipur, Bihar, Orissa, Tamil Nadu, Karnataka, Kerala, Andaman & Nicobar Islands; NEPAL, BANGLADESH, BURMA, THAILAND, CHINA, VIETNAM.

Ecol. : Common in deciduous to semi-evergreen forest of tropical and temperate regions of India, between 125 m and 2150 m altitude. Frequent in the low jungles and banks of rivers where the soils are dry, loamy or marshy.

Uses : Leaf extract is used in dyeing. Bark decoction is used for checking the bleeding gums; supposed to promote the maturation of stagnant tumours. Wood is used for house posts, making furniture, match-splits and as fuel.

Chr. No. : $2n = 22, 22 + 1 - 28$ (Nooteboom, Rev. Symplocac. 17, 1975).

Pollen : Tricolporate, brevissimicorate, tectate, tectum scabrate, some tetracolporate grains also found (Hore, Ph.D. thesis, Unpubl. Kalyani Univ. 1977).

28. *Symplocos ramosissima* Wall. ex G. Don, Gen. Syst. 4 : 3. 1837; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 577. 1882; Osmaston, For. Fl. Kumaon 328. 1927; Cowan & Cowan, Trees N. Beng. 87. 1929; Kanjilal *et al.*, Fl. Assam 3 ; 213. 1939; Yamazaki in Hara, Fl. E. Himal. 1 : 250. 1966; Nooteboom, Rev. Symplocac. 274. 1975.

Local names : Lodh (Hindi); Tungchong (Lep.); Kala-kharani, Silingi (Nep.); Kharaney (Lep.)

Large shrubs to small trees, c. 3 m. Leaves 8—13 × 2.8—3.0 cm, lanceolate to oblong-lanceolate, acuminate at apex, cuneate at base, serrulate, membranous; nerves 5—10 pairs, distinct beneath, petioles 0.6—1.0 cm.

Racemes 1.0–2.5 cm long, 6–7-flowered, axillary (axis leafless) or flowers internodal; pedicels 1–2 mm. Bracts 1.5 × 0.5 mm, lanceolate, acuminate to obtuse, margin pilose, braceoles 0.8–1.0 × 0.4–0.7 mm, margin pilose. Calyx lobes 0.5–1.1 × 0.3–0.8 mm, margin minutely glandular hairy. Corolla lobes 3–4 × 1.4–2.0 mm, entire, obtuse, white. Stamens 40. Disc and style glabrous; stigma slightly lobed or flat. Fruits 9.0 × 3.5 mm, ellipsoid, calyx-rim narrower than fruit, green when young, brown on maturity.

Type : Nepal, Sheopore, *Wallich* 4425 (K-W, Photo !).

Fls. : Mar.–May; *Frt.s.* : Jul.–Nov.

Distrib. : INDIA : Uttar Pradesh, Sikkim, West Bengal, Meghalaya; NEPAL, BHUTAN, BURMA, CHINA, VIETNAM.

Ecol. : Temperate regions of Himalayas, between 1000 m and 2500 m altitude, particularly on open hillsides.

Chr. No. : n = 11 (Mehra & Bawa in Evolution 23 : 471. 1969).

Pollen : Tricolporate, colpi slit-like, exine 3 μm , finely intectate, baculate. (Hore, Ph.D. thesis, Unpubl. Kalyani Univ. 1977).

29. *Symplocos sessilis* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 587. 1882; Gamble, Fl. Pres. Madras 784. 1923 (Repr. ed. 2 : 551. 1957); *Cordyloblaste sessilis* (C. B. Clarke) Henry & Roy in Bull. Bot. Surv. India 10 : 276. 1968. Fig. 34

Medium-sized trees, 12–14 m, d.b.h. c. 30 cm. Leaves 5–6 × 1.5–2.0 cm, oblong-lanceolate, spathulate, obtuse or retuse, minutely reflexed, base abruptly attenuate; nerves 5–6 pairs, prominent beneath, petioles 0.4–0.6 cm. Racemes 1–2-flowered, erect in the axils, mostly sessile, rarely subsessile. Calyx lobes 0.4–0.7 × 0.8–1.8 mm. Corolla 10 mm long, tubular, gradually tapering towards the base, connate about 2/3 of its length from base. Staminal tube adnate to corolla, free; filaments filiform, very short. Stigma disc-shaped. Fruits 12–15 × 2.5–3.2 mm, cylindric or club-shaped, turning black when ripe.

Type : India, Travancore (Kerala), *Beddome* 229 (K, Photo !).

Fls. : Oct.–Nov.; *Frt.s.* : Mar.–Apr.

Distrib. : INDIA : Tamil Nadu, Kerala; SRI LANKA.

Ecol. : Rare in the evergreen forests of Western Ghats around 1400 m altitude.

Notes : Nooteboom (Rev. Symplocac. 42. 1975) treated this species as a synonym of *Symplocos pendula* Wight var. *pendula*. But on the basis

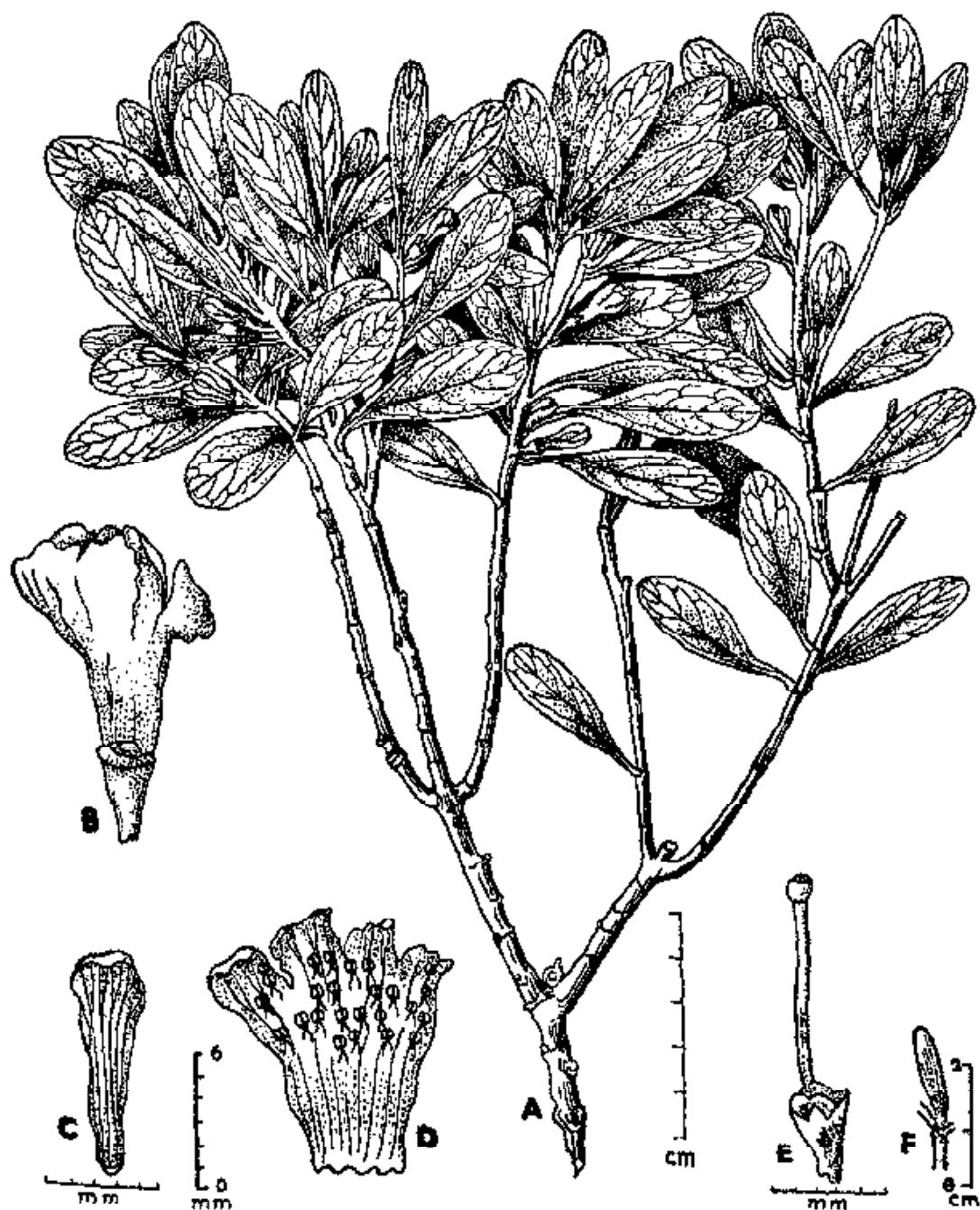


Fig. 34. *Symplocos sessilis* C. B. Clarke
A. Flowering twig. B. Flower. C. Calyx. D. Corolla-split-open.
E. Pistil. F. Young fruit.

of morphological characters (mentioned in the key) it is better to treat *S. sessilis* as a separate species. Anatomy of the petiole also reveals the distinction. The median vascular bundle gives no lateral traces throughout the length of petiole in *S. pendula*, while in *S. sessilis* it gives two lateral traces on either side from middle to distal region.

30. *Symplocos sumuntia* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 145. 1825; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 578. 1882; Cowan & Cowan, Trees N. Beng. 87. 1929; Kanjilal *et al.*, Fl. Assam 3 : 211. 1939; Nooteboom, Rev. Symplocac. 284. 1975 *et al.* in Fl. Males. I. 8 (2) : 271. 1977. *S. sumuntia* Buch.-Ham. ex D. Don var. *floribunda* DC., Prod. 8 : 255. 1844.

Local names : Eing-marang-snah (Kh.); Singan (Lep.); Aul-kharana, Chumlone (Nep.).

Large shrubs or trees, 3—18 m, d.b.h. 0.3—0.6 m; branchlets glabrous or patently villous, brown. Leaves 8.0—12.0 × 2.5—3.5 cm, lanceolate to ovate, glandular crenulate, base attenuate, nerves usually 10 pairs; petioles 1.0—1.5 cm. Racemes 2.5—4.0 cm, lax, highly villous or fulvous subhirsute; pedicels 1—2 mm; bracts and bracteoles with silky brown hairs on the margin, caducous. Calyx lobes 0.8—1.5 × 0.6—1.0 mm, margin glabrous or appressedly hairy. Corolla lobes 3.5—5.0 × 1.5—2.0 mm, glabrous, yellowish. Stamens 35—40. Disc and style glabrous. Fruits c. 4.0 × 2.5 mm, ovoid cylindric.

Type : Nepal, Narainhetty, Buchanan-Hamilton s. n. (BM, Photo !).

Fls. : Mar.—Apr.; *Frt.* : May—Aug.

Distrib. : INDIA : West Bengal, Meghalaya, Manipur, Nagaland; NEPAL, BANGLADESH, BURMA, CHINA, VIETNAM, JAPAN.

Ecol. : Evergreen trees in tropical to temperate hilly jungles of eastern Himalayas, between 1500 m and 2600 m.

Uses : The leaves and bark are used as a mordant in dyeing leather and in calico-printing.

Pollen : Brevicolpate, oblate, $36 \times 52 \mu\text{m}$, range $34—36 \times 50—52 \mu\text{m}$, aspidate. Amb triangular. Colpi c. $20 \mu\text{m}$ in length and $4 \mu\text{m}$ in width. Colpi membrane psilate. Ora transversely elongated (lalongate), c. $5 \times 15 \mu\text{m}$ with thickened margins, ora membrane ornamented. Exine c. $2 \mu\text{m}$ thick. Sexine as thick as nexine. In some pollen grains sexine slightly wavy. Pattern granulate [Gupta & Sharma in Geophytology 7 (2) : 152. 1977].

31. *Symplocos theaefolia* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 145. 1825; C. B. Clarke in Hook. f., Fl. Brit. India 3 : 575. 1885; Gamble, Fl. Pres. Madras 784. 1923 (Repr. ed. 2 : 551. 1957); Osmaston, For. Fl.

Kumaon 328. 1927; Cowan & Cowan, Trees N. Beng. 37. 1929; Kanjilal *et al.*, Fl. Assam 3 : 218. 1939; Yamazaki in Hara, Fl. E. Himal. 1 : 251. 1966.

Local names: Bhauri (Beng.); Cashing (Bhut.); Dieng-pei (Kh.); Kharani (Nep.); Kharane (Lep.).

Trees 6—20 m; d.b.h. c. 2 m. Leaves 9—12 × 2.5—4.5 cm, lanceolate to oblong, serrulate to obscurely serrulate, acuminate at apex, cuneate at base, nerves indistinct; petioles 0.7—1.2 cm. Panicles 1.5—2.0 cm, often tripartite below, bracts 2.0—2.4 × 1.6—2.0 mm, bracteoles 1.3—2.1 × 1.4—1.7 mm, villous. Flowers loosely arranged, subsessile, white, fragrant. Calyx lobes 1.2—1.8 × 1.0—1.3 mm, lanceolate to ovate, margin glandular villous. Corolla lobes 2.5—3.5 × 1.7—2.2 mm, lanceolate to ovate, obtuse, entire, glabrous. Stamens 20—25. Disc hairy. Styles villose from base upwards; stigma capitate or discoid. Fruits c. 7 × 5 mm, rounded or ovoid.

Type: Nepal, Narainhetty, *Hamilton s. n.* (BM, Photo !).

Fls. : Oct.—Nov.; *Frt.s.* : Feb.—May.

Distrib. : INDIA : Uttar Pradesh, Sikkim, West Bengal, Assam, Meghalaya, Mizoram, Nagaland; BHUTAN, NEPAL.

Ecol. : Temperate Himalayas between 1200 m and 2500 m. Commonly found in deciduous forests.

Uses : Tender leaves boiled and decoction used as eye-wash. Wood used as fuel and as cheap house-post.

Pollen : Sub-oblate 40 × 50 μm (excluding spines), aspidate, Amb triangular. Pore circular c. 5 μm in diameter, annulate (c. 2 μm). Pore membrane psilate. Exine c. 2 μm thick. Sexine as thick as nexine. Spines c. 5 μm in length and 1 μm in width with acute apices, sparsely placed. Pattern more or less obscure (Gupta & Sharma in Geophytology 7 (2) : 151. 1977).

Notes : The species approaches *Symplocos lucida* Sieb. & Zucc. in certain features but differs in having (i) leaf nerves indistinct (ii) stamens 20—25 (iii) densely hairy disc.

32. *Symplocos viridissima* Brand in Engl., Pflanzenl. Heft 6 : 41. 1901; Nooteboom, Rev. Symplocac. 291. 1975; Balakrishnan, Fl. Jowai 1 : 298. 1981. *S. lancifolia* C. B. Clarke in Hook. f., Fl. Brit. India 3 : 577. 1882 non Sieb. & Zucc. 1846.

Large shrubs c. 3—5 m; twigs glabrous or appressedly fine pubescent. Leaves 7—10 × 2.5—3.0 cm, oblong-elliptic, apex caudate, or rarely acuminate, base attenuate, cuneate, entire to subserrulate; nerves 3—6

pairs, anastomosing at a distance of 2/3 to the margin; petioles 2—5 (—7) mm. Racemes 1—2 cm long, few-flowered, axis glabrous to sparsely pubescent; bracts and bracteoles triangular to ovate, persistent. Calyx lobes c. 1 mm long, puberulous. Corolla lobes 3—5 mm. Stamens c. 40. Disc cylindrical, glabrous. Style glabrous. Fruits c. 7 × 3—4 mm, ampulliform.

Type : India, Nagaland, Patkoi Hills, *Griffith* 3659 (K).

Fls. : Nov.—Dec.; *Frs.* : Dec.—Jan.

Distrib. : INDIA : Meghalaya, Nagaland; BURMA, CHINA.

33. *Symplocos wynadense* (O. Ktze.) Nooteboom, Rev. Symplocac. 293. 1975; Henry & Swaminathan in Ind. For. 107 : 702. 1981. *Eugenoides wynadense* O. Ktze., Rev. Gen. Pl. 2 : 975. 1891. *S. acuminata* Bedd., For. Man. Bot. 150. 1872, *non* Miq. (1859); C. B. Clarke in Hook. f., Fl. Brit. India 3 : 583. 1882.

Shrubs; branchlets sparsely villose. Leaves 7.0—8.5 × 2.5—3.0 cm, obovate-lanceolate, acuminate at apex, attenuate at base, serrulate, pilose, nerves 5—6 pairs; petioles 0.8—1.0 cm. Racemes 4—7 cm long, few-flowered, slender, hairy; pedicels 0.8—1.0 cm; bracts 1.0 × 0.2 cm, elongated, acuminate, margin villose, caducous. Calyx lobes 1.3 × 0.8—1.0 mm, apex mostly hirsute, rarely on the margin. Corolla lobes 4.0—4.5 × 1.5—3.0 mm. Stamens c. 75; filaments gradually broader from base to apex. Disc pilose. Style glabrous; stigma slightly notched. Fruits 1.1 × 0.4 cm, glabrous, light yellowish.

Type : India, Travancore (Kerala), Attramallay, *Beddome* 4936 (BM).

Fls. : Feb.—Mar.; *Frs.* : Mar.—Apr.

Distrib. : INDIA : Tamil Nadu, Kerala; endemic.

Ecol. : A rare species in the evergreen forest of South Indian hills, between 1000 m and 1800 m altitude.

Pollen : Grains oblate, tricolporate, ora 2.5 μ m, exine 2 μ m, granulose (Hore, Ph.D. thesis, Unpubl. Kalyani Univ. 1977).

TETRACENTRACEAE

Van Tiegh. in Jour. Bot. 14 : 355 seq. (Tetracentracees) 1900.

Rolla S. Rao* and P.K. Hajra**

Trees; branchlets generally with short shoots and nodes, alternately directed, sometimes forking by means of occasional lateral long shoots; short shoots marked by concentric scars of fallen leaves and bud-scales. Leaves simple, deciduous, alternate, petiolate. Scales of terminal short shoots coriaceous, strongly concave. Inflorescence spike-like, short pedunculate. Flowers many in clusters of 4, bisexual, actinomorphic, sessile, bracteate. Perianth 4, obscurely imbricate at base; torus inconspicuous, flattened. Stamens 4; filaments slender; anthers basifix. Carpels 4, alternate with stamens and perianth; ovary triquetrous, unilocular; style subulate, at first erect, later recurved, placentae 2, parallel along ventral side of ovary; ovules attached to placenta near middle of locule. Fruits 4 laterally coalescent follicles. Seeds pendulous, few, with oily endosperm.

Distrib. : Temperate and subalpine regions of INDIA, NEPAL, BURMA, CHINA. Monotypic.

TETRACENTRON

Oliver in Hook. Ic. Pl. 19 : t. 1892. 1889; Prantl in Engl. & Prantl, Nat. Pflanzenfam. 3 (2) : 273. 1891; Smith in Jour. Arn. Arbor. 26 : 135. 1945; Hutch., Gen. Fl. Pl. 2 : 90. 1967 (Rep. ed. 1980).

Characters of the family.

Monotypic genus in the temperature and subalpine E. Himalayas (Nepal to Arunachal Pradesh), N. Burma, W. & C. China. 2500—3,500 m.

Notes : This monotypic genus, once treated under Magnoliaceae and subsequently under Trochodendraceae, is now placed under an independent family Tetracentraceae of the order Hamamelidales.

Pollen : The pollen grains are colporoidate. The granulations are "Most prominent in the Central (c. oroid?) part. The "os" or "oroid" is perhaps due to the presence of (endo-) nexinous right angles" (Erdtman, 1952).

Agababian and Zavarian (1971) do not throw any light on the two questions (oroid? grooves) raised by Erdtman. They just described the pollen as 3(2) colporate (Colporate), colpus membrane thick with well developed operculum-colpus margin uneven, even somewhat torn.

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According to G. Thanikaimoni (1973), who studied the pollen from our material "In none of the pollen grains a clear cut endoaperture could be observed. Perhaps it is only tricolpate as described by Nast and Bailey or it may represent a transitional stage between colpate and colporate condition".

Tetracentron sinense Oliver in Hook. Ic. Pl. 19 : t. 1892. 1889; Smith in Journ. Arn. Arbor. 26 : 137. 1945. *Tetracentron sinense* Oliver var. *himalense* Hara & Kanai in Jour. Jap. Bot. 39 : 195. 1964; Hara in Fl. E. Himal. 85. f. 13. t. 19-20. 1966; Srinivasan & Sengupta in Bull. Bot. Surv. India 8 : 342. 1967.

Fig. 35

Trees, 15—25 m high, 1—2 m in diameter, much branched above; young branches lenticellate, purpurascent. Short shoots 0.5—3.0 cm long; outer bract 10—13 × 4—5 mm, oblong-elliptic, obtuse or acute at apex, entire, scarious at margin; inner bract 13—15 × 3—5 mm, mucronate at apex. Stipular flanges papyraceous, or scarious, linear, 5—15 mm long, subacute at apex. Leaves 5—14 × 3—10 cm, ovate or ovate-elliptic, glabrous, green above, light green beneath, papyraceous or chartaceous when dry, acute or shortly acuminate at apex, deeply or shallowly cordate at base with rounded sinus or truncate-rounded, finely serrate at margin; petioles 1.5—3.0 cm long, veins 5—7, spreading from base; veinlets freely anastomosing. Inflorescence 9—18 cm long. (3—6 cm long when young, arcuate), slender, pendant; peduncle 8—12 mm long. Flowers c. 3 mm across, sessile, green, 60—112 at anthesis. Bracts minute, c. 0.5 mm long, obtuse at apex. Perianth each 0.5—1.0 mm across, deltoid suborbicular, green. Stamens: filaments 1.0—1.5 mm long; anthers c. 0.5 mm, oblong. Carpels c. 1.5 mm long; styles c. 1 mm long; ovules 6, slightly flattened; mature folliculae c. 3 mm long, oblong, depressed at apex. Seeds usually 6 per follicle, c. 2 mm long.

Type : China, A. Henry 6243 (6H) A. Henry 6690 (A. 6H, US).

Fls. & Frts. : April—Sept.

Distrib. : INDIA: Sikkim, Arunachal Pradesh, (Kameng); NEPAL, BHUTAN, N. BURMA, W.C. CHINA. 2,500-3,500 m.

Exsicc. : Arunachal Pradesh: Kameng, 25 km from Dirang on way to Senge, 3000 m, 15.4.1973, Rolla S. Rao 53866 (ASSAM); Senge-Supper Road, 14 km point, P. K. Hajra 54001 (ASSAM); Bomdila-Rupa Road, 14.4.1957, Panigrahi 6903 (ASSAM); Bomdila, 14.5.1955, Srinivasan (BSIS).

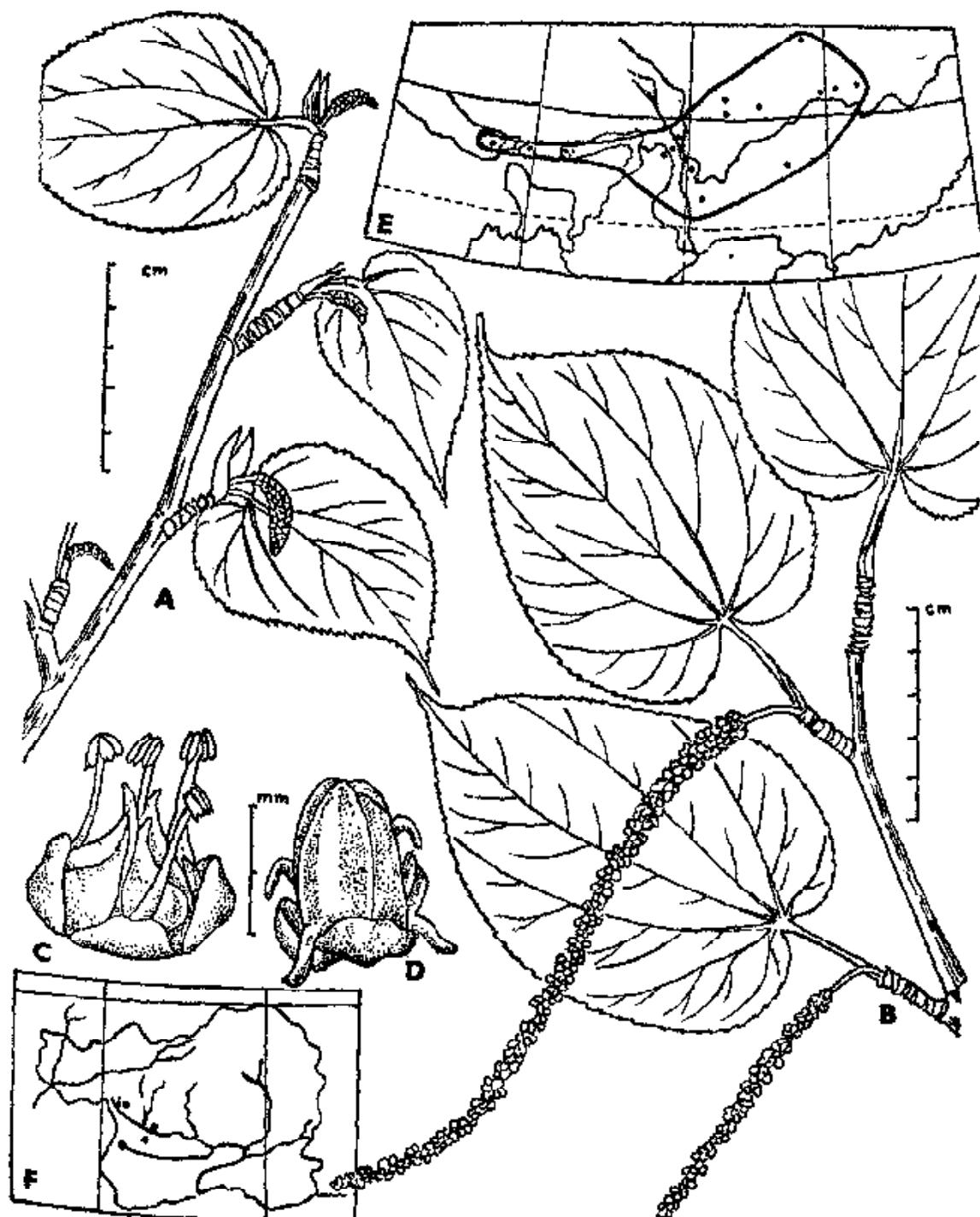


Fig. 35. *Tetracentron sinense* Oliver. A. Branchlet with young inflorescence. B. Branchlets with mature inflorescence. C. Flower with stamens and carpels. D. Young fruit. E. Map showing world distribution. F. Map showing distribution in Arunachal Pradesh (India).

ZYGOPHYLLACEAE

R. Br. in Flinders, Voy. Terra Austr. 2 : 545. 1814, 'Zygophylleae'
nom. cons.

Paramjit Singh and V. Singh*

Annual to perennial herbs, shrubs or rarely trees; branches often jointed or swollen at the nodes. Leaves opposite, sometimes alternate or fasciculate, pinnate, rarely simple, petiolate to subsessile; stipules free, foliaceous, sometimes fleshy or spinescent, persistent, rarely deciduous. Flowers solitary or in cymes, usually bisexual, regular or rarely irregular, hypogynous. Sepals usually 5, free or rarely connate basally, imbricate or valvate. Petals usually 5, free, often clawed, imbricate or convolute, rarely absent. Disc convex or concave, rarely annular or indistinct. Stamens in 1—3 whorls of 5 each, free, outermost whorl usually opposite the petals and occasionally adnate to them basally; filaments appendaged at the base or naked; anthers nearly basifixd to versatile, longitudinally dehiscent, introrse. Ovary sessile or rarely shortly stipitate. (2-) 5—10 (-12)-locular, placentation axile; style simple, angular or furrowed, rarely 5 and free; stigma simple capitate or lobed. Fruits capsular or schizocarpic, rarely drupaceous or baccate. Seeds 1—many in each locule; endosperm present or absent; cotyledons flat.

Type : *Zygophyllum* Linn.

Distrib. : 26 genera and c. 250 species, widely distributed but mainly in the tropical, subtropical and warm temperate regions. 7 genera and 14 species in India. One species, viz. *Guaiacum officinale* Linn. a native of America, is cultivated.

Notes : The family has been variously placed under the orders Geraniales (Benth. & Hook. f., Gen. Pl. 1 : 262. 1862; Takhtajan, Fl. Pl. Orig. & Disper. 226. 1969), Sapindales (Cronquist, Evoln. & Classif. Fl. Pl. 262. 1968) and Malpighiales (Hutchinson, Evoln. & Phyl. Fl. Pl. 272. 1969). It has been considered to be closely related to the family Rutaceae by Airy Shaw (Dict. Fl. Pl. 1213. 1966) and to the family Linaceae by Hutchinson (*l. c.*). Most of the botanists, however, place it near the families Erythroxylaceae, Geraniaceae, Oxalidaceae and other Geraniales *sensu* Engler.

The circumscription of the family is also controversial. Takhtajan (*l. c.*) treated *Balanites* Del., *Nitraria* Linn. and *Peganum* Linn. along with *Malacocarpus* Fisch. & Mey. under separate families viz. Balanitaceae,

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Nitrariaceae and Peganaceae respectively. Later he transferred Peganaceae to the Zygophyllaceae (in Bot. Rev. 46 : 225-359, 1980). Hadidi (in Bull. Cairo Univ. Herb. 7 & 8 : 103-108, 1977), in addition to recognising the families Balanitaceae, Nitrariaceae and Peganaceae, further split the family into Tribulaceae (*Tribulus* Linn. *Kallstroemia* Scop., *Kelleronia* Schinz, *Neoluuederitzia* Schinz, and *Sisymbrite* Mey. ex Sond.) and Zygophyllaceae s. str. The family, as circumscribed here, includes Nitrariaceae, Peganaceae and Tribulaceae.

KEY TO THE GENERA

- 1a. Flowers in cymes. Fruits drupaceous ...*Nitraria* 3
- 1b. Flowers solitary. Fruits capsular or schizocarpic :
 - 2a. Stipules spiny ...*Fagonia* 1
 - 2b. Stipules not spiny :
 - 3a. Petal present. Stamens 10-15, rarely 5 :
 - 4a. Leaves simple. Fruits capsular :
 - 5a. Leaves opposite, entire. Staminal appendages present ...*Zygophyllum* 7
 - 5b. Leaves alternate, irregularly dissected. Staminal appendages absent ...*Peganum* 4
 - 4b. Leaves pinnately compound. Fruits schizocarpic :
 - 6a. Intrastaminal glands present. Fruits splitting into 4-5 mericarps ...*Tribulus* 6
 - 6b. Intrastaminal glands absent. Fruits splitting into 10-12 mericarps ...*Kallstroemia* 2
 - 3b. Petals absent. Stamens 5 ...*Seetzenia* 5

I. FAGONIA

Tourn. ex Linn., Sp. Pl. 386, 1753 et Gen. Pl. ed. 5, 182, 1754; DC., Prodr. 1 : 704, 1824; Benth. & Hook. f., Gen. Pl. 1 : 267, 1862; Boiss., Fl. Orient. 1 : 903, 1867; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 425, 1874; Engl. in Engl. & Prantl. Nat. Pflanzenfam. ed. 2, 19a : 158, 1931; Hutch., Gen. Fl. Pl. 2 : 620, 1967; Hadidi in Bot. Notis. 125 : 524, 1972.

Annual or perennial, spreading to upright herbs or undershrubs; stem woody at base, diffusely branched; branches quadrangular or terete, sulcate or striate. Leaves opposite, 1-3-foliolate, rarely simple, glandular

hairy to glabrous; stipules usually spiny and acicular; leaflets petiolulate or subsessile, linear to broadly ovate, entire. Flowers solitary, axillary, pedicellate, purplish pink, violet or red-purple, rarely yellow. Sepals 5, deciduous or persistent. Petals 5, spatulate, clawed. Disc indistinct. Stamens 10; filaments filiform; anthers oblong. Ovary ovoid or obovoid, pentagonal, 5-loculed, each locule biovulate; style simple, persistent; stigma capitate. Capsules globular or pyramidal, deeply 5-angled, glandular-pubescent to glabrous, dehiscing septicidally into 5 basally dehiscent cocci. Seeds oblong-ovoid, compressed; testa mucilaginous; endosperm horny; cotyledons ovate.

Type : *Fagonia cretica* Linn.

Distrib. : c. 50 species, distributed mainly in the arid and dry regions of the world, excepting Australia; 4 species in India.

Pollen : 3-zonocolporate, amb circular, reticulate, aperture lalongate, colpi tips acute. Sexine thicker than nexine.

Chr. No. : $2n = 18, 20, 22, 24$ (Fedorov, Chromosome Numbers of Flowering Plants 727, 1974).

Uses : Among the Indian species, *F. indica* Burm. f. and *F. schweinfurthii* Hadidi, in particular, are known to cure asthma, fever, vomiting, dysentery and urinary discharges, and also reduce tumours and purify blood.

KEY TO THE SPECIES

- 1a. Internodes quadrangular. Stipular spines longer than the leaves ...*F. bruguieri* 2
- 1b. Internodes terete. Stipular spines equal to or shorter than the leaves :
 - 2a. Calyx deciduous. Capsules c. 0.5 mm. across ...*F. arabica* 1
 - 2b. Calyx persistent. Capsules c. 4 mm across :
 - 3a. Leaves unifoliolate, rarely a few basal ones trifoliolate. Fruiting pedicels equal to or shorter than the fruits ...*F. indica* 3
 - 3b. Leaves trifoliolate, upper ones unifoliolate. Fruiting pedicels twice as long as the fruits ...*F. schweinfurthii* 4

1. *Fagonia arabica* Linn., Sp. Pl. 386. 1753; Hadidi in Bot. Notis. 125. 525. 1972; Ghafoor in Jafri & El-Gadi, Fl. Libya 38 : 32. 1977. *F. cretica* Linn. var. *arabica* (Linn.) T. Anders. in Journ. Linn. Soc. 5 : 12. 1868.

Local name : *Dhraman* (Guj.)

Perennial shrublets, up to 50 cm tall; suberect to erect, diffusely branched, glandular, internodes 2–3 cm long, terete, striate. Lower leaves trifoliolate, upper unifoliolate; petioles 3–5 mm long; leaflets 4–12 × 1.5–3.0 mm, linear-oblong, mucronate; stipular spines 1–2 cm long. Flowers 10–12 mm across, pinkish purple; pedicels 4–5 mm long. Sepals c. 3.0 × 1.5 mm, oblong-lanceolate, glandular outside, deciduous. Petals 5–6 × 3–4 mm, obtuse. Stamens c. 5 mm long. Capsules 5 mm across, glandular-pubescent.

Type : Arabia, Shaw s.n. (BM).

Fls. & Frts. : Oct.—Mar.

Distrib. : INDIA : Gujarat; PAKISTAN, ARABIA, N. AFRICA.

Exsicc. : Saurashtra Coast, Dwarka, 10.2.1963, B. Safui 2416 (CAL); Beyt Island, 18.10. 1961, T. A. Rao 515 (CAL).

2. *F. bruguieri* DC., Prodr. 1 : 704. 1824; Boiss., Fl. Orient. 1 : 905. 1867; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 425. 1874; Blatt. in Rec. Bot. Surv. India 8 : 97. 1919; Hadidi in Rech. f., Fl. Iran. no. 98 : 7. t. 8, f. 1, 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan Fasc. 76 : 11. f. 2, A-F. 1974 et in Jafri & El-Gadi, Fl. Libya 38 : 18. f. 6. 1977. *F. echinella* Boiss., Diagn. Pl. Or. Nov. Ser. 1 (8) : 123. 1849.

Local name : *Dhamasa* (Raj.)

Shrublets up to 30 cm tall, pale green, profusely branched; branches distinctly sulcate, 4-angled; internodes up to 2 cm long. Basal leaves mostly trifoliolate, upper ones unifoliolate; petioles up to 5 mm long; leaflets 4–12 mm long, ovate-oblong, sharply mucronate, fleshy; stipular spines mostly recurved. Flowers c. 10 mm across, pale pink; pedicels up to 5 mm long. Sepals c. 2.5 × 1.5 mm, oblong-lanceolate, glandular outside, persistent. Petals 3.5–6.0 mm long, obtuse. Stamens c. 4 mm long. Capsules c. 4 × 4 mm, pubescent.

KEY TO THE VARIETIES

- | | |
|---|---------------------------|
| Ia. Basal leaves trifoliolate, upper unifoliolate | ...var. <i>bruguieri</i> |
| Ib. All leaves unifoliolate | ...var. <i>rechingeri</i> |

var. *bruguieri*

Type : Between Aleppo and Baghdad, *Bruguiere & Olivier* 1522 (G-DC, Microfiche !)

Fls. & Frts. : Feb.—May.

Distrib. : INDIA : Rajasthan; PAKISTAN, AFGHANISTAN, IRAN, IRAQ, ARABIA, AFRICA.

Exsicc. : Rajasthan, Jaisalmer, Tanot, 2.3.1978, *Shetty* 6104 (BSJO).

var. *rechingeri* Hadidi in Candollea 27 : 91. 1972 et in Rech. f., Fl. Iran. no. 98 : 8. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 13. f. 2, 1974.

Branches prostrate, internodes c. 15 mm long. Leaves subsessile, 4-10 mm long. Petals c. 6.0 × 2.5 mm. Capsules c. 4.0 × 3.5 mm, sparingly hairy; pedicels shorter than or equal to the capsules.

Type : Iran, 1948, *K.H. Rechinger & F. Rechinger* 3387 (W)

Fls. & Frts. : Sep.—Mar.

Distrib. : INDIA : Rajasthan; PAKISTAN, AFGHANISTAN, IRAN, IRAQ.

Ecol. : On gravel plains in N. W. Rajasthan, rare.

Exsicc. : Rajasthan, Jaisalmer, Barabagh, *Shetty* 3496 (BSJO); near Barabagh, *P. Singh* 7181 (BSJO).

Notes : This taxon is intermediate between *F. bruguieri* DC. var. *bruguieri* and *F. olivieri* DC. var. *olivieri*.

3. *F. indica* Burm. f., Fl. Ind. 102. t. 34. f. 1. 1768; Linn., Mant. Alt. 238. 1771; Hadidi in Rech. f., Fl. Iran. no 98 : 5. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 17. 1974. *F. cretica* auct. non Linn., Cooke, Fl. Pres. Bombay 1 : 164. 1901 (Repr. ed. 1 : 173. 1958) p.p. Duthie, Fl. Upp. Gang. Pl. 1 : 127. 1903 (Repr. ed. 1 : 120. 1960) p.p. *F. arabica* auct. non Linn. Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 425. 1874, p.p. Gamble, Fl. Pres. Madras 1 : 130. 1935 (Repr. ed. 1 : 93. 1957), p.p. *F. mysorensis* Roth, Nov. Sp. Pl. Ind. Or. 215. 1821; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 1 : 145. 1834; Dalz. & Gibbs., Bombay Fl. 45. 1861. *F. persica* DC., Prodr. 1 : 704. 1824. *F. parviflora* Boiss., Diagn. Pl. Or. Nov. ser. 1, 8 : 124. 1849.

Local names : Dama, Dhamanh, Samaba (Punj.); Dhamasa (Raj.); Hinguna, Ustarkhar, Chittigara (Tel.).

Annual to perennial shrublets, up to 60 cm tall; profusely branched, cylindrical, striate, pale green, glandular internodes 2—5 cm long. Leaves

unifoliolate, sometimes a few basal trifoliolate; petioles 2—8 mm long; leaflets 8—16 × 3—4 mm, ovate-lanceolate; stipular spines equal to or shorter than the leaves, occasionally reduced. Flowers c. 12 mm across, pinkish-purple; pedicels 4—6 mm long. Sepals c. 3.5 × 1.5 mm, ovate, glandular outside, persistent. Petals c. 6 × 3 mm, obtuse. Stamens c. 6 mm long. Capsules c. 4 × 4 mm, softly hairy.

Type : Iran, *Garcin s. n.* (G).

Fls. & Frts. : Almost throughout the year.

Distrib. : INDIA : Andhra Pradesh, Haryana, Karnataka, Rajasthan; PAKISTAN, AFGHANISTAN, IRAN, IRAQ, ARABIA, SOMALIA, ETHIOPIA, SUDAN, EGYPT, LIBYA.

4. *F. schweinfurthii* (Hadidi) Hadidi [in Osterr. Bot. z. 121 : 273. 1973] ex Ghafoor in Jafri & El-Gadi, Fl. Libya 38 : 31. 1977; Hadidi in Webbia 33 : 87. 1978. *F. indica* Burm. f. var. *schweinfurthii* Hadidi in Reich. f., Fl. Iran. no. 98 : 6. t. 6. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 19. f. 4, A-D, J-K. 1974. *F. cretica* auct. non Linn.; Cooke, Fl. Pres. Bombay 1 : 164. 1901 (Repr. ed. 1 : 173. 1958), p.p.; Duthie, Fl. Upp. Gang. Pl. 1 : 127. 1903 (Repr. ed. 1 : 120. 1960) p.p. *F. arabica* auct. non Linn.; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 425. 1874 p.p. Gamble, Fl. Pres. Madras 1 : 130. 1935 (Repr. ed. 1 : 93. 1957) p.p.

Local names : Dharaman, Dhamaso (Guj.); Dharnaso (Mar.); Dama, Dharamah, Samaba (Punj.); Dhamasa (Raj.); Hinguna, Ustarkhar, Chittigara (Tel.).

Annual to perennial, prostrate to erect, glandular to glabrous shrublets up to 50 cm tall; internodes 1—3 cm long, striate. Lower leaves trifoliolate, upper unifoliolate; petioles 5—10 mm long; leaflets 10—30 × 2—4 mm, linear-lanceolate, lateral ones (if trifoliolate) shorter than the terminal; stipular spines patent, shorter than the leaves, sometimes much reduced. Flowers c. 8—10 mm across, pinkish-purple; pedicels up to 8 mm long, glandular to glabrous. Sepals 3—4 × 1.5—2.0 mm, ovate, sparsely glandular outside, persistent. Petals 4—6 × 2—3 mm, obtuse. Stamens c. 5 mm long. Capsules c. 4 × 4 mm, softly hairy.

Type : Ethiopia, Eritrea, Sati, Schweinfurth 365 (K, Photo !).

Fls. & Frts. : Almost throughout the year.

Distrib. : INDIA : Andhra Pradesh, Gujarat, Haryana, Karnataka, Rajasthan, Punjab; PAKISTAN, AFGHANISTAN, IRAN, IRAQ, ARABIA TO SOUTHERN SAHARA AND TROPICAL AFRICA.

Notes : In the Indian floras *F. schweinfurthii* Hadidi and *F. indica* Burm. f. are erroneously identified either as *F. cretica* Linn. or *F. arabica* Linn. Examination of the type of *F. cretica* Linn. has revealed that it does not occur in the Indian subcontinent and is probably restricted to mediterranean region (Hadidi, 1972). In India *F. arabica* Linn. appears to be confined to Gujarat.

2. KALLSTROEMIA

Scopoli, Introd. Hist. Nat. 212. 1777; Benth. & Hook. f., Gen. Pl. 1 : 264. 1862 (sub *Tribulus*); Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19a : 177. 1931; Hutch., Gen. Fl. Pl. 2 : 618. 1967; Porter in Journ. Arn. Arb. 53 : 539. 1972. *Ehrenbergia* Mart., Nov. Gen. Sp. Pl. 2 : 72. 1827, non Spreng. 1820. *Heterozygia* Bunge in Mem. Sav. Etr. Acad. St. Petersb. 2 : 604. 1835.

Prostrate to ascending herbs, diffusely branched; branches herbaceous to suffruticose, densely pubescent to glabrate. Leaves opposite, paripinnate, one of each pair alternately smaller or sometimes abortive; leaflets (4—) 6—10 (—12) pairs, opposite, subsessile, elliptic to obovate, terminal pair directed forward, falcate. Flowers solitary, axillary, pedicellate. Sepals 5, free, usually persistent. Petals 5. Stamens 10, rarely 12; filaments filiform, naked; anthers globose or ovoid, extrastaminal glands truncate. Ovary ovoid or pyramidal, glabrous to pubescent, 10—12-lobed and loculed, each locule with one ovule; style simple, cylindrical to conical, persistent; stigma capitate or 10—12-lobed, papillose. Schizocarps separating into 10—12, triangular, wedge-shaped, tuberculate mericarps from a persistent styliferous axis. Seeds oblong-ovoid, endosperm absent.

Type : *Kallstroemia maxima* (Linn.) Torrey & A. Gary (= *Tribulus maximus* Linn.)

Distrib. : c. 17 species, distributed in the New World. Introduced into India, W. Africa.

Kallstroemia pubescens (G. Don) Dandy in Kew Bull. 10 : 138. 1955; Bennet in Ind. For. 91 (5) : 281. 1965 et Fl. Howrah 193. 1979; Bhide in Journ. Bomb. Nat. Hist. Soc. 75 : 529. 1979; Verma, Fl. Bhagalpur-Dicots. 87. 1981. *Tribulus pubescens* G. Don, Gen. Syst. 1 : 769. 1831. *Kallstroemia minor* Hook. f. in Hook., Niger Fl. 269. 1849.

Annual herbs; branches up to 50 cm long, diffusely-procumbent. Leaves 2—5 cm long; leaflets subsessile, 0.5—2.0 × 0.3—1.2 cm, elliptic to obovate, apiculate; stipules 3—5 mm long, linear-lanceolate, hairy. Flowers

c. 10 mm across, pale yellow; pedicels 10–20 mm long. Sepals 4.5–6.0 × 1.5–1.7 mm, linear-lanceolate, acuminate, persistent. Petals 6–7, 4.5–5.0 mm, obovate. Stamens 10, 5 mm long. Ovary c. 1 mm across; style conical, 10–12-ridged, persistent; stigma capitate. Schizocarps c. 8 mm across, pyramidal, ribbed; mericarps c. 5 × 3 mm, 1-seeded.

Type : W. Africa, Gold Coast, "Cape Coast", G. Don (BM).

Distrib. : INDIA : Bihar, Maharashtra, W. Bengal; MEXICO TO CENTRAL AMERICA, SOUTH AMERICA, W. AFRICA.

Chr. No. : $2n = 32$ (Datta in Curr. Sci. 37 : 477, 1968), $2n = 36$ (Pandey & Pal in Taxon 29 : 545, 1980).

3. NITRARIA

Linn., Syst. Nat. ed. 10, 1044, 1759; Benth. & Hook. f., Gen. Pl. 1 : 265, 1862; Boiss., Fl. Orient. 1 : 918, 1867; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19a : 178, 1931; Hutch., Gen. Fl. Pl. 2 : 616, 1967.

Much branched shrubs, sometimes spinous. Leaves alternate or fasciculate, simple, fleshy, entire, rarely 3-lobed at apex. Inflorescence a scorpioid cyme. Flowers short pedicelled or sessile, yellow to greenish white. Sepals 5, free or basally connate, imbricate, fleshy, persistent. Petals 5, concave, cucullate. Disc small, fleshy. Stamens 15; filaments naked; anthers oblong. Ovary oblong-pyramidal, appressed long silky hairy; 3-loculed, ovule solitary, pendulous in each locule; style simple; stigma 3-lobed, decurrent. Drupes ovoid, acuminate, endocarp bony. Seeds ovoid, endosperm absent, embryo straight, cotyledons linear ovate.

Type : *N. schoberi* Linn.

Distrib. : c. 7 species, distributed from N. W. Africa to Siberia, Australia. 1 species in India (Kashmir).

Nitraria schoberi Linn., Syst. Nat. ed. 10, 1044, 1759; Boiss., Fl. Orient. 1 : 919, 1867; Coode in Davis, Fl. Turkey 2 : 493, 1967; Hadidi in Rech. f., Fl. Iran no. 98 : 10, 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 3, f. 1 A-F, 1974.

Woody shrubs; young branches greyish pubescent, spiny at the apices. Leaves fasciculate, sessile, 20–50 × 3–8 mm, oblong-spathulate, obtuse, mucronulate, sparsely hairy; stipules minute. Flowers sessile, c. 4 mm across, whitish-yellow. Sepals 1.5–2.0 × 1.2 mm, broadly ovate, glabrous or glabrescent, slightly connate at base. Petals c. 3 mm long, oblanceolate, incurved at apex, glabrous. Stamens in 3 whorls of 5 each; anthers versatile. Drupes 5–15 mm across, ovoid-spherical, glabrous, reddish-purple.

Type : Herb. Linn. 624. 1 (LINN, Microfiche!)

Distrib. : INDIA : Jammu & Kashmir; CHINA, USSR, PAKISTAN, IRAN, ISRAEL, SYRIA, TURKEY.

Chr. No. : $2n = 48, 96$ (Fedorov, Chromosome Numbers of Flowering Plants 727. 1974).

Note : Only one specimen (Baltistan : Paiju, Baltoro glacier, *H. Hartman* 3480, RAW) represents its distribution in Jammu & Kashmir.

4. PEGANUM

Linn., Sp. Pl. 444. 1753 et Gen. Pl. ed. 5. 204. 1754; DC., Prodr. 1 : 712. 1824 (sub Rutaceae); Benth. & Hook. f., Gen. Pl. 1 : 287. 1862 (sub Rutaceae); Hook. f., in Fl. Brit. India 1 : 486. 1875 (sub Rutaceae); Boiss., Fl. Orient. 1 : 917. 1867; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19a : 154. 1931; Hutch., Gen. Fl. Pl. 2 : 615. 1967.

Perennial, erect herbs, pubescent or glabrous. Leaves alternate, simple, irregularly multifid; stipules setaceous. Flowers solitary, terminal or subterminal, leaf-opposed, pendulous, white to yellow. Sepals 4—5, free, entire or pinnatifid, persistent. Petals 4—5, subequal, free. Disc small, annular or angular. Stamens 12—15; filaments dilated at base, naked; anthers linear-oblong. Ovary globose, sulcate, 3—4-loculed, each locule with many ovules; styles simple, with stigmatose keels. Capsules globose, loculicidally dehiscent, rarely indehiscent. Seeds angular, testa spongy; endosperm fleshy, embryo curved.

Type : *P. harmala* Linn.

Distrib. : c. 6 species distributed from Mongolia to N. Africa, S. Europe, Tropical America, Australia. 1 species in India.

Peganum harmala Linn., Sp. Pl. 444. 1753; Hook. f. in Hook. f., Fl. Brit. India 1 : 486. 1875 (sub Rutaceae); Cooke, Fl. Pres. Bombay 1 : 162. 1901 (Repr. ed. 1 : 172. 1958); Duthie, Fl. Upp. Gang. Pl. 1. 1 : 128. 1903 (Repr. ed. 1 : 120. 1960); Prain, Beng. Pl. 1 : 292. 1903. (Repr. ed. 1 : 202. 1963); Haines, Bot. Bih. & Or. 1 : 154. 1921 (Repr. ed. 1 : 159. 1961); Bhandari, Fl. Ind. Desert 86, f. 28 c. 1978.

Perennial herbs, up to 1 m high, glabrous, basally woody; branches erect, terete, somewhat succulent. Leaves sessile, 3.0—7.5 cm long, multifid; lobes linear-lanceolate to elliptic, acute; stipules 1.5—2.5 mm long. Flowers 2—3 cm across, creamy-white to yellowish-white; pedicels 1.5—2.0 cm long. Sepals 5, 15—20 × 1—2 mm, linear, usually pinnatifid, acute. Petals 5, 10—17 × 4—6 mm, oblong to oblong-elliptic. Stamens 12—15, c. 10 mm long; anthers 5—6 mm long. Ovary c. 3 mm across, globose; style

c. 10 mm long, 3-keeled, upper half stigmatose, persistent. Capsules sub-globose, depressed at apex. Seeds 2-3 × 1.5-2.0 mm, triangular, brownish-black.

KEY TO THE VARIETIES

- 1a. Leaf segments 2-4 mm broad. Sepals c. 20 × 2 mm. Capsules c. 15 mm across ...var. *harmala*
 - 1b. Leaf segments 1-2 mm broad. Sepals c. 15 × 1 mm. Capsules c. 10 mm across ...var. *stenophyllum*
- var. *harmala*

Type : In arena Madritii, Alexandria. Linn. Herb. 621. 1, 621.2 (LINN, Photo).

Fls. & Frts. : Mar.-Oct.

Distrib. : INDIA: Jammu & Kashmir (Ladakh); CHINA, MONGOLIA, USSR, PAKISTAN, AFGHANISTAN, IRAN, IRAQ, SYRIA, TURKEY, JORDAN, ISRAEL, GREECE, TROPICAL AFRICA. Introduced in AMERICA, AUSTRALIA.

Chr. No. : n = 12 (Amin in Taxon 22: 115, 1973) and n = 24 (Henelt in Taxon 22: 649, 1973).

Exsicc. : Jammu & Kashmir, Ladakh, 13.9.1970, U. C. Bhattacharyya 41151 (BSD).

var. *stenophyllum* Boiss., Fl. Or. 1: 917. 1867; Hadidi in Reich. f., Fl. Iran no. 98: 20. t. 15. 1972.

Local names : Isaland (Beng.); Hurmal (Hindi, Punj.); Harmal, Gandhiyo (Raj.); Simayalavinai (Tamil.); Simagoronti (Tel.).

Type : Griffith 1196 (G, DD!)

Fls. & Frts. : Mar.-Oct.

Distrib. : INDIA: Gujarat, Haryana, Karnataka, Kashmir, Maharashtra, Punjab, Rajasthan, Uttar Pradesh; PAKISTAN, AFGHANISTAN, TURKMENIA, IRAN, IRAQ.

Uses : The plant has several therapeutic properties and is useful in curing lumbago, paralysis, weakness of muscles and brain, ophthalmia, laryngitis, rheumatism, asthma and chronic bronchitis; sometimes used as abortifacient. Seeds are stimulant, emmenagogue, anthelmintic and mildly narcotic.

Pollen : 3-zonocolporate, amb circular, faintly reticulate, prolate to subprolate, spheroidal, P/E 34/28/24-20 µm, aperture lolongate to circular,

$3 \mu\text{m}$ in diam., sexine thicker than nexine (as *P. harmala* Linn.. Bhandari & Parveen in Bir (Ed.) Rec. Res. Pl. Sci. 672. 1979).

5. SEETZENIA

R. Br. in Denham & Clapp. Narr. Travels Africa Bot. app. 231. 1826; Benth. & Hook f., Gen. Pl. 1 : 266. 1862; Boiss., Fl. Orient. 1 : 916. 1867; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19a : 160. 1931; Hutch., Gen. Fl. Pl. 2 : 620. 1967.

Perennial, spreading herbs, woody at base; branches prostrate, glabrous to papillose. Leaves opposite, petiolate, trifoliolate; leaflets shortly petiolulate, leathery, apiculate, glabrous to pubescent above, papillose beneath; stipules triangular. Flowers solitary, axillary, greenish; pedicels reflexed at maturity. Sepals 5, free, deciduous. Petals absent. Disc small. Stamens 5, alternating with sepals; filaments filiform, naked; anthers oblong to subglobose. Ovary oblong-clavate, 5-loculed, each locule with one ovule; styles 5, free, divergent; stigma capitate. Capsules ovoid, 5-angled, pendulous, dehiscing into 5 cocci from the persistent central axis; cocci thick, green or black, thin, muricated, straw-coloured on lateral walls. Seeds elliptic-oblong, flattened, narrow at both ends; testa thick; endosperm present; cotyledons thick.

Type : *S. africana* R. Br. *nom. illeg.* *Zygophyllum lanatum* Willd. *Seetzenia lanata* (Willd.) Bullock (Mc Neill in Taxon 30 : 463. 1981).

Distrib. : A monotypic genus sporadically distributed in INDIA : W. Rajasthan; PAKISTAN, AFGHANISTAN, ARABIA, AFRICA.

Seetzenia lanata (Willd.) Bullock in Kew Bull. 19 : 204. 1965; Hadidi in Bot. Notis. 125 : 534. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 8, f. 1 G-J. 1974. *Zygophyllum lanatum* Willd., Sp. Pl. 2 : 564. 1799. *Z. prostratum* Thunb., Prodr. Fl. Cap. 189. 1800. *Seetzenia africana* R. Br. in Denham & Clapp. Narr. Travels Africa Bot. app. 231. 1826, *nom. illeg.* *S. prostrata* (Thunb.) Eckl. & Zeyh., Enum. Pl. Agric. Austr. 98. 1834. *S. orientalis* Decne in Ann. Sc. Nat. ser. 2, 3 : 281, t. 7. 1835; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 424. 1874; Cooke, Fl. Pres. Bombay 1 : 161. 1901 (Repr. ed. 1 : 171. 1958); Bhandari, Fl. Ind. Desert 86, fig. f. 29. 1978.

Local name : *Dhakari* (Raj.).

Perennial herbs; branches up to 35 cm long, internodes 10—45 mm long, articulated. Leaves up to 15 mm long, petioles 2—4 mm long, thick, papillose; central leaflet 5—10 × 2—8 mm, obovate-cuneate, emarginate, lateral leaflets 3—10 × 1—6 mm, obliquely oblong; stipules 1.0—1.5 mm long,

triangular, villous. Flowers c. 5 mm across; pedicels 6–10 mm long. Sepals 2.5–4.0 × 1.0–1.5 mm, elliptic-lanceolate, acute or apiculate, inflexed at tip. Stamens 5, 3–4 mm long. Ovary 2.5–3.5 × 0.7–1.5 mm, ribbed; styles 5, c. 0.5 mm long. Capsules 6.5–8.0 × 5–6 mm. Seeds 4–5 × 1.5–2.0 mm, smooth, brown to blackish-brown.

Type : Sierra Leone, *Herb. Willd.* 8098 (B, Microfiche !)

Fls. & Frts. : Sep.–Mar.

Distrib. : Same as genus.

Pollen : 3-zonocolpate, amb circular, triangular, reticulate, lumina small; prolate to oblate spheroidal, P/E/52/48 μm . Colpi membrane granular, sexine thicker than nexine, tegillate, baculate, exine 4 μm thick. (sub *S. orientalis* Decne, Bhandari & Parveen in Bir (Ed.) Rec. Res. Pl. Sci. 672, 1979).

Notes : Bullock (*op. cit.*) considered *Seetzenia* R. Br. as a genus with 2 species viz. *S. lanata* (Willd.) Bullock and *S. orientalis* Decne. We support Hadidi's (*op. cit.*) view in considering it a monotypic genus, as the characters used for separating the two species do not hold good in the flora area.

6. TRIBULUS

Tourn. ex Linn., Sp. Pl. 386. 1753 et Gen. Pl. ed. 5. 183. 1754; DC., Prodr. 1 : 703. 1824; Benth. & Hook. f., Gen. Pl. 1 : 264. 1862, p.p.; Boiss., Fl. Orient. 1 : 901. 1867; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 423. 1874; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19a. 174. 1931; Hutch., Gen. Fl. Pl. 2 : 618. 1967; Nayar & Giri in Bull. Bot. Surv. India 24 : 160 (1982) 1983.

Annual to perennial, prostrate to semi-erect herbs, hairy to glabrescent. Leaves opposite, one of each pair alternately smaller or sometimes abortive, paripinnate; leaflets 6–20, opposite, subsessile to sessile. Flowers solitary, axillary, pedicellate, yellow. Sepals 5, pubescent, deciduous or persistent. Petals 5, obovate to obovate-oblong, membranous. Disc annular, 10-lobed. Stamens 5–10, outer whorl of 5 slightly longer, opposite the petals; filaments filiform, naked; anthers oblong to ovoid. Each of inner whorl of 5 stamens subtended adaxially by intrastaminal gland and abaxially by extrastaminal gland. Ovary globose, covered with bulbous-based stiff hairs, 5-locular, each locule 2–5-locellate and ovuled; style simple, cylindrical, 5-ridged; stigma 5-rayed. Schizocarp separating into 4–5, dorsally spiny, winged or tubercled, indehiscent mericarps. Seeds oblique-pendulous; endosperm absent; cotyledons oval.

Type : *Tribulus terrestris* Linn.

Distrib. : c. 30 species, mainly in the tropical and subtropical countries of the world. 5 species in India.

Chr. No. : x = 6 (Mallick in Chrom. Inf. Serv. 7 : 7. 1966).

Uses : The young leaves and stems of *T. terrestris* L. are eaten as pot herb. The fruits of *T. terrestris* L. and *T. pentandrus* Forssk. are used as tonic, aphrodisiac, diuretic, and in treating cases of kidney diseases, chronic cystitis and gonorrhoea.

KEY TO THE SPECIES

- 1a. Fruits with winged mericarps ... *T. pentandrus* 2
- 1b. Fruits with spiny mericarps :

 - 2a. Intrastaminal glands ciliate. Style pubescent ... *T. subramanii* 4
 - 2b. Intrastaminal glands eciliolate. Style glabrous :

 - 3a. Each mericarp with 2 median and 20—30, dorsal spines ... *T. rajasthanensis* 3
 - 3b. Each mericarp with 4 spines :

 - 4a. Pedicels shorter than the subtending leaves. Style stout, shorter than the ovary. Stigma prominently 5-rayed ... *T. terrestris* 5
 - 4b. Pedicels equal to or longer than the subtending leaves. Style slender, longer than the ovary. Stigma usually subcapitate or faintly 5-rayed ... *T. lanuginosus* 1

1. *Tribulus lanuginosus* Linn., Sp. Pl. 1 : 387. 1753 et Mant. Alt. 380. 1771; DC., Prodr. 1 : 704. 1824; Wight & Arn., Prodr. Fl. Pen. Ind. Or. I : 145. 1834; Nayar & Giri in Bull. Bot. Surv. India 24 : 161. 1983.

Annual or biennial, usually prostrate, silky-pubescent herbs. Leaves up to 5 cm long; leaflets 6—12, 3—10 × 2—5 mm, elliptic-oblong, oblique, acute; stipules c. 2.5 × 1.0 mm, lanceolate or falcate. Flowers c. 12 mm across, pale yellow; pedicels more than 10 mm long. Sepals 5—7 × 2—3 mm, lanceolate. Petals 5—6 × 2—3 mm, obovate-oblong, cuneate, obtuse-truncate. Stamens 10, c. 4 mm long; anthers oblong. Intrastaminal glands triangular, free; extrastaminal glands thick, truncate. Ovary c. 1 mm across; style c. 1.5 mm long; stigma faintly 5-rayed or subcapitate. Fruits disc-shaped; mericarps c. 4 × 2.5 mm, acuminate at apex, 2—4-spined.

Type : Herb. Linn. 547. 2-3 (LINN. Microfiche !)

Fls. & Frts. : Almost throughout the year.

Distrib. : INDIA : Almost throughout; SRI LANKA.

2. *T. pentandrus* Forssk., Fl. Aegypt.-Arab. 88. 1775; Hadidi in Taec-kholmia 9 : 61. 1978. *T. alatus* Del., Fl. Aegypt. Illus. 62. 1813; DC., Prodr. 1 : 703. 1824; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 423. 1874; Cooke, Fl. Pres. Bombay 1 : 161. 1901 (Repr. ed. 1 : 170. 1958); Bhandari, Fl. Ind. Desert 87. 1978; Nair, Fl. Punj. Pl. 49. 1978. *T. longipetalus* Viv., Pl. Egypt. Dec. 10, t. 2. f. 5. 1831; Zohary, Fl. Palaeastina 2 : 255. 1972; Hadidi in Rech. f. Fl. Iran no. 98 : 13. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 22. 1974; Nayar & Giri in Bull. Bot. Surv. India 24 : 162. (1982) 1983.

Local names : Gokhuri-kalan (Hindi); Bhakra, Hasak (Punj.); Bakda (Raj.).

Annual or biennial, prostrate to procumbent, pilose to densely villous, greyish white herbs. Leaves up to 7 cm long; leaflets (6-) 8-12 (-14), 3-10 (-13) × 2-5 mm, elliptic-oblong, oblique, acute; stipules 2-5 mm long, ovate-lanceolate or falcate, acute. Flowers 6-12 mm across, yellow; pedicels up to 15 mm long. Sepals 4-6 × 1.5-2.0 mm, lanceolate. Petals 4-7 × 2-3 mm, obovate-oblong, cuneate, obtuse-truncate and wavy at apex. Stamens 5-10, 2.5-4.0 mm long; anthers oblong. Intrastaminal glands triangular, free or slightly connate, glabrous; extrastaminal glands thick, slightly bilobed or truncate. Ovary c. 1.5 mm across, densely bulbous-based stiff hairy; style c. 1 mm long; stigma 5-rayed. Mericarps with 2-15 mm broad dentate to serrate wings, pubescent to pilose 2-3-seeded.

KEY TO THE VARIETIES

- 1a. Wings of mericarps up to 8 mm broad, pubescent, grey to greyish-yellow :
- 2a. Flowers 6-8 mm across. Wings of mericarps up to 4 mm broad ...var. *pentandrus*
- 2b. Flowers 10-12 mm across. Wings of mericarps 5-8 mm broad ...var. *macropterus*
- 1b. Wings of mericarps more than 8 mm broad, glabrous, straw yellow ...var. *pterophorus*

var. *pentandrus*

Type : Forsskal 743 (G, Microfiche!)

Fls. & Frts. : Sept.-Mar.

Distrib. : INDIA : Punjab, Haryana, Rajasthan; PAKISTAN, AFGHANISTAN, IRAN, IRAQ, SYRIA, ISRAEL, ARABIA, SOMALIA, SUDAN, N. AFRICA.

var. *macropterus* (Boiss.) P. Singh & V. Singh *comb. stat. nov.* *T. macropterus* Boiss., Diagn. Pl. Or. Nov. ser. 1, 1 : 61. 1843 *et* Fl. Orient. 1 : 903. 1867. *T. longipetalus* Viv. ssp. *macropterus* (Boiss.) Maire ex Ozenda & Quezel in Trav. l' Inst. Rech. Sahar. 14 : 73. 1956; Hadidi in Rech. f., Fl. Iran no. 98 : 13. t. 21, f. 1. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 23. f. 5 E-H. 1974. *T. longipetalus* Viv. var. *macropterus* (Boiss.) Zohary, Fl. Palaestina 2 : 255. 1972.

Type : Iran, Aucher-Eloy 803-bis (G).

Fls. & Frts. : Sept.—Mar.

Distrib. : INDIA : Rajasthan; PAKISTAN, AFGHANISTAN to N. AFRICA.

Exsicc. : Ganganagar, Gharsana, 10.11.1976, G. P. Roy 3831 (BSJO).

var. *pterophorus* (Presl.) P. Singh & V. Singh, *comb. et stat. nov.* *T. petrophorus* Presl., Bot. Bern. 30. 1844. *T. longipetalus* Viv. subsp. *pterophorus* (Presl.) Hadidi in Rech. f., Fl. Iran. no. 98 : 14. t. 20. f. 2. 1972; Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 24. 1974.

Type : South Africa, Cape, 1938, Drege (K).

Fls. & Frts. : Aug.—Nov.

Distrib. : INDIA : Rajasthan; PAKISTAN, AFGHANISTAN, S.W. AFRICA.

Exsicc. : India, Rajasthan, Jaisalmer, West of Ramgarh, 7.9.1976, Shetty 3469 (BSJO).

3. *T. rajasthanensis* Bhandari & Sharma in Bot. Notis. 129 : 367. f. 1. 1977; Bhandari, Fl. Ind. Desert 88. 1978; P. Singh in Bull. Bot. Surv. India 24 : 237. 1983.

Annual to perennial, prostrate to procumbent herbs; branches up to 50 cm long, hirsute. Leaves 2—5 cm long; leaflets 8—14, 4—12 × 3—6 mm, elliptic-oblong to ovate-oblong, oblique, pubescent above, villous beneath; stipules 5—7 × 1—2 mm. Flowers 10—15 mm, across, yellow; pedicels 10—20 mm long. Sepals 5—7 × 1—2 mm, linear-lanceolate, acute, villous outside, pubescent inside towards tip. Petals 5.0—7.5 × 3.0—5.0 mm, obovate-cuneate. Stamens 10, c. 3.5 mm long; anthers oblong. Intrastaminal glands broadly triangular, free; extrastaminal glands round, trunate or emarginate. Ovary c. 2 mm across; style c. 1 mm long; stigma 5-rayed.

Mericarps $6-7 \times 4-5$ mm, densely hispid, 2 major, c. 5 mm long, divergent, median spines and 20-30, minor spines 2-3 mm long, unequal.

Type : India : Jodhpur, rocky plateau of Massuria, 3.10.1959. Bhandari 537 (Holo, CAL; Iso JACI).

Fls. & Frts. : Jul.-Nov.

Distrib. : INDIA : Rajasthan, Gujarat; PAKISTAN.

Chr. No. : $n = 6$ (Bhandari & Sharma, *op. cit.*).

Pollen : Polyporate, amb circular, spheroidal; $38-50 \mu\text{m}$ in diam., reticulation distinct with hexagonal lumina and simplibaculate muri, each lumina with a circular pore, $3.5 \mu\text{m}$ in diam., sexine as thick as nexine. (Bhandari & Parveen in Bir, Rec. Res. Pl. Sci. 672. 1979).

Notes : It was described from W. Rajasthan but the present study has revealed that its distribution extends southwards to Gujarat and westwards to Pakistan.

4. *T. subramanyamii* P. Singh, Giri & V. Singh in Bull. Bot. Surv. Ind. 25 : 197. 1985.

Annual, silky hairy herbs; branches up to 40 cm long, striate. Leaves 4-6 cm long; leaflets 6-10, $8-15 \times 6-9$ mm, elliptic to obovate, oblique, apiculate, thinly to densely pubescent above, silky villous beneath; stipules $3.5-4.5 \times 1.5-3.0$ mm, falcate or linear to ovate. Flowers 10-15 mm across; pedicels c. 10 mm long. Sepals $5-7 \times 1.5-2.0$ mm, linear-lanceolate, acute. Petals $6-8 \times 5.0-5.5$ mm, obovate, cuneate. Stamens 10, c. 5 mm long; anthers oblong, intrastaminal glands free, almost triangular; extrastaminal glands thick, orbicular to oblong. Ovary c. 2.5 mm across; style c. 1.5 mm long; stigma pyramidal, 5-rayed. Schizocarp 15 mm across; mericarps c. 10×6 mm, dorsally ridged, appressed silky hairy, greenish-yellow, spines 4 or sometimes the lower pair reduced.

Type : India, Coimbatore, on the way to Varapalayam, 666 m. 25.7.1956, K. subramanyam 390 (Holo, CAL; Iso, CAL, MH).

Distrib. : INDIA : Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu.

Notes : This species is allied to *T. terrestris* L. but differs mainly in having pubescent style and ciliate intrastaminal glands.

5. *T. terrestris* Linn., Sp. Pl. 387. 1753; DC., Prodr. 1 : 703. 1824; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 423. 1874 p.p.; Cooke, Fl. Pres. Bombay 1 : 160. 1901 (Repr. ed. 1 : 170. 1958) p. p.; Duthie, Fl. Upp. Gang. Pl. 1 : 127. 1903 (Repr. ed. 1 : 119. 1960); p.p. Prain,

Bengal Pl. 1 : 292. 1903 (Repr. ed. 1 : 201. 1963); *p.p.*; Gamble, Fl. Pres. Madras 1 : 130. 1915 (Repr. ed. 1 : 92. 1957); Haines, Bot. Bih. & Or. 1 : 153. 1921 (Repr. ed. 1 : 159. 1961); Hadidi in Rech. f. Fl. Iran. no. 98 : 15, t. 18, 19. 1972 *Ind. var.* Ghafoor in Nasir & Ali, Fl. W. Pakistan no. 76 : 26. 1974.

Local names : Gokshura, Chota gokhru, Gokhru (Hindi); Negalu (Kan.); Neringii (Mal.); Labana gokhru, Sarate (Mar.); Bhakra (Punj.); Nerunji (Tam.); Palleru-mullu, Chirupalleru (Tel.).

Annual, prostrate to procumbent or suberect, hairy herbs; branches up to 1 m long, hirsute to sericeous. Leaves 3–7 cm long; leaflets 8–14, 4–11 × 2–5 mm, ovate to elliptic, oblique, acute or obtuse; stipules 2–5 × 1.0–1.5 mm, subulate to falcate. Flowers 8–10 mm across, yellow; pedicels c. 10 mm long. Sepals 2–4 × 1.5–2.0 mm, ovate-lanceolate, acute, hirsute, margins scarious, minutely ciliate. Petals 2.5–5.0 × 1–3 mm. Stamens 10, 3–4 mm long; anthers oblong. Ovary c. 1.5 mm across, with stiff, upward spreading, bulbous-based hairs; style c. 1.0 mm long; stigma 5-rayed, slightly asymmetrical. Fruit 10–15 mm across excluding spines; mericarps 4–8 × 5–7 mm, dorsally tuberculate, spines 4 or 2.

Type : S. Europe, Herb. Linn. 547.4 (LINN, Photo !)

Fls. & Frts. : Almost throughout the year.

Distrib. : INDIA : Common throughout from sea level to 3500 m; Pantropical.

Pollen : Polyporate, amb circular, spheroidal, 55–64 μm in diam., reticulate, lumina large, each lumina with a circular pore, 4 μm in diam. Interporal distance 10–12 μm , sexine as thick as nexine, tegillate, retipilate; exine 8.5 μm thick. (Bhandari & Parveen in Bir. Rec. Res. Pl. Sci. 672, 1979).

Chr. No. : $2n = 12, 24, 36, 48$ (Fedorov, Chrom. Num. Fl. Pl. 727. 1974), $n = 16$ (Sarkar *et al.* in Taxon 26 : 443. 1977).

Notes : This is an exceedingly variable species in both vegetative and reproductive characters. Hadidi (1972) recognised 4 varieties under it viz. *T. terrestris* var. *orientalis* (Kerner) G. Beck, *T. terrestris* var. *robustus* (Boiss. & Noe) Boiss., *T. terrestris* var. *bicornutus* (Fisch. & Mey.) Hadidi and *T. terrestris* var. *intermis* Boiss., but the characters used for separating them are overlapping and variable. Hence, no infra-specific categories are recognised here.

7. ZYGOPHYLLUM

Linn., Sp. Pl. 385. 1753 *et* Gen. Pl. ed. 5. 182. 1754; DC., Prodr. 1 : 705. 1824; Benth. & Hook. f., Gen. Pl. 1 : 266. 1862; Edgew. & Hook. f.

in Hook f., Fl. Brit. India 1 : 424. 1874; Boiss., Boiss. Fl. Orient. 1 : 909. 1867; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19a : 160. 1931; Hutch., Gen. Fl. Pl. 2 : 619. 1967.

Annual or perennial, prostrate or erect undershrubs or herbs. Leaves opposite, palmately 1—2-foliolate, rarely simple to more than 2-foliolate; leaflets cylindrical or flat, usually fleshy. Flowers solitary, axillary, pedicellate, white or yellow. Sepals 4—5, deciduous or persistent. Petals 4—5, spatulate. Disc fleshy, angled, concave. Stamens 8—10; filaments filiform, usually with a scaly appendage at base; anthers oblong-ovate. Ovary angular, 4—5-loculed, each locule with 2 or more pendulous ovules; style angular; stigma minute. Capsules 4—5-angled or winged. Seeds 1—many in each locule; endosperm present; cotyledons oblong.

Type : *Z. fabago* Linn. (Lectotype)

Distrib. : c. 100 species in deserts and steppes of RUSSIA, ASIA, MEDITERRANEAN REGION, AFRICA and AUSTRALIA.

Chr. No. : 2n = 16, 20, 44 (Fedorov, Chromosome Numbers of Flowering Plants 727. 1974).

1. *Zygophyllum simplex* Linn., Mant. 68. 1767; Boiss., Fl. Orient. 1 : 912. 1867; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1 : 424. 1874; Cooke, Fl. Pres. Bombay 1 : 163. 1901 (Repr. ed. 1 : 172. 1958); Ghafoor, in Nasir & Ali, Fl. W. Pakistan no. 76 : 31. 1974; Nair, Fl. Punjab Pl. 49. 1978; Bhandari, Fl. Ind. Desert 89. 1978; Shah, Fl. Gujarat 140. 1978. *Z. portulacoides* Forssk., Fl. Aegypt-Arab. 88. 1875.

Local name : Alethi (Guj.); Lunwo (Raj.).

Annual, procumbent to suberect, profusely branched, glabrous herbs, 10—20 cm tall; internodes up to 3 cm long, pale green to purple, finely striat. Leaves simple, sessile, unequal, up to 2 cm long, cylindrical, succulent. Flowers c. 5 mm across, yellow; pedicels c. 2 mm long, slender. Sepals 5, c. 2 × 1 mm, obovate, obtuse, cucullate. Petals 5, c. 3 × 1 mm, spatulate, membranous. Disc 10-lobed. Stamens 10, 2—3 mm long; staminal scales c. 1 mm long, bipartite; anthers oblong. Ovary c. 1 mm across, 5-loculed; style angular, c. 1 mm long, persistent; stigma minute. Capsules c. 3 mm across, turbinate, 5-angled, rugulose, septicidally dehiscent into 5 cocci. Seeds 2—3 per coccus, c. 1.0 × 0.6 mm, plano-convex, acute at both ends, brown.

Type : Arabia, Forsskal (G?).

Fls. & Frts. : Aug.—Jan.

Distrib. : INDIA : Gujarat; Haryana, Rajasthan; PAKISTAN, AFGHANISTAN, IRAN, ARABIA to N. & S.W. AFRICA.

Chr. No. : 2n = 20 (Fedorov, Chromosome Numbers of Flowering Plants 727, 1974), $n = 8$ (Eid in Taxon 19 : 265, 1970).

Pollen : 3-zonocolporidate, amb circular, psilate, prolate spheroidal. P/E12-14/10 μm , colpi tips acute and membrane psilate, sexine tegillate, psilate; exine 1.5 μm thick (Bhandari & Parveen in Bir., Rec. Res. Pl. Sci. 674, 1979).

EXCLUDED SPECIES

Edgeworth & Hooker (in Hook., f., Fl. Brit. India 1 : 423, 1874) reported *T. cistoides* L. from Bengal and Western Peninsula. The authors came across only 4 herbarium sheets of this taxon deposited in CAL, BSI and MH. These collections are from the plants grown in Botanic Garden, Howrah, and probably introduced by W. Hamilton in 1799 from America (Roxburgh, Hortus Beng. 33, 1814). The authors have not been able to locate even a single collection representing its wild occurrence in India and propose to exclude this species.

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POACEAE (TRIBE GARNOTIEAE)	3	Nov. 1979
SIMAROUBACEAE	4	April 1980
BALANITACEAE	4	April 1980
ORCHIDACEAE (GENUS COELOGYNE)	5	June 1980
PITTOSPORACEAE	6	Nov. 1980
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LEGUMINOSAE (GENUS DERRIS)	8	July 1982
ACERACEAE	9	Aug. 1982
ANNONACEAE (TRIBE UVARIEAE)	10	Sept. 1982
CUCURBITACEAE	11	Dec. 1982
VIOLACEAE	12	Aug. 1983
LINACEAE	13	Sept. 1983
IXONANTHACEAE	13	Sept. 1983
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HYPECOACEAE	17	July 1984
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MALVACEAE	19	Mar. 1988
NYSSACEAE	19	Mar. 1988