

# FLORA OF INDIA

VOLUME 3

PORTULACACEAE - IXONANTHACEAE

BOTANICAL SURVEY OF INDIA

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PORTULACACEAE - IXONANTHACEAE

Editors

B.D. SHARMA

and

M. SANJAPPA

with assistance from

N.P. Balakrishnan



भारतीय वनस्पति सर्वेक्षण  
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## ABBREVIATIONS

of

### INDIAN LANGUAGES

Abhor	: Abhor	Kum.	: Kumaonese
And.	: Andaman	Lep.	: Lepcha
Asm.	: Assamese	Lus.	: Lushai
Beng.	: Bengali	Mal.	: Malayalam
Bhoj.	: Bhojpuri	Mani.	: Manipuri
Bhut.	: Bhutia	Mar.	: Marathi
Cachar	: Cachar	Mikir	: Mikir
Coorgi	: Coorgi	Miri	: Miri
Eng.	: English	Naga	: Naga
Garo	: Garo	Nep.	: Nepali
Garh.	: Garhwali	Or.	: Oriya
Goa.	: Goanese	Port.	: Portugese
Guj.	: Gujarati	Punj.	: Punjabi
Hindi	: Hindi	Raj.	: Rajasthani
Jain.	: Jaintea	Sans.	: Sanskrit
Jaun.	: Jaunsar	Sant.	: Santal
Kang.	: Kangri	Sind.	: Sindhi
Kan.	: Kannada	Tam.	: Tamil
Kash.	: Kashmiri	Tel.	: Telugu
Kh.	: Khasi	Tipp.	: Tippera (Tripura)
Kon.	: Konkani	Urdu	: Urdu

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10. *Eriolaena lushingtonii* Dunn : Flowers; Biligi rangana Hills, Karnataka (photo: V.B. Hosagoudar).



11. *Helicteres isora* L. Flowers; Eastern Ghats, Andhra Pradesh (photo : N. Rama Rao).



12. *Elaeocarpus serratus* L.: Flowers; Mudumalai, Nilgiri, Tamil Nadu (photo : D. Stephen).



13. *Elaeocarpus tuberulatus* Roxb. : Flowers; Mudumalai, Nilgiri, Tamil Nadu (photo: D. Stephen).



14. *Dipterocarpus kerri* King : Flowers; Saddle Peak, Andaman & Nicobar Islands (photo : M. Sanjappa).



15. *Abroma angusta* (L.) L.f. : Fruits; Chungtang, Sikkim (Photo : M. Sanjappa).



## PORTULACACEAE

(M. K. V. Rao)

Annual or perennial, semi-succulent herbs or shrubs, mostly branched, creeping or erect, occasionally rooting at nodes, some with woody stems at base or with a tuberous main root. Leaves simple, alternate and spirally arranged or opposite, subsessile, obovate or linear-terete or elliptic, entire. Nodes in some with axillary hairs or scales. Flowers in terminal and/or axillary clusters (capituli) or in corymbose cymes or thyrses, dichasia, or rarely solitary, 4- or 5-merous, bisexual, actinomorphic, bracteate or not, bracts leafy or membranous, bracteoles hairy or scariosus. Sepals 2 (in some extra Indian genera 4 - 8), cymbiform, deltoid to obovate, imbricate, carinate or not, deciduous, connate at base and confluent with petals and stamens, partly enveloping ovary. Petals 4(- 6 or more in cultivars), mostly obovate, subequal, free or shortly connate, imbricate, fugaceous or macrescent, variously coloured. Stamens (1 -) 3 - many in one or more whorls, filaments basally connate; anthers 2- or 4-loculed, dorsifixed, dehiscence longitudinal. Ovary superior or semi-inferior, unilocular, ovules 4 - many on free central placenta; style apically 3 - 5-armed. Capsules globose, ovoid or conical, dehiscing valvular or circumscissile with operculum. Seeds mostly numerous, reniform to orbicular, minutely tubercled or smooth.

Cosmopolitan, ca 15 genera and 200 species; 2 genera and 8 species in India.

*Notes.* Most of the species occur as adventives or weeds in waste places, or cultivated as ornamental and food plants.

*Literature.* CAROLIN, R. (1987). A review of the family Portulacaceae. *Australian J. Bot.* 35: 383 - 412. ENGELMANN, G. (1850). *Plantae Lindheimerianae*. *Bost. J. Nat. Hist.* 6: 154. GEESINK, R. (1971). Portulacaceae. In: STEENIS, C.G.G.J. VAN, *Fl. Males. I*, 7: 121 - 133. KOWAL, T. (1967). *Studia nad morfologia i anatomia naison Portulacaceae*. *Rchb. Monogr. Bot.* 12: 1 - 48. MC NEIL, J. (1974). Synopsis of a revised classification of Portulacaceae. *Taxon* 23: 725 - 728. NYANANYO, B.L. (1986). Taxonomic significance of stomatal complex in the Portulacaceae. *Feddes Repert.* 97: 763 - 766. PAX, F. & K. HOFFMANN (1934). Portulacaceae. In: Engler, A. & H. Harms, *Die Naturlichen Pflanzenfam.* ed. 2, 16: 234 - 262. STENER, E. (1944). Cytogenetic studies on *Talinum* and *Portulaca*. *Bot. Gaz.* 105: 374 - 379.

*Notes.* One of the nine families of angiosperms which are known to possess red and yellow pigments, the betacyanins and betaxanthins in their floral and vegetative parts (Mabry, T.J. The betacyanins and betaxanthine. In: Swain, T. (ed.) *Comparative Phytochemistry*, 231 - 244. 1966.

*Portulaca grandiflora* is a common ornamental plant. *P. oleracea* is used as vegetable and also medicinally (leaves used for local application to swellings and bruises and as a poultice for abscesses and boils; plant juice is used for treating ear ache, toothache and

sypylis). *Talinum triangulare* is often cultivated in gardens and farms as a substitute for spinach; leaves and stems are eaten as salad. *Portulacaria afra* is introduced in India as a hedge or border plant in gardens.

#### KEY TO THE GENERA

- 1a. Ovary semi-inferior; capsules opening by circumscissile operculum; seeds usually tuberculate; leaves less than 2 cm broad **1. *Portulaca***
- b. Ovary superior; capsules dehiscing by valves splitting downwards; seeds usually smooth; leaves more than 2 cm broad **2. *Talinum***

#### 1. *Portulaca* L.

Annual or perennial, succulent, much branched herbs. Leaves dorsiventral or subterete, upper most clustered into foliar involucre with axillary hairs or scales. Flowers solitary or 2 - 30 in terminal capituli; receptacle infundibular with hairs or scales in the axils of bracts. Sepals 2, carinate or hooded, deciduous or persistent. Petals 4 - 6 (- 8), obovate, free or subconnate at base, macrescent. Stamens 8 - 9 in one whorl, inserted on calyx and adnate to petals. Ovary semi-inferior, 1-locular; styles 2 - 8 - armed, radiating. Capsules circumscissile at about middle. Seeds many, reniform, tubercled, rarely smooth.

Cosmopolitan, ca 100 species; 6 in India.

*Literature.* GEESINK, R. (1969). An account of the genus *Portulaca* in Indo-Australia and the Pacific. (Portulacaceae). *Blumea* 17: 275 - 307. LAL, J. & A.M. KHAN (1982). Pharmacognosy of the stems of *Portulaca quadrifida* L. and *P. oleracea* L. *Proc. Ind. Acad. Sci. (Pl. Sci.)* 91: 235 - 240. MATHEWS, J.F. & P.A. LEVINS (1986). The systematic significance of seed morphology in *Portulaca* (Portulacaceae) under scanning electron microscopy. *Syst. Bot.* 11: 302 - 308. NYANANYO, B.L. (1987). Taxonomic studies in the genus *Portulaca* L. (Portulacaceae). *Feddes Repert.* 98: 399 - 402. NYANANYO, B.L. & B.E. OKALI (1987). Cytological and morphological studies in Nigerian species of *Portulaca* (Portulacaceae) in relation to their taxonomy. *Feddes Repert.* 98: 583 - 587. POELLNITZ, K.V. (1934). Versuch einer Monographie der Gattung *Portulaca* L. *Feddes Repert.* 37: 240 - 329. SIVARAJAN, V.V. (1981). Taxonomic notes of the genus *Portulaca* Linn. in India. *J. Bombay Nat. Hist. Soc.* 78: 256 - 260.

*Notes.* The infrageneric treatments are attempted by Engelmann (1850), Poellnitz (1934), Geesink (1969), Mathews & Levins (1985) based on gross morphological characters taking into account species of particular geographical regions. Nyananyo (1987) considers them not satisfactory and recognizes two sections based on cytological, leaf morphological and anatomical, palynological, phytochemical and seed morphological evidences. The two sections are viz., sect. *Portulaca* (Engelmann) Nyananyo and sect. *Rotundatae* Poellnitz.

## KEY TO THE SPECIES

- 1a. All leaves opposite; hairs or scales intra- and interpetiolar; membranous bracteoles absent 2  
 b. At least middle leaves cauline spirally arranged; hairs only axillary; membranous bracteoles present 3  
 2a. Leaves visible; nodes with axillary hairs and no scales; flowers solitary 4. *P. quadrifida*  
 b. Leaves mostly concealed by nodal appendages; flowers 2 - 7 in clusters 6. *P. wightiana*  
 3a. Sepals distinctly carinate; axillary hairs not conspicuous, 0.5 - 1 mm long, deciduous 2. *P. oleracea*  
 b. Sepals not carinate, at the most only apically keeled; axillary hairs prominent, more than 2 mm long,  
 mostly persistent 4  
 4a. Flowers more than 2.5 cm across; petals 12 - 25 mm long; capsules ca 5 mm in diam. 1. *P. grandiflora*  
 b. Flowers less than 1 cm across; petals ca 12 mm long; capsules 2 - 3 mm in diam. 5  
 5a. Plants erect or suffruticose; roots branched, woody; flowers pink 3. *P. pilosa*  
 b. Plants spreading with tuberous main root; flowers yellow 5. *P. tuberosa*

**1. *Portulaca grandiflora*** Hook. in Bot. Mag. n.s. 3: t. 2885. 1829; Bailey, Man. Cult. Pl. 364, t. 6, 1949. *P. pilosa* L. subsp. *grandiflora* (Hook.) Geesink in Blumea 17: 297. 1969 & in Steenis, Fl. Males. 1, 7: 131. 1971; Sivarajan in J. Bombay Nat. Hist. Soc. 78: 260. 1981.

Eng.: *Sun plant; common rose moss.*

Diffuse, decumbent herbs, up to 30 cm high. Leaves alternate or subopposite, 12 - 25 x 1 - 4 mm, linear-subulate, often curved, terete, obtuse or acute at both ends, with ca 5 mm long, axillary hairs. Flowers 2.4 cm across, 2 - 8 in capituli, flowering successively, subtended by 5 - 8 involucreal leaves, deltoid bracteoles and ca 10 mm long hairs. Sepals 5 - 12 mm long, ovate, with an apical keel. Petals 5 (many in cultivated forms), pink, red, orange or yellow, 10 - 25 x 10 mm, obovate. Stamens numerous (40 - 75); filaments 2.5 - 6 mm long; anthers ca 1.4 x 0.3 mm. Styles 7 - 13 mm long with 5 - 10 arms. Capsules ca 5 mm in diam., globose, operculum shining straw-yellow. Seeds ca 6 mm in diam., shining; testa cells more or less stellulate with marginal ones having a central tubercle.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Cultivated widely as an ornamental and occasionally occurs as an escape.

Native of tropical America.

*Note.* Very variable in flowers, leaves and pubescence under cultivation. Several cultivated forms, including "double-flowered" are existing.

2. *Portulaca oleracea* L., Sp. Pl. 445. 1753; Dyer in Fl. Brit. India 1: 246. 1874.

Erect or decumbent herbs, up to 40 cm high. Leaves fleshy, spirally arranged or subopposite, 2 - 4 x 1.5 - 15 mm, obovate-spathulate or linear-terete, with inconspicuous, ca 1 mm long axillary hairs. Flowers 2 - 30 in capituli, with 2 involucreal leaves, surrounded by ca 5 x 6 mm bracteoles and inconspicuous hairs. Sepals up to 8 x 8 mm, carinate; carina ca 2 mm high. Petals 4 or 5, yellow, 3 - 10 x 8 mm, broadly obovate. Stamens 7 - 10 (- 15); filaments ca 4 mm long; anthers small. Styles up to 5 mm long with 3 - 5 arms. Capsules ca 4 x 3 mm, ovoid; operculum 2/3 to 1/2 the length of capsule, shining, straw-yellow. Seeds many, reniform, 6 - 7 mm in diam., shining black, granulate, testa cells stellulate with many tubercles.

*Notes.* Danin, A. *et al.* (*Israel J. Bot.* 27: 177 - 211. 1978) used seed size and morphology to describe nine subspecies under *P. oleracea*. Two varieties are recognized in India.

KEY TO THE VARIETIES

- |   |                               |
|---|-------------------------------|
| 1a. Leaves linear, subterete; seeds 55 - 75 per capsule                 | 2.1. var. <i>linearifolia</i> |
| b. Leaves spathulate, obovate, dorsi-ventral; seeds 20 - 25 per capsule | 2.2. var. <i>oleracea</i>     |

2.1. var. *linearifolia* Sivarajan & Manilal in New Botanist 4: 30. 1977; Sivarajan in J. Bombay Nat. Hist. Soc. 78: 258. 1981.

*Distrib.* India: Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Gujarat, Maharashtra and Tamil Nadu.

So far known only from India.

2.2. var. *oleracea*

Fig. 1.

*Asm.:* Noniya; *Beng.:* Baraloniya; *Guj.:* Motiloni, Ghol; *Hindi:* Khursa, Kulfa; *Kan.:* Dooddagooni Soppu; *Mar.:* Bhuigoli, Kurfah, Mhotighol; *Or.:* Purunisag; *Punj.:* Lonak, Kundar; *Sans.:* Brihalloni, Lonica, Lonamala; *Tam.:* Karikeerai, Paruppukiray, Pullikirai, Vazhukkaikeerai, Pasalaikeerai; *Tel.:* Peddhapayilikura, Ganga-pavilikura; *Eng.:* Common purslane.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: A weed in waste places, seashores and waysides, throughout.

Pantropical.

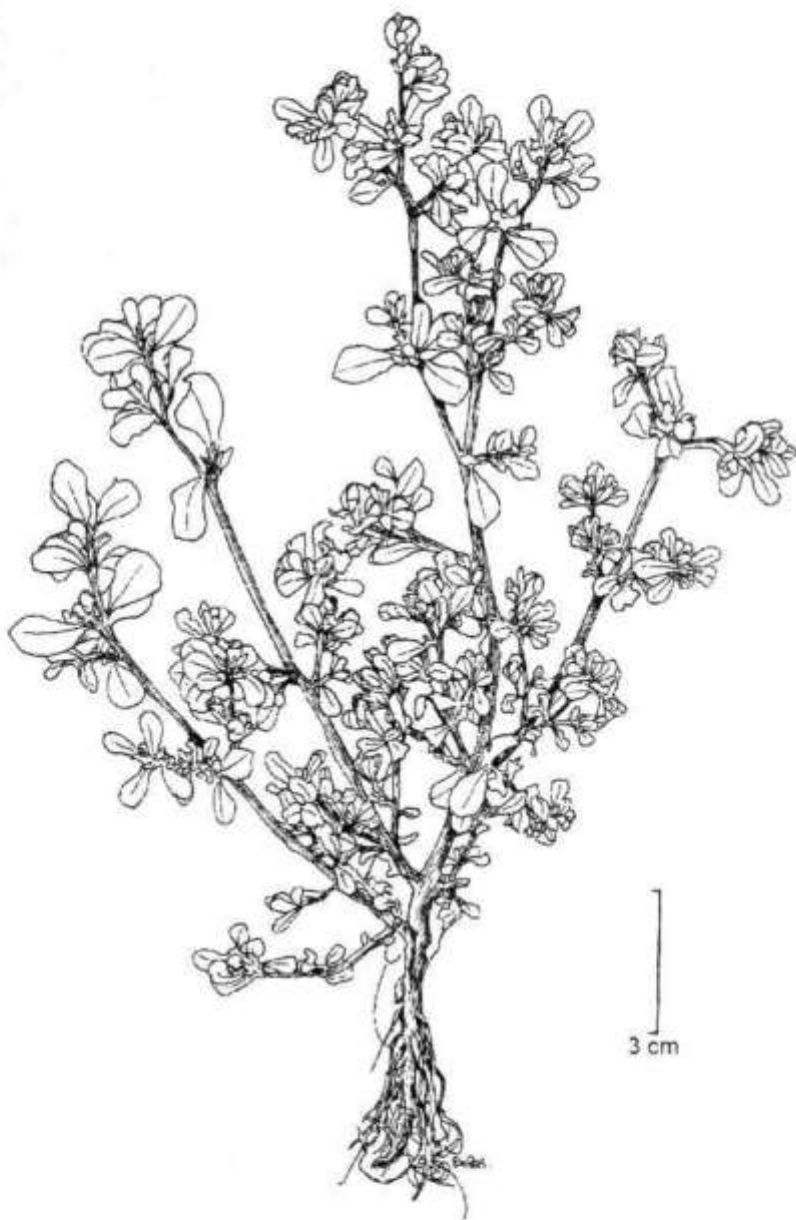


Fig. 1. *Portulaca oleracea* L.

3. *Portulaca pilosa* L., Sp. Pl. 445. 1753; Geesink in *Blumea* 17: 294. 1969 & in Steenis, *Fl. Males.* 1, 7: 131. 1971 (quoad subsp. *pilosa* 'race' *pilosa*); Sivarajan in *J. Bombay Nat. Hist. Soc.* 78: 259. 1981 (quoad var. *pilosa*). *P. parvula* auct. non A. Gray; Y.S. Murthy & V. Singh in *Proc. Nat. Inst. Sci. India* 27: 14. 1961; M. Sharma in *Bull. Bot. Surv. India* 15: 136. 1976.

Perennial herbs, much branched, caespitose, up to 30 cm high, with branched woody roots. Leaves spiral, crowded at apices of branches, subterete, 4 - 28 x 0.5 - 4 mm, linear-lanceolate; axillary hairs sparse. Flowers pink or red-purple, 2 - 6 in capituli. Sepals 2 - 6 x 1 - 4 mm, ovate, ecarinate or sometimes inconspicuously hooded at apex. Petals 4 - 6, 2.5 - 8 x 1.8 - 11 long, obovate. Stamens 10 - 16; filaments 1 - 5 mm long. Styles 2 - 8 mm long, 3 - 7-armed. Capsules 2 - 3 mm in diam., more or less globose; operculum half the length of capsule, shining, straw-yellow to olive-green. Seeds dull or bluish, 0.4 - 0.7 mm in diam.; testa cells elliptic, tubercled or stellulate all over except smooth margin.

*Fl. & Fr.* July - Sept.

*Distrib.* India: Uttar Pradesh, Bihar, West Bengal, Rajasthan, Andhra Pradesh and Kerala.

Native of tropical America, now pantropical.

4. *Portulaca quadrifida* L., *Mant. Pl.* 1: 73. 1767; Dyer in *Fl. Brit. India* 1: 247. 1874.

Beng.: *Nuniya*, *Chota luniya*; Hindi: *Chounlayi*, *Chotalunia*, *Lomiya*, *Khate chawal*; Guj.: *Luni*, *Jhiniluni*; Kan.: *Gooni Soppu*, *Hali dajjili*, *Hali bachchdi*; Mal.: *Neelakeera*; Mar.: *Khatechanval*, *Ranghol*; Sans.: *Laghulonina*, *Uppadyki*; Tam.: *Chinnaparuppukirai*, *Taraipsalai*, *Sirupasalai*.

Much branched herbs; branches up to 10 cm long, creeping, profusely rooting at nodes; nodes with a whorl of dense silvery white, ca 5 mm long hairs. Leaves fleshy, 0.6 - 20 x 0.8 - 7 mm, elliptic-cordate to ovate-lanceolate, acute at apex, entire. Flowers solitary, terminal on an infundibular receptacle, subtended by four leaves and encircled by hairs. Sepals ca 3 mm long. Petals 4, yellow, ca 5 x 4 mm, obovate. Stamens 8 or 12; filaments 3.5 mm long. Styles cylindrical with (3 -) 4(-5) arms. Capsules 3.5 - 5 x 3 mm, obovate-conical; operculum to nearly 2/3 the length of capsule, shining, straw-yellow. Seeds many, 0.8 - 1 mm in diam., dull black; testa cells elliptic, radially elongated, margins straight, surface converse or tubercled.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Ruderal, also in moist grasslands. Punjab, Uttar Pradesh, Bihar, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pantropical (except Australia and Pacific, east of Samoa).

*Note.* Very variable with regard to hairiness.

**5. *Portulaca tuberosa* Roxb.**, [Hort. Beng. 91. 1814, nom. nud.] Fl. Ind. 2: 464. 1832; Dyer in Fl. Brit. India 1: 246. 1874. *P. suffruticosa* Wallich ex Wight & Arn., Prodr. 356. 1834; Dyer in Fl. Brit. India 1: 247. 1874. *P. pilosa* L. subsp. *pilosa* 'race' *tuberosa* Geesink in Blumea 17: 296. 1969 & in Steenis, Fl. Males. 1, 7: 1978. *P. pilosa* L. var. *tuberosa* (Roxb.) Sivarajan in J. Bombay Nat. Hist. Soc. 78: 259. 1981. Fig. 2.

Perennial herbs, erect or decumbent, ca 5 m high, with thick tuberous root. Leaves spiral, 4 - 28 x 0.5 - 5 mm, oblong, obtuse or rounded at apex, axillary hairs 1 - 18 mm long. Flowers solitary or 2 - 4 in capituli, subtended by an involucre of 3 - 8 cauline leaves. Sepals ecarinate, 2 - 6 x 1 - 4 mm. Petals 4 - 6, bright yellow, 2.5 - 12 x 1.8 - 11 mm, obovate, spreading. Stamens 10 - 25; filaments 1 - 5 mm long. Styles 3 - 5 - armed. Capsules 2 - 3 mm in diam., ovoid-globose; operculum 1/2 to 2/3 the length of capsule, shining.

*Distrib.* India: On rocky laterite soils and sandy coasts. Uttar Pradesh, Bihar, West Bengal, Orissa, Punjab, Rajasthan, Maharashtra, Andhra Pradesh, Tamil Nadu, Kerala and Lakshadweep Islands.

Pantropical.

**6. *Portulaca wightiana* Wallich ex Wight & Arn.**, Prodr. 356. 1834; Dyer in Fl. Brit. India 1: 247. 1874.

Herbs, ca 10 cm high; branches angled; internodes very short (ca 2 mm). Leaves ca 4 x 2.7 mm, cordate to ovate, acute at apex, enveloped by large axillary silvery scales covering internodes, caducous; scales ca 4 x 2 mm, deltoid to ovate, acute, membranous. Flowers 2 - 7 in terminal capituli subtended and surrounded by hairs and scales. Sepals ca 3 x 3.3 mm. Petals 4, ca 2.8 x 1.7 mm, elliptic. Stamens 10; filaments ca 0.8 mm long. Styles ca 2 - 3 mm long, ending in 3 - 6 arms. Capsules ca 2 mm in diam., globose, operculum nearly 2/3 the length of capsule, straw-yellow. Seeds ca 0.5 mm in diam., testa cells hexangular with central tubercle.

*Distrib.* India: Common along sandy coasts. Andhra Pradesh and Tamil Nadu.

Sri Lanka.



Fig. 2. *Portulaca tuberosa* Roxb.



## 2. *Talinum* Adans., nom. cons.

Perennial herbs or shrubs with stout roots. Leaves alternate, spirally arranged, sometimes lower most opposite, linear to obovate, sessile or shortly petioled, exstipulate. Inflorescences terminal, corymbiform, thyrsoid, racemiform or paniculiform. Sepals free or shortly connate, ovate, deciduous. Petals 5, red-purple, withering or sometimes persistent. Stamens 5 - many. Ovary superior; styles 3-armed. Capsules globose or ellipsoid, mostly 3-valved or irregularly dehiscent. Seeds many, tuberculate or ribbed or smooth, shining, with caruncle.

Native of America and South Africa, ca 50 species, a few species are now pantropical. 2 species introduced and naturalized in India.

*Literature.* NYANANYO, B.L. & J.D. OLOWOKUDEJU (1986). Taxonomic studies in the genus *Talinum* (Portulacaceae) in Nigeria. *Willdenowia* 15: 455 - 463. POELLNITZ, K.V. (1934). Monographie der Gattung *Talinum* Adans. *Feddes Repert.* 35: 1 - 34. ROSE, J.N. & P.C. STANDLEY (1911). The genus *Talinum* in Mexico. *Contrib. U.S. Natl. Herb.* 13: 281 - 288. TOLKEN, H.R. (1969). The genus *Talinum* (Portulacaceae) in Southern Africa. *Bothalia* 10: 19 - 28.

### KEY TO THE SPECIES

- |                                      |                              |
|--------------------------------------|------------------------------|
| 1a. Leaf apex apiculate              | 1. <i>T. portulacifolium</i> |
| b. Leaf apex emarginate or mucronate | 2. <i>T. triangulare</i>     |

(According to Hutchinson & Dalziel (*Fl. W. Tropical Africa* I, 1: 136. 1954) these two species are very similar and almost indistinguishable morphologically and the only character that distinguishes them is the leaf shape. Nyananyo & Olowokudeju (*l.c.*) have found differences on the basis of palynology, seed morphology and leaf anatomy).

1. *Talinum portulacifolium* (Forsskal) Asch. ex Schweinf. in *Bull. Herb. Boiss.* 4, App. 2: 172. 1896. *Orygia portulacifolia* Forsskal, *Fl. Aegypt.-Arab.* 103. 1775. *Portulaca cuneifolia* Vahl, *Symb. Bot.* 1: 33. 1790. *Talinum cuneifolium* Willd., *Sp. Pl.* 2: 864. 1799; Roxb., *Fl. Ind.* 2: 465. 1832; Dyer in *Fl. Brit. India* 1: 247. 1874. *T. indicum* Wight & Arn., *Prodr.* 356. 1834.

Herbs or subshrubs, robust, glabrous with rootstock. Leaves subsessile, 6 - 8 x 2 - 3 cm, obovate or oblanceolate, obtuse or rotund and mucronate at apex, entire, fleshy, glossy above, obscurely nerved. Inflorescences terminal, racemose or paniculate. Flowers 1.5 - 2 cm across; bracts 1 - 6 mm long, linear; pedicels 0.7 - 1.5 cm long. Sepals 2, 4 - 6 x 3 mm, ovate-lanceolate, acuminate, 3-nerved. Petals 5, pink, purple, or white, 9 - 12 x 5 - 6 mm, obovate to ovate-rotund. Stamens many, filaments 2 - 3.5 mm long, unequal, basally connate; anthers ca 1 mm long, oblong. Ovary superior, ca 2 mm long, 1-loculed; ovules many on free central placenta; styles 3-armed. Capsules 5 - 7 mm in

diam., globose, 3-valved. Seeds ca 35 in each capsule, 1 mm long, ovoid or subreniform, black, shining, with concentric striations.

*Distrib.* India: Introduced in gardens for flowers and foliage; occasionally grows as an escape.

Pantropical.

**2. *Talinum triangulare*** (Jacq.) Willd., Sp. Pl.2: 862. 1799; Geesink in Steenis, Fl. Males. 1, 7: 124. 1971. *Portulaca triangularis* Jacq., Enum. Pl. Carib. 22. 1760. *P. racemosa* L., Mant. Pl. 242. 1771.

Tam.: *Pasalai*, *Ceylon keerai*; Eng.: *Fame flower*, *Ceylon spinach*, *Sweetheart*, *Surinam purslane*.

Erect subshrubs, up to 1 m high. Leaves ca 15 x 5 cm, elliptic to obovate, acute to acuminate, pinnately nerved; axillary buds with 2 small subulate cataphylls. Inflorescences terminal, thyrsoid, up to 15 cm across, axes triangular, with ca 10 dichasia, each with 8 - 30 flowers; bracts and bracteoles subulate. Sepals 2, ca 4 x 3.5 mm, deltoid-suborbicular, acute or acuminate. Petals 5, 4 - 8 x 2 - 4 mm, obovate, emarginate. Stamens 20 - 40; filaments ca 5 mm long; anthers up to 5 mm long. Styles 1.5 - 2.5 mm long, 2 - 3-armed. Capsules yellow or pinkish, 3 - 5 mm in diam., (2 -) 3-valved. Seeds many, ca 1.2 mm in diam.; testa cells radially elongate, smooth, tubercled at edges.

*Distrib.* India: Karnataka, Tamil Nadu and Kerala, introduced from Sri Lanka.

Native of tropical America, now a pantropical weed.

*Notes.* Commonly used as vegetable. Easily propagated by cuttings. Cultivated in gardens as substitute for *Amaranthus gangeticus* in India.

#### CULTIVATED SPECIES

***Portulacaria afra*** Jacq., Collectanea 1: 160, t. 22. 1786.

Eng.: *Speckboom*, *Elephant's food*.

Glabrous shrubs, 4 - 5 m high. Leaves obovate-roundish, entire, 1.5 - 2 cm long, thick, fleshy. Flowers clustered on short shoots, ca 5 mm across, rose-pink, pedicels short. Fruits 3-angled, 1-seeded.

Introduced in gardens of India for hedges and borders.

Native of South Africa.

## TAMARICACEAE

(B.V. Shetty & R.P. Pandey)

Shrubs, undershrubs or trees with slender, flexuous branches, rarely herbs, halophytic or xerophytic. Leaves usually small, often scale-like, alternate, simple, exstipulate, usually sessile, sometimes sheathing, rarely subsessile, generally fleshy and with punctate salt secreting glands. Flowers in racemes, panicles, spike-like racemes or spikes, sometimes solitary, actinomorphic, bisexual or rarely unisexual with plants dioecious, hypogynous. Sepals 4 - 5 (- 6), free or connate at base, imbricate, persistent. Petals 4 - 5 (- 6), free, imbricate, persistent, subsistent or caducous. Stamens 4 - 10 (- 14) or numerous, inserted on or below the disc, free or basally connate, united up to middle or above, or in 5 bundles, persistent, subsistent or caducous; anthers 2-loculed, dehiscing longitudinally. Pistil 1; ovary (2 -) 3 - 4 (- 5)-carpelled, unilocular or imperfectly septate, with parietal or basal or parietal-basal placentation, ovules 2 - many on each placenta, anatropous; styles (2 -) 3 - 4 (- 5), free or rarely basally connate or absent; stigmas capitate. Fruit a capsule, pyramidal or bottle-shaped, 3 - 5-angled and valved, dehiscing down to the base. Seeds erect with a coma of long, unicellular hairs at distal end or covered all over with long hairs; embryo straight; endosperm absent or present; cotyledons flat.

Chiefly in the temperate and subtropical regions of Europe, Africa and Asia; 4 genera and ca 90 species; 3 genera with 16 species in India.

*Literature.* QAISER, M. (1982). Tamaricaceae. In: NASIR, E. & S. I. ALI, Fl. W. Pakistan 141: 1 - 65.

### KEY TO THE GENERA

- |  |                     |
|--|---------------------|
| 1a. Stamens connate to half or more of their length                        | 1. <i>Myricaria</i> |
| b. Stamens free  | 2                   |
| 2a. Leaves normal; styles absent; seeds with stipitate coma                | 2. <i>Myrtama</i>   |
| b. Leaves reduced and scale-like; styles distinct; seeds with sessile coma | 3. <i>Tamarix</i>   |

### 1. *Myricaria* Desv.

Shrubs or undershrubs, erect or prostrate. Leaves sessile, ovate, ovate-lanceolate, oblong-ovate or linear-oblong, rarely obovate. Flowers many in terminal or lateral racemes or spike-like racemes, rarely 1 - 3-flowered, bracteate, bisexual. Calyx 5-partite nearly to the base; lobes linear-lanceolate, linear-oblong, ovate-lanceolate, oblong-ovate or ovate with scarious margins. Petals 5, obovate, obovate-spathulate or oblong-obovate, persistent or subsistent. Stamens 10, alternately long and short, monadelphous with filaments connate up to middle or a little above, persistent; free part of filaments

usually dilated at base. Disc almost obsolete. Ovary pyramidal to conical with obscurely 3-lobed, capitate, sessile stigma. Capsules elongate-pyramidal. Seeds many, small with sessile, subsessile or stipitate coma.

Europe and mainly in Asia, ca 10 species; 6 in India (all in Himalayas).

*Literature.* BOBROV, E.G. (1967). A review of the genus *Myricaria* Desv. (Tamaricaceae) and its history. Bot. Zhurn. 52: 924 - 936 (in Russian with English summary). QAISER, M. (1976). Revision of the family Tamaricaceae from Pakistan. 1. The genera *Myricaria* Desv. and *Reaumuria* L. Pakistan J. Bot. 8: 199 - 212.

*Notes.* *Myricaria elegans* Royle (= *Tamarix ladachensis* Baum) is now considered as belonging to a separate monotypic genus, *Myrtama* Ovcz. & Kinz. For further details see note under *Myrtama*.

#### KEY TO THE SPECIES

- |   |   |
|---|---|
| 1a. Racemes lax, short, few-flowered  | <b>4. <i>M. prostrata</i></b>                               |
| b. Racemes dense, many-flowered   | 2   |
| 2a. Seeds with sessile or subsessile coma; bracts lanceolate to ovate-lanceolate with narrow scarious margins   | 3   |
| b. Seeds with stipitate coma; bracts elliptic, oblong-elliptic, oblong-ovate, oblong-obovate, rhomboid or trapezoid with broad scarious margins in lower half                         | 4   |
| 3a. Prostrate undershrubs; base of peduncle with numerous scales; bracts 7 - 11 x 1.5 - 3 mm; sepals 4 - 6 x 1 - 1.5 mm; petals 6 - 8 x 2 - 3.5 mm, reddish; capsules 10 - 15 mm long | <b>5. <i>M. rosea</i></b>                                   |
| b. Erect shrubs; base of peduncles devoid of scales; bracts 3.5 - 7 x 1 - 2 mm; sepals 3 - 4 x 1 mm; petals 4 - 5 x 2 - 2.5 mm, white; capsules 8 - 10 mm long                        | <b>1. <i>M. albiflora</i></b>                               |
| 4a. Peduncles with numerous scales at base; bracts rounded or with short obtuse point at apex; margin subentire   | 5   |
| b. Peduncles devoid of scales at base; bracts long acuminate, margin crose-denticulate  | <b>3. <i>M. germanica</i><br/>ssp. <i>alopecuroides</i></b> |
| 5a. Racemes often densely fasciculate; bracts rhomboid, 4.5 - 6 mm broad; leaves usually narrowed at base   | <b>2. <i>M. davurica</i></b>                                |
| b. Racemes not fasciculate; bracts elliptic, oblong-elliptic, oblong-ovate or oblong-obovate, 1.7 - 3 mm broad; leaves usually rounded at base  | <b>6. <i>M. squamosa</i></b>                                |

**1. *Myricaria albiflora*** Grierson & Long in Notes Roy. Bot. Gard. Edinburgh 40: 116, f. 1. 1982.

Shrubs, 1 - 2 m high. Leaves 2 - 7 x 0.5 - 2 mm, linear to ovate-lanceolate, subacute to acuminate at apex, subentire. Racemes 3 - 6 x 1 cm. Flowers white; pedicels 2 - 3 mm long; bracts lanceolate to ovate-lanceolate, subentire, acute at apex. Sepals lanceolate, subentire, acute to subacute at apex. Petals obovate-spathulate, cucullate. Stamens

connate to about half of their length; free part of longer filaments ca 1.5 mm long, of shorter ca 1 mm long. Seeds obovoid to ellipsoid, ca 1.5 mm long; coma ca 6 mm long.

*Fl. & Fr.* June - Nov.

*Distrib.* India: Sikkim.

Bhutan and China (Tibet).

2. *Myricaria davurica* (Willd.) Ehrenb. in *Linnaea* 2: 278. 1827; Qaiser in Nasir & Ali, *Fl. W. Pakistan* 141: 54. 1982. *Tamarix davurica* Willd., *Abh. Konigl. Acad. Wiss. Berlin* 85. 1816.

Shrubs, 1 - 3 m high; branches erect. Leaves 4.5 - 7.5 x 1 - 2 mm, ovate-lanceolate, ovate-elliptic or ovate, subacute to obtuse at apex, subentire. Racemes dense, 3 - 4 (- 6) x 1 - 1.5 cm, scales at base of peduncle up to 6.5 x 3.5 mm, broadly ovate to oblong-ovate, obtuse at apex, reddish with broad scarious margin; bracts 7 - 8 x 4.5 - 6 mm. Flowers pinkish-white; pedicels 2 - 2.2 mm long. Sepals 4 - 4.5 x 1.2 - 1.5 mm, lanceolate to linear-lanceolate, subacute at apex, subequal. Petals 5 - 6 x 2 - 3 mm, oblong-elliptic to oblong-obovate. Stamens connate to 1/2 - 3/4 of their length; free part of longer filaments ca 1.5 mm long, of shorter ca 0.5 mm long. Ovary ca 4.5 mm long.

*Fl.* May - June.

*Distrib.* India: On gravelly river beds between 3200 and 4300 m. Jammu & Kashmir (Gilgit) and Himachal Pradesh (Lahul).

Pakistan, China (Tibet), Mongolia and Russia (S. Siberia).

3. *Myricaria germanica* (L.) Desv. subsp. *alopecuroides* (Schrenk) Kitam., *Fl. Afghanistan* 272. 1960. *M. alopecuroides* Schrenk in Fischer & C. Meyer, *Enum. Pl. Nov.* 1: 65. 1841. *M. bracteata* Royle, *Ill. Bot. Himal. Mts.* 1: 214, t. 144. 1835. *M. germanica* auct. non Desv., Dyer in *Fl. Brit. India* 1: 250. 1874. Fig. 3.

Shrubs, 1 - 2.5 m high; branches erect, densely leafy. Leaves 1 - 6.5 (- 10) x 0.5 - 2 mm, ovate-lanceolate, ovate-oblong, linear-oblong or ovate, obtuse to subacute at apex, subentire to obscurely denticulate, slightly incurved. Racemes 2.5 - 18.5 (- 20) x 0.7 - 1.7 (- 3) cm; bracts 4 - 9 x 2 - 6 mm, trapezoid. Flowers pink, purplish-pink or pinkish-white; pedicels 1.5 - 3.5 mm long. Sepals 3 - 6 x 1 - 2 mm, ovate, ovate-lanceolate or oblong-ovate, acute to obtuse at apex, denticulate to subentire, subequal. Petals 5 - 7 x 2 - 3.5 mm, obovate, obovate-spathulate or oblong-obovate. Stamens connate to 1/2 - 3/4 of their length; free part of longer filaments 1 - 2.5 mm long, of shorter 0.5 - 2 mm long. Ovary 3.5 - 7.5 mm long. Capsules 0.7 - 1.2 cm long. Seeds obovoid, ellipsoid or oblong-ellipsoid, 1 - 1.5 mm long, beak 1 - 1.5 mm long; coma 4 - 5 mm long.

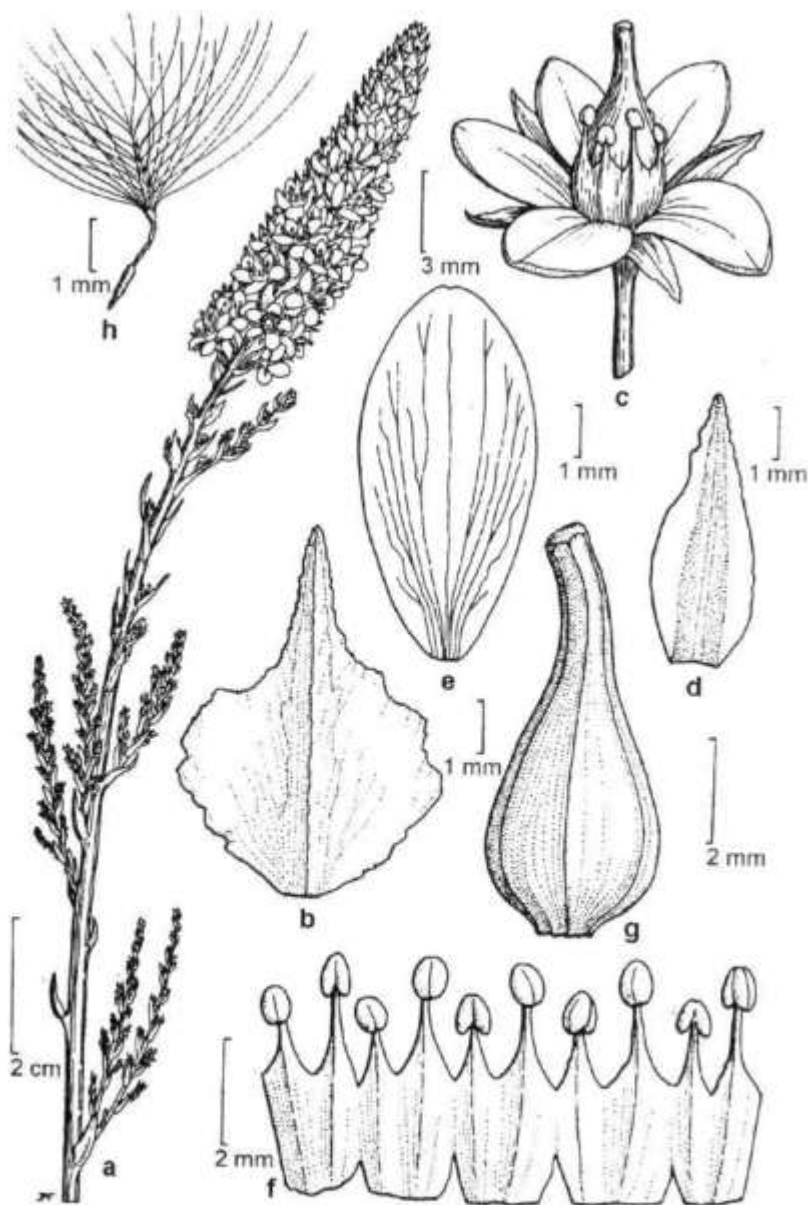


Fig. 3. *Myricaria germanica* (L.) Desv. subsp. *alopecuroides* (Schrenk) Kitam. : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium; g. pistil; h. seed.

*Fl.* May - July; *Fr.* July - Sept.

*Distrib.* India: On sandy river beds, stream borders and valleys between 1500 and 4200 m. Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttar Pradesh (Garhwal).

Pakistan, Afghanistan, China (including Tibet) and E. Russia.

*Notes.* The branches are used as fodder for sheep and goats and the wood as fuel.

**4. *Myricaria prostrata*** Hook. f. & Thomson ex Benth. & Hook. f., *Gen. Pl.* 1: 161. 1862, p.p. *M. germanica* (L.) Desv. var. *prostrata* (Hook. f. & Thomson ex Benth. & Hook. f.) Dyer in *Fl. Brit. India* 1: 250. 1874, p.p. *M. hedinii* Paulsen in Hedin, *S. Tibet* 32: 54. 1922.

Much branched, prostrate, dwarf undershrubs. Leaves 2 - 4 x 1 mm, elliptic to elliptic-lanceolate. Racemes 1 - 3-flowered; scales at base of peduncle ca 1.5 x 1 mm, broadly, ovate, obtuse at apex. bracts ca 3 x 2 mm, ovate. Flowers pale pink; pedicels 1 - 2 mm long. Sepals ca 3.5 x 1.5 mm, ovate to oblong-elliptic, obtuse to subacute at apex, subentire. Petals ca 5 x 2.5 mm, obovate. Stamens connate to about half their length; free part of longer filaments ca 2 mm long, of shorter ca 1.5 mm long. Ovary ca 3 mm long. Capsules 1.2 - 1.4 cm long. Seeds narrowed at base, ca 1 mm long; coma sessile, ca 5 mm long.

*Fl. & Fr.* June - Oct.

*Distrib.* India: Jammu & Kashmir (border of Ladakh); rare.

China (Tibet).

**5. *Myricaria rosea*** W. Smith in *Notes Roy. Bot. Gard. Edinburgh* 10: 52. 1917. *M. prostrata* Hook. f. & Thomson ex Benth. & Hook. f., *Gen. Pl.* 1: 161. 1862, p.p. *M. germanica* (L.) Desv. var. *prostrata* (Hook. f. & Thomson ex Benth. & Hook. f.) Dyer in *Fl. Brit. India* 1: 250. 1874, p.p. **Fig. 4.**

Prostrate undershrubs with numerous ascending branches. Leaves 2 - 8 x 1 - 2 mm, ovate-lanceolate, oblong-ovate or ovate, subentire, obtuse or acute at apex. Racemes erect, 2 - 5 (- 12) x 1 - 2 (- 3) cm; scales at base of peduncle 3.5 - 8 x 1 - 2 mm, ovate-lanceolate to ovate, acute to subacute at apex, reddish; bracts lanceolate to ovate-lanceolate, acute to subacute at apex, subentire to denticulate. Flowers rose, rose-purple or reddish-purple; pedicels 1 - 2 mm long. Sepals lanceolate or linear-lanceolate, acute to subacute at apex, subequal. Petals obovate-spathulate to obovate, cucullate. Stamens connate to 3/4 - 2/3 of their length; free part of longer filaments 1.5

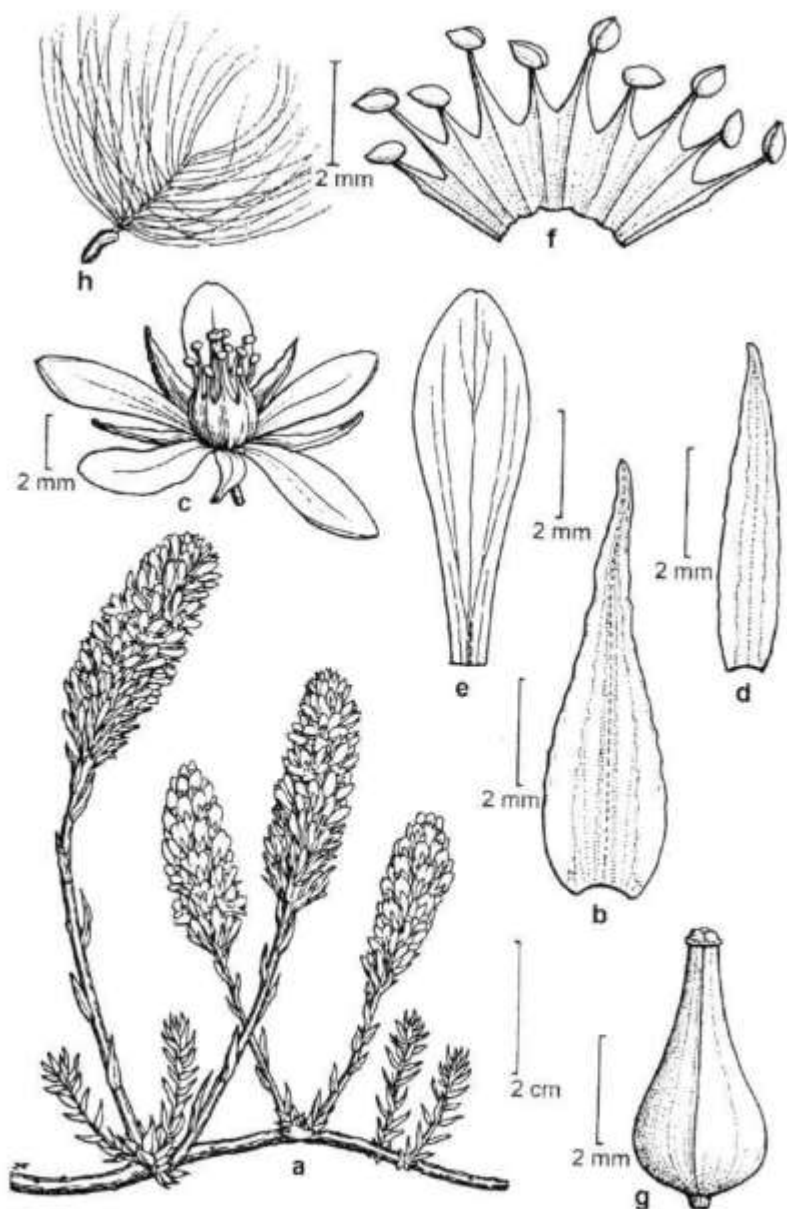


Fig. 4. *Myricaria rosea* W. Smith : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium; g. pistil; h. seed.



- 2 mm long, of shorter ca 1 mm long. Ovary 4 - 5 mm long. Seeds ovoid, obovoid or ellipsoid, 1 - 1.5 mm long; coma 4.5 - 6 mm long.

*Fl.* May - July; *Fr.* July - Sept.

*Distrib.* India: On river beds and stream borders in the alpine region between 3300 and 5200 m. Uttar Pradesh (Kumaon) and Sikkim.

Nepal, Bhutan and China (S.E. Tibet, Yunnan).

**6. *Myricaria squamosa*** Desv. in Ann. Sci. Nat. ser. 1, 4: 350. 1825; Qaiser in Nasir & Ali, Fl. W. Pakistan 141: 52. 1982. *M. armena* Boiss. & Huet, Diagn. Ser. 2(2): 58. 1856. **Fig. 5.**

Shrubs, ca 2 m high. Leaves 1 - 6 x 0.5 - 1 mm, linear-oblong, ovate-lanceolate or ovate, subacute to obtuse at apex, subentire. Racemes usually lateral, 3 - 14 x 1 - 1.5 cm, scales at base of peduncle up to 6 x 3 mm, broadly ovate to oblong-ovate, obtuse at apex; bracts 4.5 x 7 (- 10) x 1.7 - 3 mm. Flowers pink; pedicels 2 - 3 mm long. Sepals 3 - 4 x 0.7 - 1.3 mm, linear-oblong to ovate-lanceolate, subacute to obtuse at apex, subentire, subequal. Petals 4 - 6 x 1.5 - 2 mm, obovate, oblong-obovate or elliptic-obovate. Stamens connate to about 2/3 of their length; free part of longer filaments 1 - 1.5 mm long, of shorter 0.5 - 1 mm long. Ovary 3.5 - 5.5 mm long. Capsules ca 1 cm long. Seeds 1 - 1.5 mm long, obovoid-oblong, beak 0.5 - 0.7 mm long; coma ca 4.5 mm long.

*Fl. & Fr.* June - Aug.

*Distrib.* India: In valleys, sandy and pebbly banks of mountain streams and rivers. Jammu & Kashmir (Kashmir) and Himachal Pradesh.

Pakistan, Iran, C.I.S. and N. China.

## 2. *Myrtama* Ovcz. & Kinz.

Shrubs, erect, glabrous. Leaves sessile, elliptic-lanceolate, or elliptic-obovate. Flowers many in lateral or rarely terminal racemes, bracteate, bisexual. Calyx 5-lobed; lobes ovate, triangular-ovate or oblong-ovate with scarious margins. Petals 5, obovate to obovate-oblong, persistent. Stamens 10, alternately long and short, persistent; filaments slightly dilated at base. Disc almost obsolete. Ovary pyramidal with obscurely 3-lobed, capitate, sessile stigma. Capsules elongate-pyramidal. Seeds many with stipitate coma.

A monotypic genus distributed in W. Himalayas, S.W. Russia and W. China.

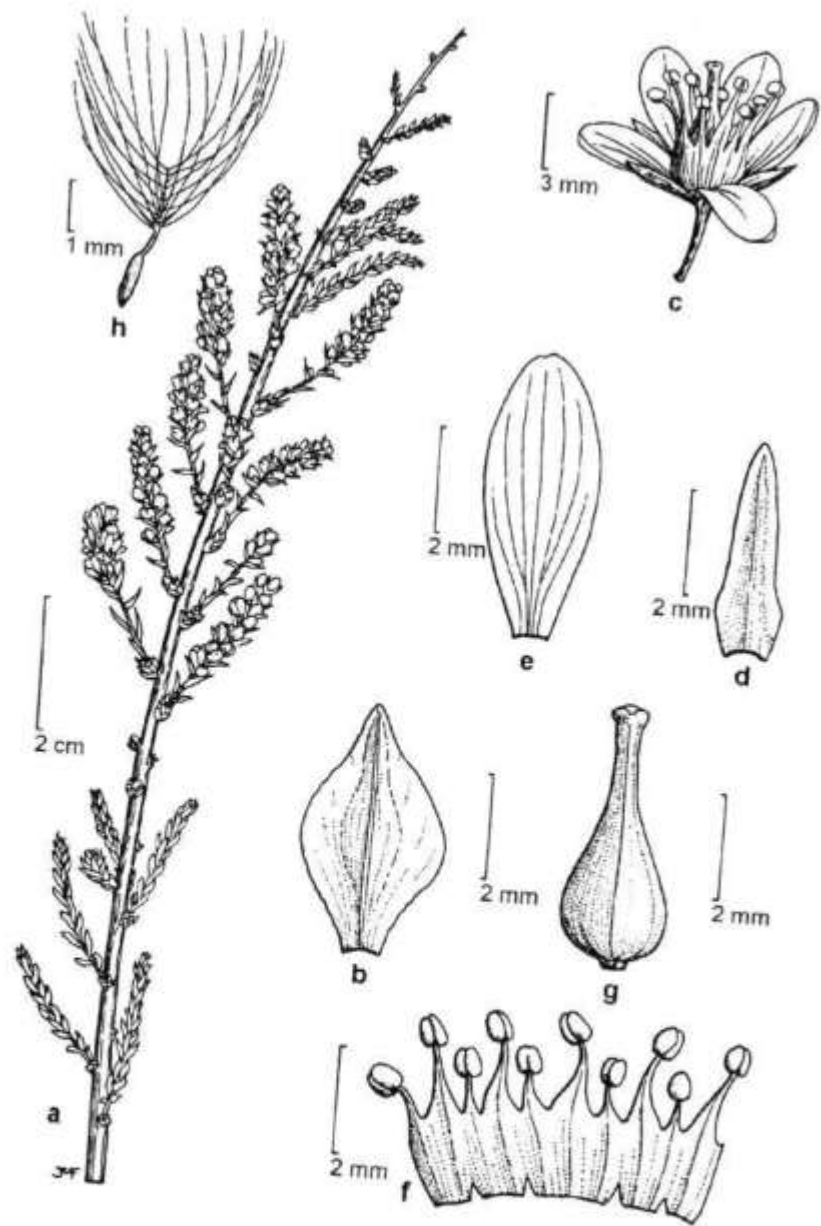


Fig. 5. *Myricaria squamosa* Desv. : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium; g. pistil; h. seed.

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*Notes.* The genus *Myrtama* Ovcz. & Kinz. had in the past been treated as *Myricaria* Desv. sect. *Parallelantherae* Niedenzu in Engler & Prantl, Nat. Pflanzenfam. 3, 6: 296. 1895 and *Myricaria* Desv. series *Elegantae* Bobrov in Bot. Zhurn. 52: 930. 1967, p.p. The genus *Tamaricaria* Qaiser & Ali (*Blumea* 24: 154. 1978) described based on the same type as that of *Myrtama* Ovcz. & Kinz. is an illegitimate name.

*Myrtama elegans* (Royle) Ovcz. & Kinz. in Dokl. Acad. Nauk Tadzh. SSR 20(7): 56, 57. 1977. *Myricaria elegans* Royle, Ill. Bot. Himal. Mts. 1: 214. 1835. *Tamarix ladachensis* Baum, Gen. Tamarix 162. 1978. *Tamaricaria elegans* (Royle) Qaiser & Ali in *Blumea* 24: 153. 1978, nom. illegit. Fig. 6.

Garh.: *Wombu*.

Shrubs, 3 - 4 m high; branches spreading. Leaves 6 - 15 x 2 - 4 mm, narrowed at base, subobtuse at apex, subentire. Racemes 4 - 20 x 0.8 - 1.5 cm; bracts 3 - 5.5 x 1.5 - 3.5 mm, broadly ovate to ovate-lanceolate, acute to acuminate at apex, margin scarious, irregularly denticulate. Flowers pinkish white; pedicels 2 - 3 mm long. Sepals 1.5 - 3 x 1 - 2 mm, united to half or more of their length; lobes with erose-denticulate margins, rarely subentire. Petals 5 - 7 x 2.5 - 3 mm, sometimes slightly notched at apex on one side. Longer filaments 3.5 - 4 mm long, shorter ones ca 3 mm long. Ovary 3.5 - 4.5 mm long. Capsules 0.8 - 1.2 cm long. Seeds ellipsoid or obovoid-ellipsoid, 1.5 - 2 mm long, beak ca 1 mm long; coma 3.5 - 4 mm long.

*Fl.* June - July; *Fr.* Aug. - Sept.

*Distrib.* India: On mountain slopes, ravines and stream borders between 3000 and 4500 m. Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttar Pradesh (Garhwal).

Pakistan, S.W. Russia and W. China (including N. Tibet).

*Notes.* The twigs are used as fodder for sheep and goats, the wood as fuel and the leaves as an external application to bruises.

### 3. *Tamarix* L.

Undershrubs, shrubs or trees, glabrous, papillose or subpapillose. Leaves scale-like, sessile, amplexicaul, auriculate or vaginate. Flowers in racemes or panicles on younger (aestival) or older (vernal) branches, bracteate, mostly bisexual, rarely unisexual with plants dioecious. Calyx 4 - 5-lobed; lobes ovate to suborbicular, obtuse, rounded or acute at apex, subequal or equal. Petals 4 - 5, ovate, elliptic, oblong or obovate, obtuse and often slightly notched at apex, caducous or persistent. Stamens 4 - 10 (- 12), haplostemonous, diplostemonous or partially diplostemonous with antisepalous stamens, usually slightly longer than antipetalous ones, inserted on or below the nectariferous

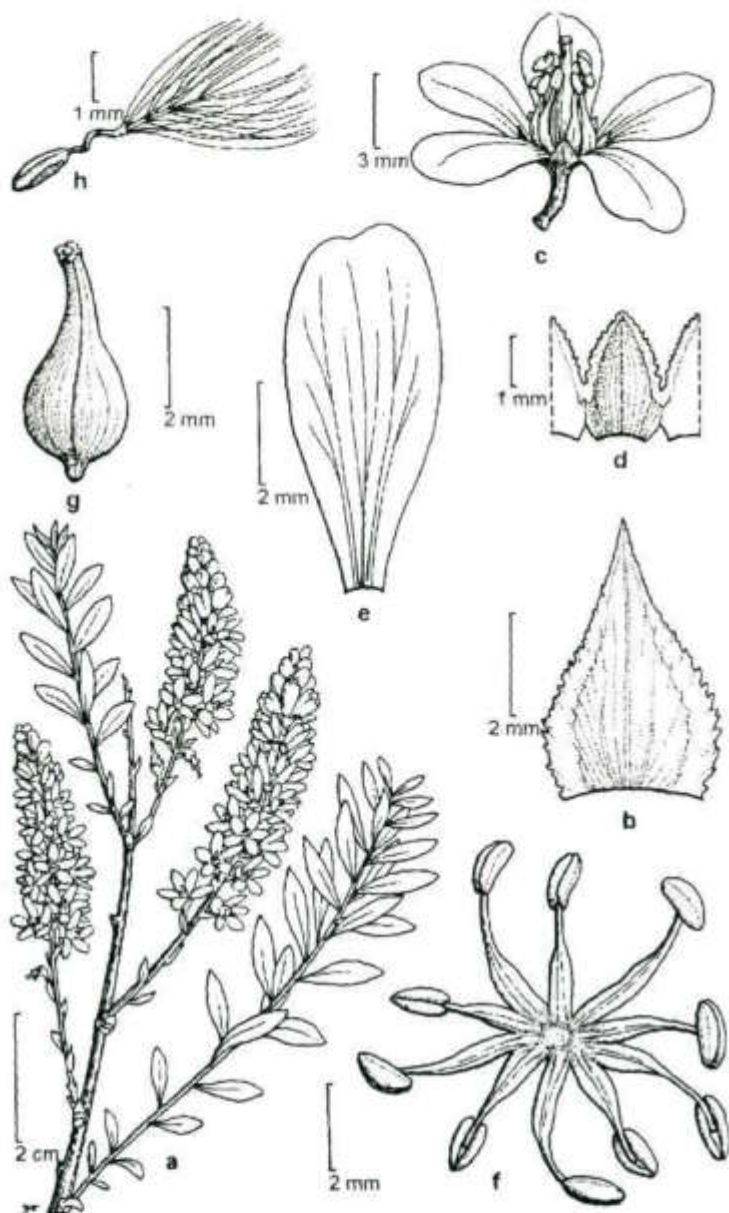


Fig. 6. *Myrtama elegans* (Royle) Ovcz. & King. : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium; g. pistil; h. seed.

rous disc; anthers ovoid, apiculate, acute or obtuse, equally or unequally 2-lobed at base. Disc variously shaped. Ovary pyramidal; styles 3 - 4, rarely 2 or 5 (3 in Indian species), free or rarely connate at base; stigmas spathulate. Capsules pyramidal, 3-valved. Seeds many, small with sessile coma.

Chiefly in saline areas of deserts, semideserts and steppes or on mountains along rivers in Europe, Africa and Asia; ca 60 species; 9 in India.

*Literature.* BAUM, B.R. (1978). The genus *Tamarix*, pp. 208. Israel Academy of Sciences and Humanities, Jerusalem. BAUM, B.R. et al. (1971). Pollen morphology of *Tamarix* species and its relationship to the taxonomy of the genus. *Pollen et Spores* 13: 495 - 521 (It also includes the palynology of *Myricaria elegans* (Royle) Ovcz. & Kinz. which Baum et al. treat as *Tamarix ladachensis* Baum). KAISER, M. (1981). The genus *Tamarix* Linn. (Tamaricaceae) in Pakistan. *Pakistan J. Bot.* 13: 107 - 158.

*Notes.* Several species of *Tamarix* are cultivated as ornamentals prized for their feathery verdure and pink bloom. They also have medicinal properties and yield useful wood. They are also useful in arresting soil erosion and act as wind breakers. The galls formed on twigs are used for dyeing and tanning purposes.

#### KEY TO THE SPECIES

- |  |  |
|--|--|
| 1a. Flowers unisexual; plants dioecious  | 3. <i>T. dioica</i>                                  |
| b. Flowers bisexual  | 2  |
| 2a. Androecium haplostemonous; stamens 5   | 3  |
| b. Androecium diplostemonous or partially diplostemonous; stamens 10 or 6 - 10   | 7  |
| 3a. Leaves vaginate; racemes spirally twisted  | 1. <i>T. aphylla</i>                                 |
| b. Leaves pseudo-vaginate, amplexicaul or narrowed at base; racemes not spirally twisted   | 4  |
| 4a. Leaves pseudo-vaginate or amplexicaul; sepals rounded or truncate at apex; plants of plains  | 5  |
| b. Leaves narrowed at base; at least some sepals acute at apex; plants of high altitude  | 6  |
| 5a. Rachis glabrous to sparsely papillose; racemes 3 - 4 (- 5) mm broad; lobes of disc notched; filaments mesodiscine  | 5. <i>T. indica</i>                                  |
| b. Rachis densely papillose; racemes 5 - 7 mm broad; lobes of disc not notched; filaments epilophic to confluent epilophic   | 8. <i>T. pakistanica</i>                             |
| 6a. Lobes of disc notched; filaments mesodiscine   | 2. <i>T. arceuthoides</i>                            |
| b. Lobes of disc not notched; filaments confluent epilophic  | 7. <i>T. leptostachya</i>                            |
| 7a. Leaves vaginate in lower part; racemes 1 - 1.5 (- 2) cm broad; bracts more than 2 mm long; petals irregularly denticulate in upper half; stamens 10; disc fleshy | 4. <i>T. ericoides</i>                               |
| b. Leaves amplexicaul or semi-amplexicaul; racemes 5 - 8 mm broad; bracts less than 2 mm long; petals entire, often emarginate; stamens 6 - 10; disc not fleshy      | 8  |
| 8a. Petals 2 - 2.5 x 1 - 1.5 mm; disc lobed; filaments epilophic; capsules less than 7 mm long   | 6. <i>T. kutchensis</i>                              |
| b. Petals 3 - 4.5 x 2 - 2.5 mm; disc not lobed; filaments epidiscine; capsules more than 8 mm long   | 9. <i>T. passerinoides</i><br>var. <i>macrocarpa</i> |

**1. *Tamarix aphylla* (L.) Karsten**, Deut. Fl. 641. 1882. *Thuja aphylla* L., Cent. Pl. 1: 32. 1755, p.p. *Tamarix orientalis* Forsskal, Fl. Aegypt-Arab. 206. 1775. *T. articulata* Vahl, Symb. Bot. 2: 48, t. 32. 1791, nom. illegit; Dyer in Fl. Brit. India 1: 249. 1874.

Guj.: *Lal-jhav-nu-jhudu*; Hindi: *Lal-jhav*; Punj.: *Farash*, *Kharlei*, *Narlei*; Raj.: *Fa-rash*; Tam.: *Shivappu-atru-shavukku*.

Small trees or tall shrubs, 2.5 - 11 m high. Leaves vaginate, the free part broadly triangular to triangular, abruptly acute to acuminate at apex, (0.2 -) 0.5 - 3 mm long. Racemes mostly aestival, simple or compound, each 3.5 - 6.5 (- 9.5) x 0.3 - 0.4 (- 0.6) cm; rachis glabrous; bracts vaginate in lower part, amplexicaul in upper part, 1.5 - 2 mm long, triangular, acute to acuminate at apex, denticulate to subentire. Flowers subsessile, pink or pinkish white, fragrant. Sepals 5, almost free, 1 - 1.5 (- 2) x 1 - 1.5 (- 1.7) mm, broadly ovate to suborbicular, rounded at apex, obscurely denticulate, outer two slightly smaller than inner three. Petals 5, (1.5 -) 2 - 2.5 x 1 - 1.5 mm, oblong, oblong-elliptic or oblong-ovate, subsistent to caducous. Stamens exserted; filaments (1.5 -) 2 - 3 mm long, mesodiscine. Disc ca 1 mm across, 5 - lobed, lobes notched. Capsules 3.5 - 4.5 x 1.3 - 2 (- 3.5) mm. Seeds ca 0.5 mm long; coma 2 - 3 mm long.

Fl. May - Aug.; Fr. Sept. - Dec.

*Distrib.* India: In sandy, saline habitats along streams and rivers. Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Gujarat and Tamil Nadu.

Pakistan, Afghanistan, S.W. Asia and E., N. & W. Africa.

*Notes.* Often cultivated as an ornamental, wind breaker and hedge. It is also recommended for planting in shifting sands. The timber is used in house building, for making agricultural implements and furniture etc. Baskets are made out of twigs and the wood is valued as cheap fuel. The bark and galls are used in tanning and as a mordant in dyeing. The bark is employed in treatment of eczema and other skin diseases. The galls and bark are astringent. The species is also a source of manna.

Chromosome number  $2n = 24$  (Bowden, W.M., *Amer. J. Bot.* 32: 195. 1945).

**2. *Tamarix arceuthoides* Bunge**, Beitr. Fl. Russl. 119. 1852 & in Mem. Sav. Etr. St. Petersb. 7: 295. 1854; Qaiser in Nasir & Ali, Fl. W. Pakistan 141: 8. 1982. **Fig. 7.**

Shrubs, 2 - 3 m high. Leaves 1 - 3 x 0.2 - 0.5 mm, ovate-lanceolate to broadly trullate-ovate, acuminate or rarely acute at apex. Racemes vernal or aestival, compound, each 3 - 6 x 0.3 - 0.4 cm; bracts 1 - 1.7 x 0.4 - 0.5 mm, trullate-lanceolate, acuminate at apex, entire to subentire. Flowers pink or purplish-pink. Sepals 5, 0.5 - 0.7 x 0.2 - 0.5 mm, ovate to trullate-ovate or rhomboid, denticulate. Petals 5, 1.5 - 1.7 x 0.5 - 1 mm, obovate to obovate-elliptic. Stamens exserted; filaments ca 1.7 mm long, mesodiscine.

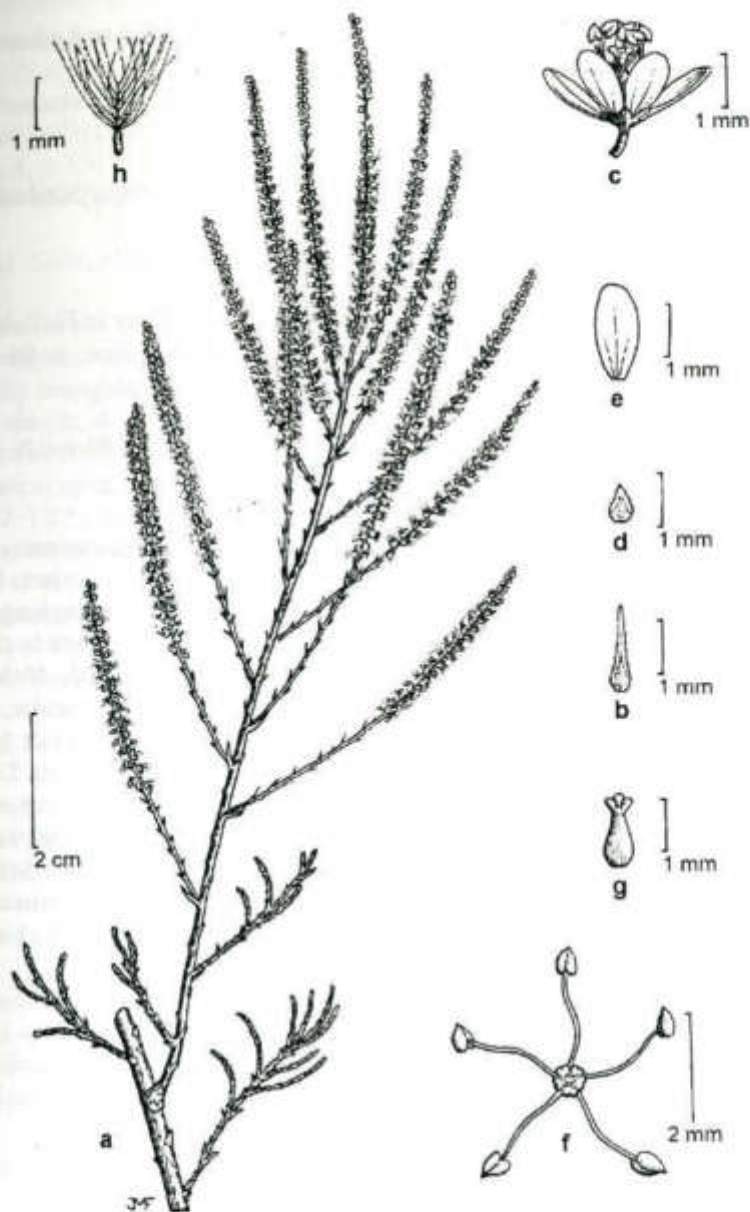


Fig. 7. *Tamarix arceuthoides* Bunge : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium; g. pistil; h. seed.

Disc ca 0.5 mm across, 5-lobed, lobes shallowly notched. Capsules ca 3 x 1 mm. Seeds ca 0.5 mm long; coma 1.5 - 2 mm long.

*Fl.* April - July; *Fr.* July - Oct.

*Distrib.* India: In valleys and along river beds. Jammu & Kashmir (Kashmir).

Pakistan, Afghanistan, Iran, Iraq, China (Tibet) and C.I.S.

**3. *Tamarix dioica*** Roxb. ex Roth, Nov. Pl. Sp. 185. 1821; Dyer in Fl. Brit. India 1: 249. 1874. *T. longepedunculata* Blatt. & Hallb. in J. Ind. Bot. Soc. 1: 86. 1919. *T. bengalensis* Baum, Gen. Tamarix 181, 84. 1978.

Asm., Beng. & Hindi: *Jhau*, *Lal-jhau*; Guj.: *Achhilaijo Pras*, *Bhruri Pras*; Kash.: *Rgelta*; Punj.: *Pilchi*, *Jhau*; Raj.: *Pilchi*, *Kachlei*.

Shrubs or small trees, 2 - 3 (- 5) m high. Leaves 0.7 - 3 mm long, vaginate, free part broadly triangular-lanceolate to triangular-ovate, keeled, acuminate at apex. Racemes aestival, simple or compound, each 2 - 8 x 0.4 - 0.7 cm; bracts 2 - 3 mm long, broadly ovate-lanceolate to trullate-ovate, keeled, acuminate at apex, denticulate to subentire. Flowers spirally arranged on rachis, pink, pinkish-violet or pinkish-red. *Male flowers*: Sepals 5, 1 - 1.7 x 0.7 - 1.2 mm, trullate-ovate to broadly ovate or suborbicular, rounded at apex, upper half denticulate, subequal, outer two strongly keeled. Petals 5, 1.7 - 2.5 x 0.7 - 1.5 mm, obovate or oblong-obovate. Stamens 5, exserted; filaments 2.5 - 4 mm long, mesodiscine. Disc ca 0.5 mm across, deeply 5-lobed. Ovary abortive or absent. *Female flowers*: Appear as bisexual but stamens functionally sterile. Sepals as in male. Petals 5, 1.7 - 0.5 x 0.7 - 1.5 mm, obtriangular-obovate to elliptic-obovate. Staminodes 5, included; filaments 1.2 - 2 mm long. Capsules 3.5 - 5 mm long with persistent sepals and staminodes and subsistent petals. Seeds ca 0.5 mm long; coma 2.75 - 3 mm long.

*Fl.* April - Dec.; *Fr.* July - Jan.

*Distrib.* India: Gregarious along the banks of rivers and streams. Jammu & Kashmir (Kashmir), Punjab, Delhi, Uttar Pradesh, West Bengal, Assam, Madhya Pradesh, Rajasthan, Gujarat and Maharashtra.

Pakistan, Afghanistan, Iran, Nepal, Bangladesh and Myanmar.

*Notes.* It provides a moderately good firewood. The wood is also employed in turnery and for making Persian-wheels in Punjab and for making polo sticks in Ladakh. Baskets are made out of the twigs. The galls are astringent and are also used as a mordant in dyeing and tanning. The manna is used in confectionary. It is a rich source of pollen for bees. Sometimes planted.



Chromosome number  $2n = 24$  (Malik, C.P. *Sci. & Cult.* 25: 437. 1960).

4. *Tamarix ericoides* Rottler & Willd. in Ges. Naturf. Freunde Berlin Neue Schriften 4: 214. 1803; Dyer in Fl. Brit. India 1: 249. 1874. *Myricaria vaginata* Desv. in Ann. Sci. Nat. ser. 1, 4: 350. 1825. *Trichaurus ericoides* (Rottler & Willd.) Arn. ex Wight & Arn., Prodr. 40. 1834, p.p.

Guj.: Gajri; Hindi: Jhau; Mar.: Saru; Raj.: Javra; Tel.: Jeelugu.

Undershrubs or shrubs, 0.7 - 2 (- 3) m high. Leaves vaginate in lower part and pseudo-vaginate in upper part, 1 - 5.5 (- 7) mm long, ovate-lanceolate to triangular-ovate or broadly triangular, keeled, acuminate or acute at apex, upcurved. Racemes mostly vernal, simple, 4 - 19 x 1 - 1.5 (- 2) cm; rachis papillose; bracts semiamplexicaul or amplexicaul, 2.5 - 5.2 (- 8) mm long, broadly triangular to broadly ovate-lanceolate, acuminate at apex, denticulate to subentire. Flowers pink or pale pink. Sepals 5, almost free, (2.2 -) 2.5 - 3.5 (- 4) x (1.2 -) 1.5 - 2.2 mm, ovate, irregularly denticulate, subequal, outer two more acute than inner three. Petals 5, (4 -) 5 - 6.5 x (2 -) 4 - 4.5 (- 4.7) mm, obovate to oblong-obovate. Five longer stamens antisepalous, inserted hypodiscally with filaments (2 -) 3.5 - 5.5. mm long, alternating with 5 shorter antipetalous ones inserted peridiscally with filaments (1.2 -) 2.5 - 4 (- 4.2) mm long. Disc 1.5 - 2 mm across, 10-lobed. Capsules 1 - 1.5 cm long. Seeds 1 - 1.5 mm long; coma 5 - 8.5 mm long.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: On river and stream beds. Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, Orissa, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Pakistan, Sri Lanka and Bangladesh.

*Notes.* The leaves are used in the treatment of cough in children and for treating enlarged spleen. The paste made from the tender shoots is applied on skin rashes by the Koyas of Andhra Pradesh. The galls are astringent. The twigs are used as firewood and for making brooms and brushes in Maharashtra.

Chromosome number  $2n = 24$  (Sharma, Y.M.L., *Ann. Bot.* 3: 869. 1939).

5. *Tamarix indica* Willd. in Ges. Naturf. Freunde Berlin Neue Schriften 4: 214. 1803. *T. gallica* L. var. *indica* (Willd.) Ehrenb. in Linnaea 2: 276. 1827; Dyer in Fl. Brit. India 1: 248. 1874. *T. indica* Koen. ex Roxb., Fl. Ind. 2: 100. 1832, nom. illegit.; *T. gallica* auct. non L.; Dyer in Fl. Brit. India 1: 248. 1874. *T. troupii* Hole in Ind. For. 45: 248. 1919.

Fig. 8.

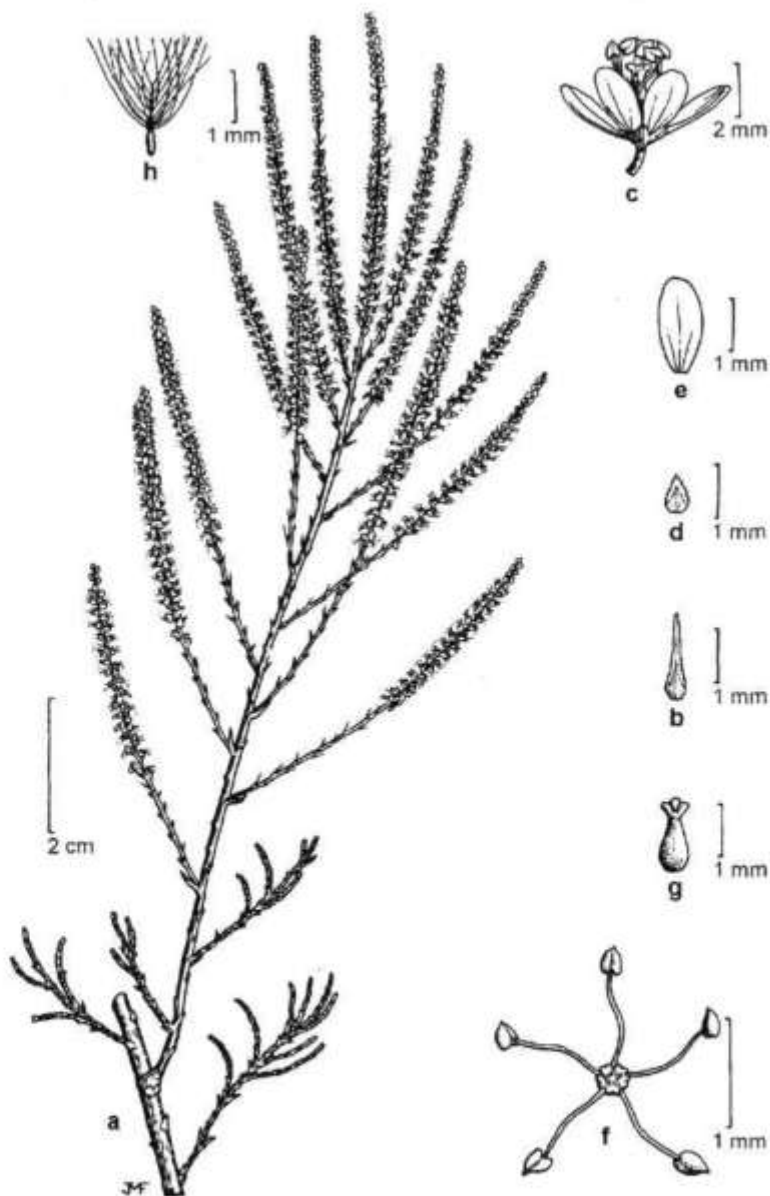


Fig. 8. *Tamarix indica* Willd. : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium with disc; g. pistil; h. seed.

Beng. & Hindi: *Jhav, Jhau*; Guj.: *Jhav-nu-khada*; Or.: *Jaula*; Punj.: *Pilchi*; Sans.: *Jhavuka, Shavaka*; Tel.: *Palivi, Erusurupakki*; Tam.: *Sirusavukku, Kiri*.

Shrubs or small trees, 1.5 - 3 (- 8) m high. Leaves 0.5 - 3 mm long, broadly triangular to ovate-lanceolate or triangular-ovate, abruptly acute to acuminate at apex, usually minutely papillose. Racemes aestival or vernal, simple or densely compound, each 3 - 7.5 (- 11) x 0.3 - 0.4 (- 0.5) cm; bracts 1.5 - 2.5 mm long, ovate-lanceolate, trullate-lanceolate or trullate-ovate, acuminate at apex, denticulate to subentire, deflexed. Flowers pale pink to pink. Sepals 5, almost free, 0.6 - 1.1 x 0.5 - 0.8 mm, equal, ovate, trullate-ovate, broadly ovate or suborbicular, rounded or truncate at apex, upper half incised denticulate. Petals 5, (1.2 -) 1.5 - 2 x 0.8 - 1.1 mm, obovate, oblong-elliptic or obovate-elliptic, caducous. Stamens exserted; filaments 2.5 - 3.5 mm long, mesodiscine. Disc 0.5 - 1 mm across, 5-lobed, lobes notched. Capsules 3 - 4 x 0.6 - 1.5 mm. Seeds ca 0.6 mm long; coma ca 2.5 mm long.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Punjab, Delhi, Uttar Pradesh, West Bengal, Orissa, Rajasthan, Gujarat, Andhra Pradesh and Tamil Nadu.

Pakistan, Afghanistan, Sri Lanka, Bangladesh and Myanmar.

*Notes.* Wood used for making agricultural implements, for turnery, lacquer work and as firewood. The twigs are used for thatching and basket making. The galls are astringent and are used in the treatment of ulcers, diarrhoea, dysentery, sore throat and piles. They are also used in tanning. Occasionally planted in gardens.

**6. *Tamarix kutchensis* Shetty & Pandey in Bull. Bot. Surv. India 31: 152. 1992.**

Shrubs, up to 1.5 m high; younger parts densely papillose. Leaves amplexicaul, 1 - 2.2 x 0.5 - 3 mm, broadly ovate, acute to acuminate at apex, upcurved. Racemes mostly aestival, simple or compound, each 2 - 4 x 0.5 - 0.7 cm; rachis papillose; bracts amplexicaul, 1 - 1.7 x 1 - 1.2 mm, broadly triangular-ovate, acute to acuminate at apex, entire or subentire. Flowers pink. Sepals 5, almost free, 1 - 1.5 x ca 1 mm, ovate to trullate-ovate, subequal, two outer ones more acute. Petals 5, elliptic-oblong, elliptic-obovate or oblong-obovate. Stamens 6 - 9 (- 10); filaments 1.5 - 2 mm long, antipetalous ones slightly shorter, epilophic. Disc 6 - 9 (- 10)-lobed. Capsules 5 - 6.5 x 1.5 - 2 mm. Seeds 0.5 - 0.7 mm long; coma ca 4 mm long.

*Fl. & Fr.* Nov. - March.

*Distrib.* India: Known only by the type collection. Gujarat, Mundra, Mandvi (S.K. Jain 11735 BSI).

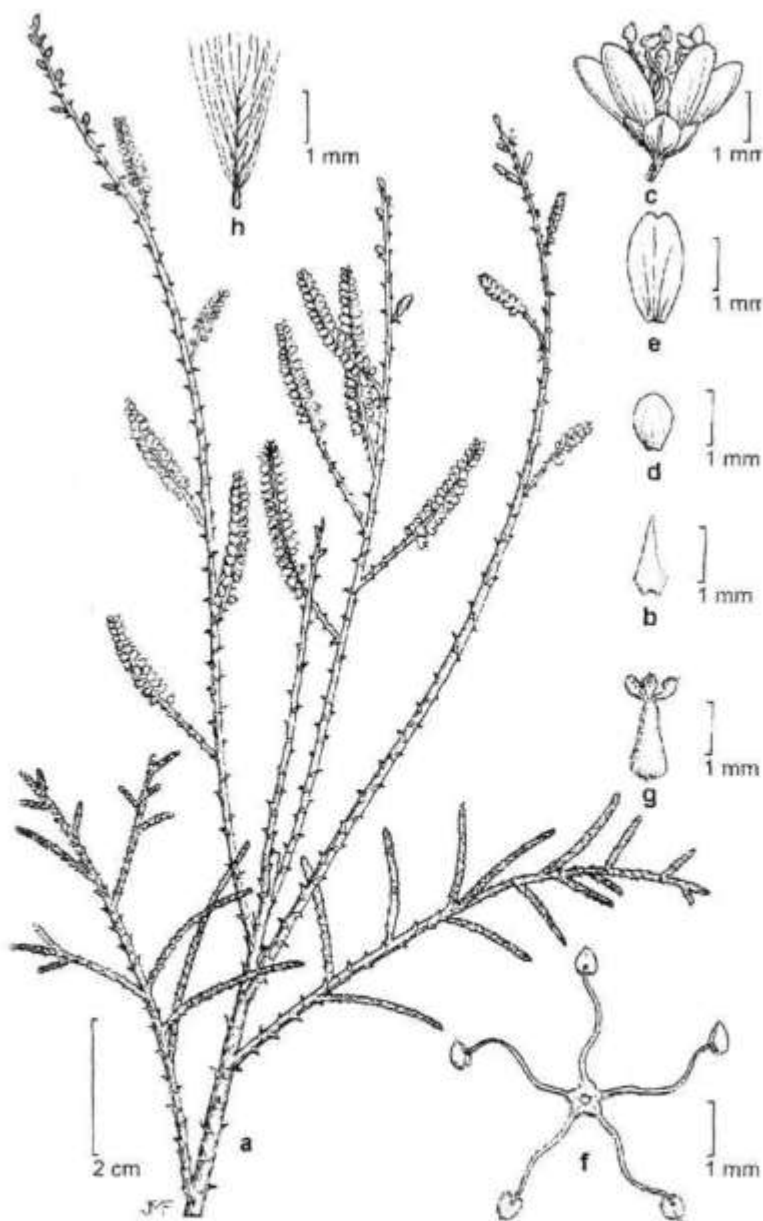


Fig. 9. *Tamarix pakistanica* Qaiser : a. flowering branch; b. bract; c. flower; d. sepal; e. petal; f. androecium with disc; g. pistil; h. seed.

7. *Tamarix leptostachya* Bunge, Beitr. Fl. Russl. 117. 1852 & in Mem. Sav. Etr. St. Petersb. 7: 293. 1854; Qaiser in Nasir & Ali, Fl. W. Pakistan 141: 9. 1982.

Shrubs 1 - 3 (- 5) high. Leaves 1.5 - 3 mm long, ovate to lanceolate, acute at apex. Racemes aestival, densely compound, each 3 - 12 x 0.2 - 0.3 cm; bracts 1 - 2 mm long, trullate-triangular to trullate-ovate, acuminate at apex, denticulate. Flowers pink. Sepals 5, almost free, 0.5 - 0.7 x 0.2 - 0.3 mm, trullate-ovate, denticulate. Petals 5, 1 - 1.5 x 0.5 - 0.6 mm, obovate. Stamens exserted; filaments ca 2 mm long, confluent epilophic. Disc ca 0.5 mm across, 5-lobed. Capsules 1.7 - 2 mm long.

*Fl. & Fr.* May - Oct.

*Distrib.* India: Jammu & Kashmir (Gilgit); rare.

Pakistan, Afghanistan, Iran, China (Tibet), Mongolia and C.I.S.

8. *Tamarix pakistanica* Qaiser in Pakistan J. Bot. 13: 119, f. 3 A-J. 1981 & in Nasir & Ali, Fl. W. Pakistan 141: 13, f.4 A-J. 1982. Fig. 9.

Shrubs, 2 - 3.5 m high. Leaves 1 - 2 x 0.5 - 1 mm, broadly triangular-ovate, acute to acuminate at apex. Racemes aestival, simple or sometimes compound, each 2.5 - 3.5 (- 7) x 0.5 - 0.7 cm; bracts 1 - 1.5 x 0.5 - 0.7 mm, trullate-ovate to trullate-lanceolate, acuminate at apex, crenate-denticulate to subentire, papillose, deflexed. Flowers pink. Sepals 5, connate at base, lobes 1 - 1.2 x 0.5 - 0.7 mm, ovate, trullate-ovate or suborbicular, rounded at apex, crenate-denticulate to subentire, subequal. Petals 5, 2 - 2.5 x 1 - 1.2 mm, oblong-elliptic to obovate. Stamens exserted; filaments 2 - 2.2 mm long, epilophic to confluent epilophic. Disc 0.5 - 0.7 mm across, 5-lobed. Capsules ca 4 - 1.5 mm. Seeds ca 0.4 mm long; coma 2.5 - 3 mm long.

*Fl. & Fr.* March - Oct.

*Distrib.* India: In saline habitats. Gujarat.

Pakistan.

9. *Tamarix passerinoides* Delile ex Desv. var. *macrocarpa* Ehrenb. in Linnaea 2: 276. 1827; Qaiser in Nasir & Ali, Fl. W. Pakistan 141: 40. 1982. *T. macrocarpa* (Ehrenb.) Bunge, Tent. 79. 1852. Fig. 10.

Shrubs, 0.7 - 2 (- 3) m high; younger parts densely papillose. Leaves amplexicaul to semiamplexicaul, 1 - 3.5 (- 4) x 1 - 4 mm, broadly ovate to ovate-lanceolate, acute to acuminate at apex, deflexed. Racemes mostly aestival, simple or rarely compound, each 2 - 4 (- 7) x 0.6 - 0.8 cm; rachis papillose; bracts amplexicaul to semiamplexicaul, 1.5 - 1.7 x 1 - 1.2 mm, broadly triangular-ovate to ovate-lanceolate, acuminate at apex, entire

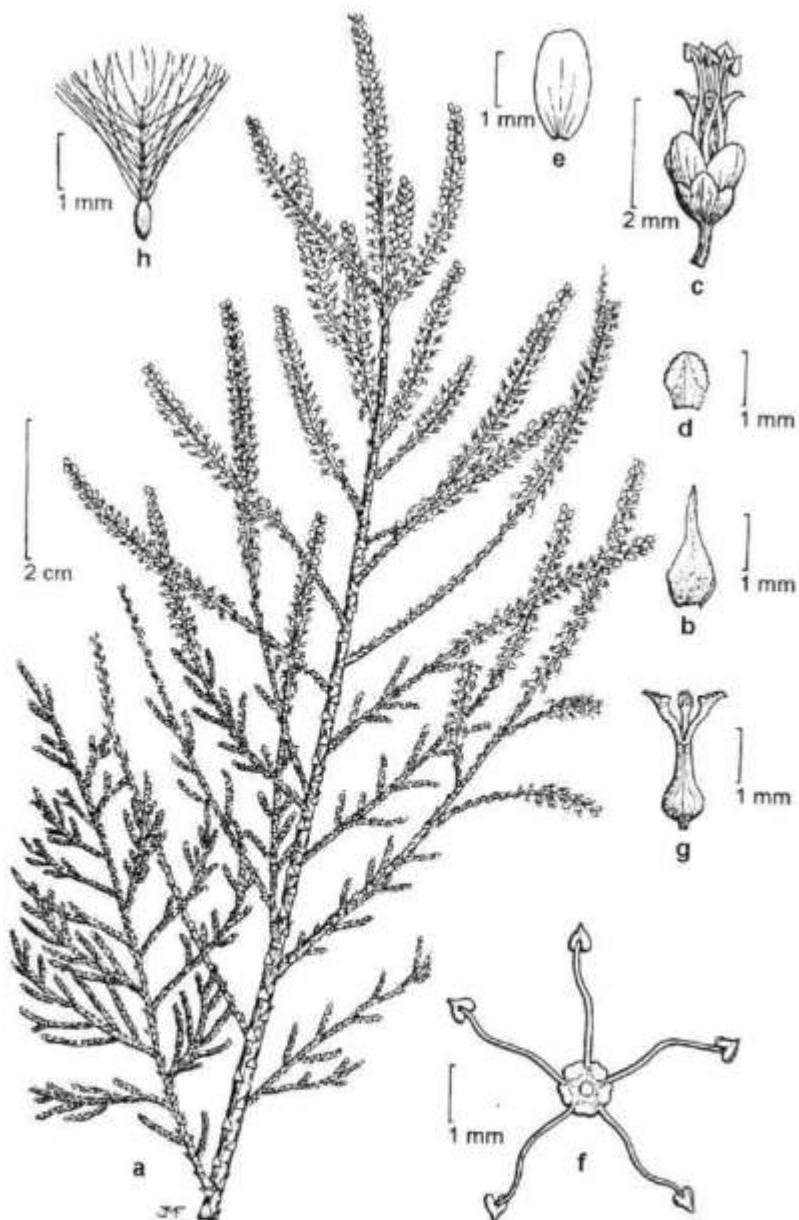


Fig. 10. *Tamarix passerinoides* Delile ex Desv. var. *macrocarpa* Ehrenb. : a. flowering branch; b. bract; c. flower; d. inner and outer sepals; e. petal; f. androecium with disc; g. pistil; h. seed.

to subentire. Flowers pink to purplish-pink. Sepals 5, 1.5 - 2.2 x 1 - 1.5 mm, ovate to trullate-ovate, denticulate, subequal, outer two smaller and more acute than inner three. Petals 5, 3 - 4.5 x 1.5 - 2 (- 2.5) mm, obovate to obovate-elliptic. Stamens usually 10, rarely 7-9; filaments inconspicuously alternately long and short, base broadened, longer filaments 2.5 - 7 mm long, shorter ones 2 - 2.5 mm, epidiscine. Capsules (8 -) 10 - 12.5 x 3 - 5 mm. Seeds 0.5 - 0.7 (- 1) mm long; coma 5 - 6 mm long.

*Fl. & Fr.* Oct. - March.

*Distrib.* India: Gujarat.

Pakistan, S.W. & W. Asia and N. Africa.

*Notes.* Chromosome number  $2n = 24$  (Paramjit Singh, *Taxon* 33: 759, 1984 - sub *T. arceuthoides* Bunge).

#### CULTIVATED SPECIES

***Tamarix chinensis*** Lour., *Fl. Cochinch.* 1: 182. 1790.

Cultivated in gardens as an ornamental plant.

## ELATINACEAE

(Jayasri Bhattacharya)

Annual or perennial herbs or undershrubs; aquatic, semiaquatic or terrestrial. Leaves simple, opposite or whorled, entire or crenate-serrate, stipulate. Flowers actinomorphic, bisexual, hypogynous, minute, axillary, solitary or in dichasial cymes. Sepals 3 - 5, free or rarely connate at base, alternate with petals, persistent. Petals 3 - 5, free, imbricate. Stamens as many as or twice the number of petals in 2 whorls, alternating with petals, free, persistent; anthers versatile, ditheous, longitudinally dehiscent. Ovary 3 - 5-carpellary, syncarpous, superior, 3 - 5-locular, placentation axile with numerous anatropous ovules; styles 3 - 5, rarely 2, free, short; stigma clavate or globose. Capsules dehiscent septically or septifrugally. Seeds numerous, minute, with or without endosperm; testa often rugose; embryo cylindric, straight or curved with short cotyledons.

Throughout temperate and tropical regions of the world, 2 genera and ca 40 species; 2 genera and 8 species in India.

*Literature.* BACKER, C.A. (1951) Elatinaceae. In: STEENIS, C.G.G.J. VAN, Fl. Males. 1, 4: 203 - 206. COOK, C.D.K. (1968). Elatinaceae. In: TUTIN, et al., Fl. Europea 2: 295 - 296. GHAFOR, A. & S.I. ALI (1972) Elatinaceae. In: NASIR, E. & S.I. ALI, Fl. W. Pakistan 19: 1 - 5. MASON, H.L.A. (1957). Fl. Marsh. California 577 - 587. NIDENZU, F (1925). Elatinaceae. In: ENGLER, A. & K. PRANTL, Nat. Pflanzenfam. ed. 2, 21: 270 - 276. SOHMER, S.H. (1980). Elatinaceae. In: DASSANAYAKE, M.D. & F.R. FOSBERG, Rev. Handb. Fl. Ceylon 1: 424 - 427.

### KEY TO THE GENERA

- 1a. Plants erect, decumbent or ascending; flowers pentamerous; sepals free, acute, with thick midrib; ovary ovoid, ellipsoid, globose or subglobose, gradually narrowed into style; capsules crustaceous; embryo straight **1. Bergia**
- b. Plants prostrate; flowers trimerous; sepals connate at base, obtuse, without midrib, ovary depressed globose, abruptly narrowed into style; capsules membranous; embryo curved **2. Elatine**

### 1. *Bergia* L.

Annual or perennial herbs or undershrubs, ascending or decumbent; stems erect, diffusely branched, glabrous or pubescent. Leaves opposite or in pseudo-whorls, oblong to elliptic, minutely serrate or entire; shortly petioled. Stipules denticulate or ciliate, persistent. Flowers solitary or fascicled; usually 5-merous, pedicellate or sessile, mostly bracteate. Sepals 5, free, ovate-oblong to lanceolate, acute, keeled with strong midrib, margin membranous, denticulate or pellucid serrulate. Petals 3 - 5, ovate-oblong or lanceolate, membranous. Stamens mostly 5 or 10 in 2 whorls; filaments dilated at base or petaloid; anthers small. Carpels 5, syncarpous, rarely free; ovary ovoid, globose or



ellipsoid, 5-loculed; styles short, straight or curved; stigmas capitate. Capsules globose, septicidal or septifugal, crustaceous or subcrustaceous. Seeds numerous, oblong with rounded ends, smooth or faintly scalariform-reticulate, exalbuminous.

Temperate and tropical regions of the world, ca 20 species; 5 in India.

#### KEY TO THE SPECIES

- |   |                           |
|---|---------------------------|
| 1a. Plants glandular pubescent  | 2                         |
| b. Plants glabrous or nearly so   | 3                         |
| 2a. Flowers 2 - 8 in cymes; stamens usually 10  | 5. <i>B. suffruticosa</i> |
| b. Flowers few to many in dense or lax, subverticillate axillary fascicles; stamens usually 5               | 2. <i>B. ammannioides</i> |
| 3a. Undershrubs; stipules setaceous, glandular; sepals denticulate; styles straight                         | 1. <i>B. aestivosa</i>    |
| b. Herbs; stipules not setaceous, eglandular; sepals entire; styles recurved                                | 4                         |
| 4a. Plants succulent, aquatic or in swampy localities; stipules pectinate, flowers in clusters              | 3. <i>B. capensis</i>     |
| b. Plants not succulent, usually grow in moist localities; stipules fimbriate, flowers solitary or in pairs | 4. <i>B. polyantha</i>    |

1. *Bergia aestivosa* Wight & Arn., Prodr. 41. 1834; Dyer in Fl. Brit. India 1: 251. 1872. *Elatine aestivosa* (Wight & Arn.) Wight, Icon. Pl. Ind. Orient. t. 222. 1839.

Glabrous undershrubs; stems erect, 20 - 25 cm, woody at base, branches numerous, opposite, slender, divaricate. Leaves dimorphic, opposite-decussate, subsessile, 20 - 25 x 5 - 8 mm, narrowly oblong to oblong, linear on flowering branches, acute at apex, crenate, serrulate or entire; stipules 1 - 3 mm long, setaceous, glandular, persistent. Flowers solitary or 2 - 4 in axillary, lax, fasciculate cymes, 3 - 4 mm across; pedicels 2 - 3.5 mm long, hairy. Sepals 2 - 2.5 mm long, lanceolate, acute, keeled, denticulate with membranous margins, glabrous. Petals pinkish or white, ca 3 mm long, obovate, mucronate, entire, transparent. Stamens 10, alternately shorter; filaments 1.5 - 2.3 mm long, dilated at base; anthers oblong. Ovary ca 2 mm long, ovoid or pyramidal, 5-loculed, sulcate; styles ca 1 mm long, free, straight; stigmas subcapitate. Capsules ovoid, 5-locular, whitish-pink, minute, ellipsoid, dark brown to black.

*Fl. & Fr.* Aug. - Dec.

*Distrib.* India: Punjab, West Bengal, Tripura, Maharashtra, Karnataka and Tamil Nadu.

Pakistan, Iraq and Indonesia (Java).

2. *Bergia ammannioides* Roxb. [Hort. Beng. 34. 1814, nom nud.] ex Roth, Nov. Pl. Sp. 219. 1821; Roxb., Fl. Ind. 2: 457. 1832, 'ammanoides'; Dyer in Fl. Brit. India 1: 251.

1874; *Elatine ammannoides* (Roxb. ex Roth) Wight & Arn., Prodr. 41. 1834 *Bergia ammannioides* Roxb. ex Roth var. *pentandra* Wight, Ill. Ind. Bot. 54, t. 25a. 1840.

Beng.: *Lal Keshuriya*; Raj.: *Tal Bhungro*.

Annual, erect, much-branched herbs, 10 - 35 cm high; stems terete, reddish-purple, somewhat woody at base, glandular-pubescent or subglabrous, swollen at nodes. Leaves 15 - 30 x 3 - 8 mm, oblanceolate or obovate-oblong, attenuate at base, acute at apex, upper half sparsely serrate with gland-tipped teeth, lower half entire, hispid to glandular pubescent or glabrescent; stipules 2 - 3 mm long, triangular-lanceolate, acute, serrate with gland-tipped teeth, pubescent. Flowers few to many in axillary fascicles, 0.5 - 2.5 mm long, 2 mm across; pedicels 1 - 3 mm long, slender, covered with glandular and eglandular hairs. Sepals 1.5 - 3.2 mm long, linear-lanceolate to ovate, acute, keeled, scarious, ciliate, glandular-pubescent, often reddish-pink. Petals reddish-pink, 1.3 - 2.5 mm long, ovate, elliptic or oblong, subacute or obtuse. Stamens usually 5, rarely more, subfiliform, ca 1 mm long; anthers minute. Ovary subglobose, sulcate, glabrous; styles 0.5 - 1 mm long, erect or shortly recurved; stigmas thick, capitate. Capsules 0.2 - 4 mm long, subglobose, reddish. Seeds numerous, minute, dark brown with shiny reticulations.

*Fl. & Fr.* Aug. - March.

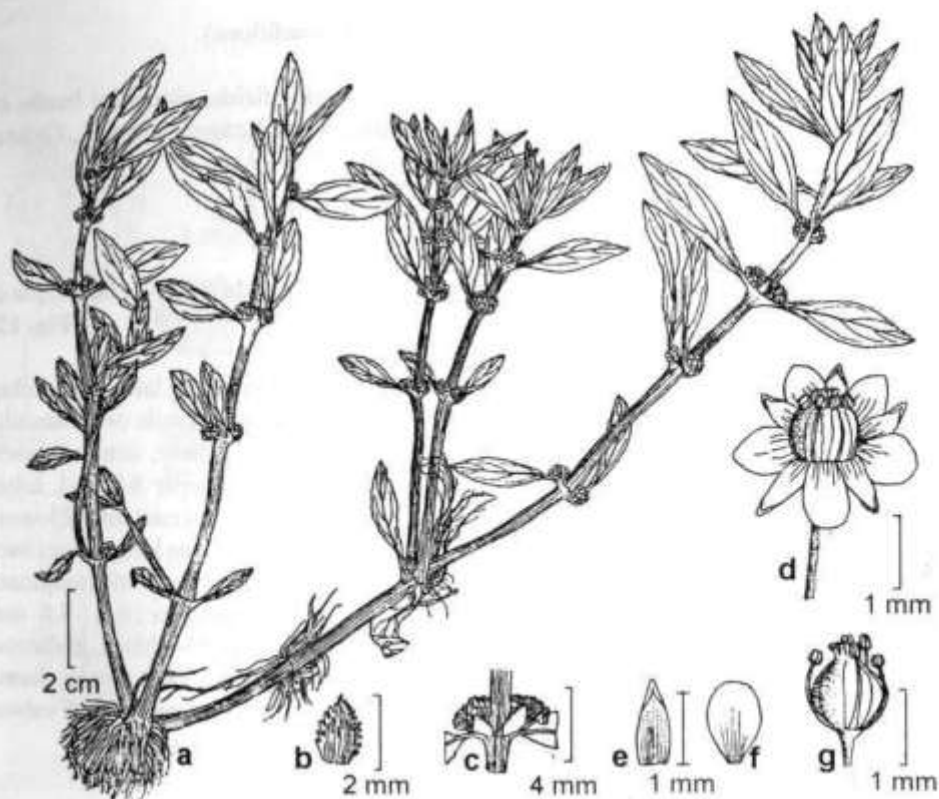
*Distrib.* India: Grows mainly in tropical and subtropical regions in muddy areas, seasonally inundated fallow fields and dedicated paddy fields, sometimes along road side ponds, river beds and in waste marshy lands. Jammu & Kashmir, Punjab, Uttar Pradesh, Bihar, West Bengal, Tripura, Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Tropical Asia from Iran to S. China, Philippines, Australia and Tropical Africa.

**3. *Bergia capensis*** L., Mant. Pl. 2: 241. 1771; T. Cooke, Fl. Pres. Bombay 1: 74. 1901. *B. verticillata* Willd., Sp. Pl. ed. 4, 2: 770. 1799; Roxb., Fl. Ind. 2: 456. 1832; Dyer in Fl. Brit. India 1: 252. 1874. *Bergia aquatica* Roxb., Pl. Corom. 2: 22, t. 142. 1800. *Elatine verticillata* (Willd.) Wight & Arn., Prodr. 41. 1834. **Fig. 11.**

Beng.: *White Keshuriya*; Tam.: *Nandu Kollupu Chedi*.

Herbs, perennial, glabrous, succulent with stems and branches creeping or ascending and rooting at basal nodes; stems 10 - 35 cm long terete with pink or reddish striations and constricted nodes. Leaves 2 - 5 x 0.8 - 2 cm, narrowly elliptic or lanceolate, oblong to oblanceolate, attenuate to somewhat decurrent at base, acute or subobtuse at apex, glabrous; petioles stout, 1 - 5 mm long; stipules 2 - 3 mm long, ovate-triangular, acute with pectinate membranous margin. Flowers many, in dense axillary cymes, ca 2.5 mm across. Sepals light green with red tips, erect, 1.5 - 2.5 mm, broadly elliptic to oblanceo-



**Fig. 11.** *Bergia capensis* L. : a. habit; b. stipule; c. nodal part of branch showing inflorescences; d. flower; e. sepal; f. petal; g. flower with sepals and petals removed

late, acuminate. Petals greenish-white or transparent, suberect or spreading, slightly shorter than sepals, linear-oblong or subspathulate. Stamens 10, equal, 0.8 - 1.5 mm long; filaments dilated at base. Ovary less than 1 mm long, ellipsoid or globose; styles shortly recurved; stigmas 5-notched. Capsules 2 - 2.5 mm in diam., subglobose, with 5-longitudinal furrows, septicial. Seeds numerous, oblong, often curved, shining, strongly reticulate.

*Fl. & Fr.* Aug. - Oct. (variable according to growth conditions).

*Distrib.* India: Generally abundant in fallow and paddy fields, along the banks of canals, ponds, lakes and in humid pastures. Bihar, West Bengal, Tripura, Orissa, Andhra Pradesh and Tamil Nadu.

Pantropical.

**4. *Bergia polyantha*** Sonder in *Linnaea* 23: 16. 1850; Raizada & R.N. Chatterjee in *Sci. & Cult.* 27: 302. 1961. **Fig. 12.**

Annual herbs, much-branched, diffuse, glabrous, 4.8 - 8.5 cm high; lateral branches procumbent, often purplish. Leaves opposite or in pseudo-whorls, sessile or subsessile, slightly fleshy, 4.5 - 6.5 x 2.5 - 3.5 mm, ovate-oblong, cuneate at base, acute at apex, denticulate at least towards apex; stipules up to 1.5 mm long, deeply 8-lobed, lobes hyaline, shortly connate at base, narrowly triangular-acuminate, persistent. Flowers solitary or in pairs, 7.5 - 9.5 mm long, 2 - 3 mm across; pedicels 4 - 5.5 mm long, sometimes longer than subtending leaves. Sepals 5, free, ca 3 mm long, lanceolate to ovate-lanceolate, acute, glabrous. Petals pink, 2 - 2.5 mm, ovate, subacute. Stamens 10, 1 - 1.5 mm long, alternately longer and shorter. Ovary globose, longitudinally 5-ribbed, glabrous; styles 5, free, ca 2 mm long, recurved; stigmas capitate. Capsules ca 2 mm in diam., globose with 5 longitudinal furrows, many-seeded, dehiscing longitudinally into 5 valves. Seeds minute, oblong, rounded at ends, curved, strongly scalariform-reticulate.

*Fl. & Fr.* Nov. - Feb.

*Distrib.* India: Uttar Pradesh and Rajasthan.

Africa and Australia.

*Notes.* Winter herb in moist areas, green when young, tinged purple when old.

**5. *Bergia suffruticosa*** (Delile) Fenzl, *Denksch. Bot. Ges.* 3: 183. 1841. *Lancretia suffruticosa* Delile, *Fl. Egypt* 213, t. 25. 1813. *Bergia odorata* Edgew. in *J. Asiat. Soc. Beng.* 7: 765. 1838; Dyer in *Fl. Brit. India* 1: 251. 1874.

Raj.: *Kankaria, Kharbuji*; Hindi.: *Rawan Rai*.

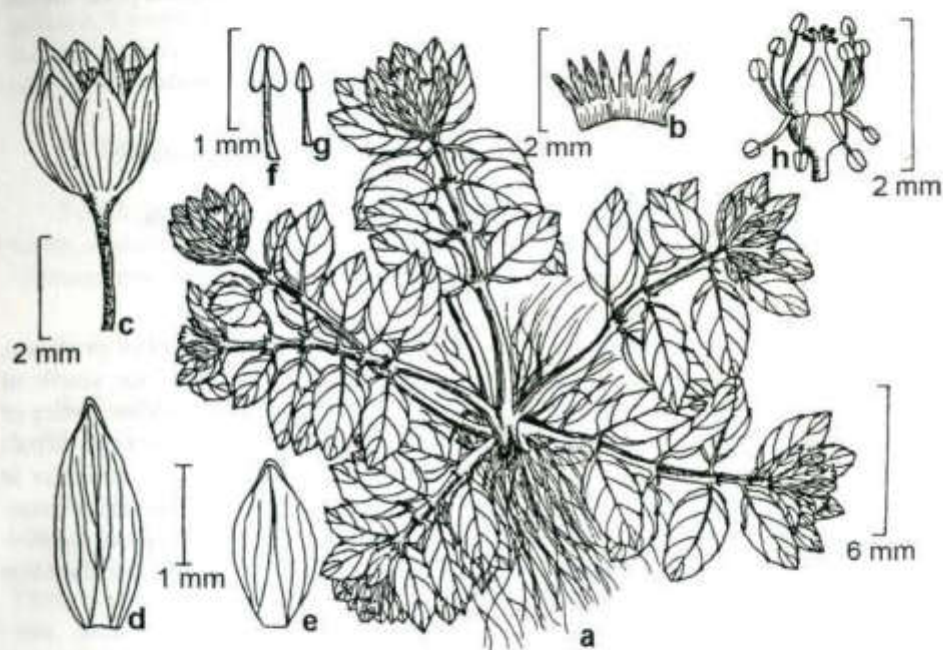


Fig. 12. *Bergia polyantha* Sonder : a. habit; b. stipule; c. flower; d. sepal; e. petal; f. longer stamen; g. shorter stamen; h. flower with sepals and petals removed

Shrubs, aromatic, decumbent with opposite branches. Stems shortly hispid; bark papery, ferruginous, peeling. Leaves 5 - 18 x 2 - 10 mm, elliptic to ovate or oblong to lanceolate, narrowed at base, obtuse to subacute at apex, crenate or serrulate, densely pubescent, sessile or subsessile; stipules 1 - 2.5 mm long, linear to lanceolate, pubescent. Flowers whitish-pink, axillary, solitary or 2 - 8 in fasciculate cymes, 3 - 4 mm across; pedicels 1 - 1.5 mm long, pubescent. Sepals 2 - 8 x 3.5 mm, ovate-oblong, acute, pubescent, keeled with hyaline margins. Petals white or pink, as long as or slightly longer than sepals, obovate-oblong, obtuse, entire, trinerved, hyaline. Stamens equal or alternately longer and shorter; filaments dilated at base; anthers 0.5 - 1 mm long. Ovary ovoid; styles ca 3.2 mm long, straight; stigmas minute. Capsules ovoid, whitish-pink. Seeds numerous, minute, oblong-ellipsoid, dark brown to shining black.

*Fl. & Fr.* Oct. - Feb.

*Distrib.* India: Punjab, Rajasthan, Gujarat, Maharashtra and Karnataka.

Pakistan, Iran, Arabia, Egypt, Sudan, Senegal, Mauritiana and Kenya.

## 2. *Elatine* L.

Annual, small herbs, aquatic, amphibious or terrestrial; stems erect or prostrate, flaccid-succulent, 2 - 7.8 cm long, glabrous. Leaves opposite or verticillate; sessile or shortly petioled, linear-spathulate to oblong, entire; stipules minute, hyaline, entire or finely toothed. Flowers small, solitary or in pairs; sessile or pedicelled, trimerous. Sepals 3, equal, membranous, obtuse, persistent. Petals membranous, usually orbicular in terrestrial species, often campanulately spreading. Stamens as many as petals or sometimes reduced to 1. Ovary globose, 3-loculed. Capsules globose, membranous, septicidal. Seeds numerous, minute, cylindric, oblong, straight or curved, with scalariform reticulations.

Tropical, subtropical and temperate regions of both the hemispheres, ca 20 species; 3 in India.

### KEY TO THE SPECIES

- |  |                       |
|--|-----------------------|
| 1a. Flowers subsessile to distinctly pedicelled; stamens shorter than sepals; seeds 4 - 6 in each locule | 1. <i>E. ambigua</i>  |
| b. Flowers sessile; stamens longer than sepals; seeds 6 - 12 in each locule                              | 2                     |
| 2a. Seeds 10 - 12 in each locule; leaves elliptic  | 3. <i>E. triandra</i> |
| b. Seeds 6 - 8 in each locule; leaves linear-spathulate  | 2. <i>E. gracilis</i> |

1. *Elatine ambigua* Wight in Hook., J. Bot. 2: 103, t. 5. 1831; Dyer in Fl. Brit. India 1. 250. 1874. Fig. 13.

Herbs, prostrate, radially branched, soft, glabrous, 1 - 4 cm high; stems terete, rooting at nodes. Leaves 2 - 5 x 0.5 - 2 mm, elliptic to oblong-lanceolate, narrowed into a flattened short petiole at base, obtuse at apex, entire, bright green, penninerved with nerves ending in hyathodes at margin; stipules ca 1 mm long, ovate-triangular, acute, entire. Flowers axillary, solitary at alternating nodes; peduncles 1 - 2 mm long, glabrous, unilateral in fruit. Sepals 3, 0.5 - 1 mm long, oblong, slightly cuneate at base. Petals 3, pinkish-white or white, 1.5 x 1 mm, ovate-oblong. Stamens 3, alternipetalous. Ovary globose, 3-loculed, glabrous; stigmas 3, sessile. Capsules ca 1 mm across, globose, thin, faintly 3-loculed, stalk pendulous or curved. Seeds oblong, light brown with hexagonal raised reticulations; embryo straight.

*Fl.* Feb.

*Distrib.* India: In patches in moist areas along the river banks and margins of the tanks; sometimes also in inundated rice fields. Jammu & Kashmir, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

E. Europe, N. America, Indonesia (Java), Fiji Island and Polynesia.

2. *Elatine gracilis* Mason in Madrono 13: 240. 1956 & Fl. Marshes California 583. f. 267. 1957. H.J. Chowdhury in Bull. Bot. Surv. India 24: 218. 1982.

Slender herbs, 2 - 5 cm high; stems prostrate, rooting at base. Leaves opposite, as long as or slightly longer than internodes, linear-elliptic to obovate, narrowed into a petiole like base; crenulate with minute callus; stipules 5 - 9 mm long, lacerate, attenuate. Flowers solitary at each node, 0.6 - 1.5 mm long, sessile. Sepals and petals 3, membranous. Stamens 3, alternate with petals. Seeds 6 - 8 in each locule, 0.5 - 0.8 mm long, straight or slightly curved with hexagonal reticulation, the transverse ridges more conspicuous than longitudinal ones.

*Fl. & Fr.* Oct. - April.

*Distrib.* India: In marshy sandy alluvial soils near lakes at ca 1387 m. Himachal Pradesh.

N. America.

*Notes.* This species is included here based on a single collection from Joginder Nagar, Mandi, Himachal Pradesh (S. K. Murti 61815 (BSD)).

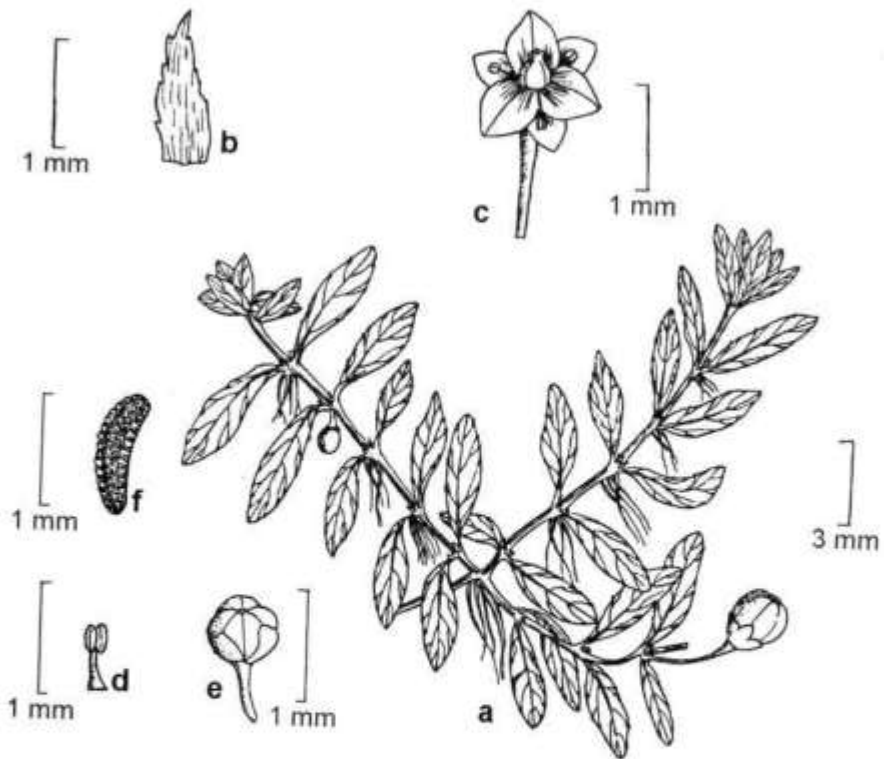
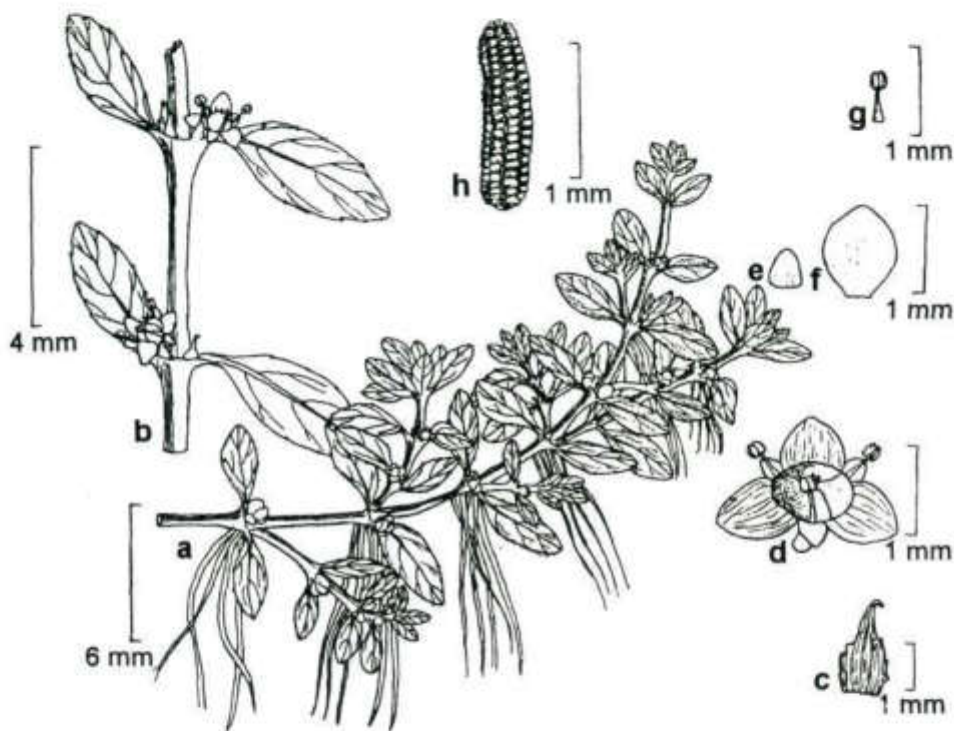


Fig. 13. *Elatine ambigua* Wight : a. habit; b. stipule; c. flower; d. stamen; e. fruit; f. seed.





**Fig. 14.** *Elatine triandra* Schkuhr : a. habit; b. part of branch showing flowering nodes; c. stipule; d. flower; e. sepal; f. petal; g. stamen; h. seed.

3. *Elatine triandra* Schkuhr, Bot. Handb. ed. 2, 1: 345, t. 109 b, f. 2. 1808. *Peplis americana* Pursh, Fl. Am. Sept. 1: 238. 1814. *Elatine americana* (Pursh) Arn. in Edinburgh J. Nat. Geogr. Sci. 1: 431. 1930; Dyer in Fl. Brit. India 1: 250. 1874. **Fig. 14.**

Herbs, annual, aquatic or limicolous, soft, glabrous; stems 3 - 12 mm long, creeping, rooting at nodes, often caespitose. Leaves opposite, 2 - 6 mm long, elliptic-oblong or ovate-oblong, decurrent or perfoliate at base, obtuse to emarginate at apex, entire, penninerved with gland-like hydathodes along margin; stipules minute, membranous, ovate-triangular, acute, slightly lacerate or dentate. Flowers axillary, solitary, alternately on left and right at nodes, sessile. Sepals 3, 0.5 - 1.2 mm long, triangular, obtuse. Petals 3, whitish-pink, 1 - 1.6 mm long, broadly ovate, obtuse with a median nerve. Stamens 3, drooping over ovary, alternipetalous; filaments ca 1 mm with flattened petaloid base; anthers ovoid. Ovary globose with 3 almost sessile, punctiform stigmas. Capsules ca 2 mm in diam., depressed subglobose, membranous, minutely stalked. Seeds ca 0.5 mm long, light brown, oblong-cylindric, straight or slightly curved, rounded at both ends with raised hexagonal reticulation.

*Fl. & Fr.* Oct. - Dec.

*Distrib.* India: In shallow inundated areas, often in marshy situations along margins of ponds and tanks, between 100 and 2800 m. Jammu & Kashmir, Himachal Pradesh, Andhra Pradesh and Tamil Nadu.

Tropical Asia, Australia, New Zealand, Europe and N. America.

## HYPERICACEAE

(S.N. Biswas)

Annual or perennial herbs, shrubs, trees, rarely climbers. Leaves simple, opposite and decussate, verticillate, rarely alternate, sessile or shortly petioled, entire or gland-toothed, often marked with translucent and sometimes with black or red glandular dots and/or lines, exstipulate, pinnately veined, sometimes 3-veined from base. Flowers bisexual, actinomorphic, yellow, red or white, terminal and sometimes axillary, rarely solitary or in 1-many-flowered cymes to thyrsoid, rarely racemose or corymbose, bracteate initially, homostylous or heterodistylous. Sepals 4 - 5, free or rarely connate at base, imbricate, entire or margins variously divided and often glandular. Petals 4 - 5, free, imbricate, sessile or clawed, antisepalous, entire or margin variously divided and often glandular, lamina glandular like leaves, sometimes with nectariferous basal appendage, glabrous, caducous or persistent. Stamens numerous or rarely definite, epipetalous, free or variously united in 3 - 5, rarely 6 - 8 bundles/fascicles; anthers 2-locular, dorsifixed; often connective gland-tipped, dehiscence longitudinal. Ovary 3 - 5-carpelled, syncarpous, superior, 3 - 5-locular, rarely 1-locular, with few to many anatropous ovules on parietal placentation, rarely ovules solitary and basal; rarely placentation axile or pseudo-central; styles 3 - 5, free or connate at base, slender; stigmas punctiform to capitate. Fruits capsular, dehiscing septicidally or loculicidally, 3 - 5-valved, rarely a berry. Seeds 1 - numerous, sometimes winged or carinate; embryo straight or curved; exalbuminous.

Cosmopolitan except for Arctic regions and most of Polynesia, ca 7 genera and 550 species; ca 3 genera and 29 species in India.

*Note.* The family Hypericaceae is sometimes treated as subfamily of Guttiferae (Clusiaceae).

*Literature.* KHAN, H.A. (1969). Pollen morphology of Indian Hypericaceae. *J. Palynol.* (Lucknow) 5: 97 - 99. ROBSON, N.K.B. & P. ADAMS (1968). Chromosome numbers in *Hypericum* and related genera. *Brittonia* 25: 95 - 106. ROBSON, N.K.B. (1974) Hypericaceae In: STEENIS, C.G.G.J. VAN, Fl. Males. 1, 8: 1 - 29. ROBSON, N.K.B. & D.G. LONG (1984) Hypericaceae In: GRIERSON, A.J.C. & D.G. LONG, Fl. Bhutan 1: 372 - 378. ROBSON, N.K.B. (1973) Guttiferae In: NASIR, E. & S.I. ALI, Fl. W. Pakistan 32: 1 - 12.

### KEY TO THE GENERA

- 1a. Trees; leaves devoid of black or translucent glands; capsules loculicidally 3-valved; seeds winged **1. Cratoxylum**
- b. Herbs or shrubs; leaves with black or translucent glands; capsules septicidal; seeds wingless **2**
- 2a. Petals yellow; stamens numerous, filaments generally free; hypogynous scales absent **2. Hypericum**

- b. Petals white; stamens always 9, in 3 fascicles with filaments united almost up to the middle, alternating with 3 hypogynous scales 3. **Triadenum**

### 1. **Cratoxylum** Blume

Deciduous to evergreen trees or shrubs. Leaves simple, sessile to petioled, opposite, entire, thin. Flowers axillary or terminal in panicles or fascicled in axils of fallen leaves, heterodistylous or heterotristylous; bracteoles minute, caducous. Sepals 5, persistent, coriaceous, mostly accrescent. Petals 5, caducous to subsistent, alternise-palous, deep crimson to pink or white. Staminal fascicles or bundles 3 or 5, stalked, unequal; anthers subsistent, dorsifixed, introrse; hypogynous scales 3, fleshy, alternate with staminal fascicles or bundles. Ovary 3-locular; ovules 4 - many in each locule, anatropous on axile placentation. Styles free; stigmas punctiform, truncate or thickened, papillose to capitate. Capsules ovoid-ellipsoid to ellipsoid-oblong, loculicidally dehiscent into 3-valves; valves septiferous; columella like placenta in the base of capsule, persistent and woody. Seeds either oblong and winged all around or oblong to obovate, winged unilaterally (as in Indian spp.); embryo erect, oblong.

Tropical Asia, ca 6 species; 3 in India.

*Literature.* GOGELIN, A.J.F. (1967). A revision of the genus *Cratoxylum* Bl. (Guttiferae). *Blumea* 15: 453 - 475.

#### KEY TO THE SPECIES

- 1a. Intramarginal veins present in leaves; petals with distinct scales; inflorescences always axillary 2. **C. formosum**
- b. Intramarginal veins absent in leaves; petals without scales; inflorescences axillary and terminal 2
- 2a. Leaves 2.5 - 16 x 1 - 4.2 cm, glaucous beneath; petioles 2 - 4.5 mm long; inflorescences 1 - 3-flowered, axillary and terminal; pedicels 1 - 2 mm long, accrescent, 1.8 - 4 mm long in fruit 1. **C. cochinchinense**
- b. Leaves 4 - 19 x 2 - 2.5 cm, never glaucous beneath; petioles up to 15 mm long; inflorescences many-flowered, terminal; pedicels 1.5 - 5 mm long, accrescent, 3.5 - 5.5 mm long in fruit 3. **C. sumatranum**

1. **Cratoxylum cochinchinense** (Lour.) Blume, *Mus. Bot.* 2: 17. 1852. *Hypericum cochinchinense* Lour., *Fl. Cochinch.* 471. 1790. *Ancistrolobus* sp. Wight, *Ill. Ind. Bot.* 1: 111. 1840. *Cratoxylum polyanthum* Korthals in Temminck, *Verh. Nat. Gesch. Ned. Bezitt. Bot.* 175, t. 36. 1842; Dyer in *Fl. Brit. India* 1: 257. 1874 incl. vars. *ligustrinum* & *wightii*. *Cratoxylum wightii* Blume, *Mus. Bot.* 2: 17. 1852.

Shrubs or deciduous trees; branchlets terete, glabrous. Leaves elliptic to lanceolate, rarely ovate-lanceolate, obtuse to attenuate at base, obtuse to acuminate at apex, glabrous above and glaucous beneath; petioles 2 - 5 mm long. Flowers heterostylus

1 - 4 in axillary and terminal racemes; pedicels 1 - 2 mm long. Sepals 5, 5 - 7 x 3 - 3.5 mm, obovate to obovate-oblong, obtuse at apex, entire, black glandular punctate beneath. Petals 5, 7 - 8(-10) x 2.5 - 4.5 mm, obovate, rounded to truncate at apex, entire, glandular punctate. Stamens in 3 phalanges with ca 25 in each. Ovary 2.5 - 3 cm long, styles 3, ca 3 mm long. Capsules 8 - 12 x 4 - 5 mm, ellipsoid, partly covered by accrescent sepals. Seeds 6 - 7 x 2 - 3 mm, obovate with an unilateral wing.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Wild in Andaman & Nicobar Islands ? elsewhere cultivated.

Myanmar, China, Hong kong, N. & S. Vietnam and Cambodia.

*Notes.* This species is included in this flora based on a collection of Helfer, records of its distribution by Kurz (*For. Fl. Brit. Burma* 1: 85. 1877) and Gamble (*Man. Indian Timb.* 48. 1922). So far this species has not been re-collected from Andaman and Nicobar Islands.

Wood is regarded as suitable for building purposes and cabinet making. Sometimes cultivated in mainland India.

**2. *Cratoxylum formosum*** (Jack) Dyer in *Fl. Brit. India* 1: 258. 1874; Parkinson, *For. Fl. Andaman* 85. 1923. *Elodea formosa* Jack in *Malay. Misc.* 2: 24. 1822.

Medium-sized, deciduous trees, 10 - 25 m tall; stems di- to trichotomously branched from base; branchlets glabrous or pubescent to rusty tomentose. Leaves 3 - 13 x 1 - 7 cm, elliptic to oblong-lanceolate, sometimes ovate to obovate, acute, subacuminate, obtuse or rounded at apex, glaucous, black glandular punctate beneath; petioles 6 - 10 mm long. Flowers light pink to red, 1 - 8 in axillary peduncles at defoliate nodes. Sepals 5, 5 - 6.5 x 2 - 2.5 mm, ovate-elliptic, obtuse to truncate at apex, glabrous to pubescent. Petals 5, pinkish white to red, 8 - 12 x 3 - 6 mm, entire to infrequently fringed towards apex, sparsely black glandular punctate; petal scales 2 - 4 mm long. Stamens in 3 phalanges of ca 25 each; anthers up to 3 mm long. Ovary oblongoid to oblong-lanceolate; styles 3; stigmas capitate. Capsules 1 - 2.2 cm long, ovoid to ellipsoid, many-seeded. Seeds 5 - 7 x 2 - 2.5 mm, obovate, unilaterally winged.

#### KEY TO THE SUBSPECIES

- 1a. Plants glabrous; hypogynous scales 2 mm long, liguliform; capsules ellipsoid, 38 - 40-seeded  
2.1. subsp. **formosum**
- b. Young twigs, pedicels and outside of calyx rusty tomentose; hypogynous scales less than 1 mm long, truncate; capsules ovoid, 54 - 58-seeded  
2.2. subsp. **pruniflorum**

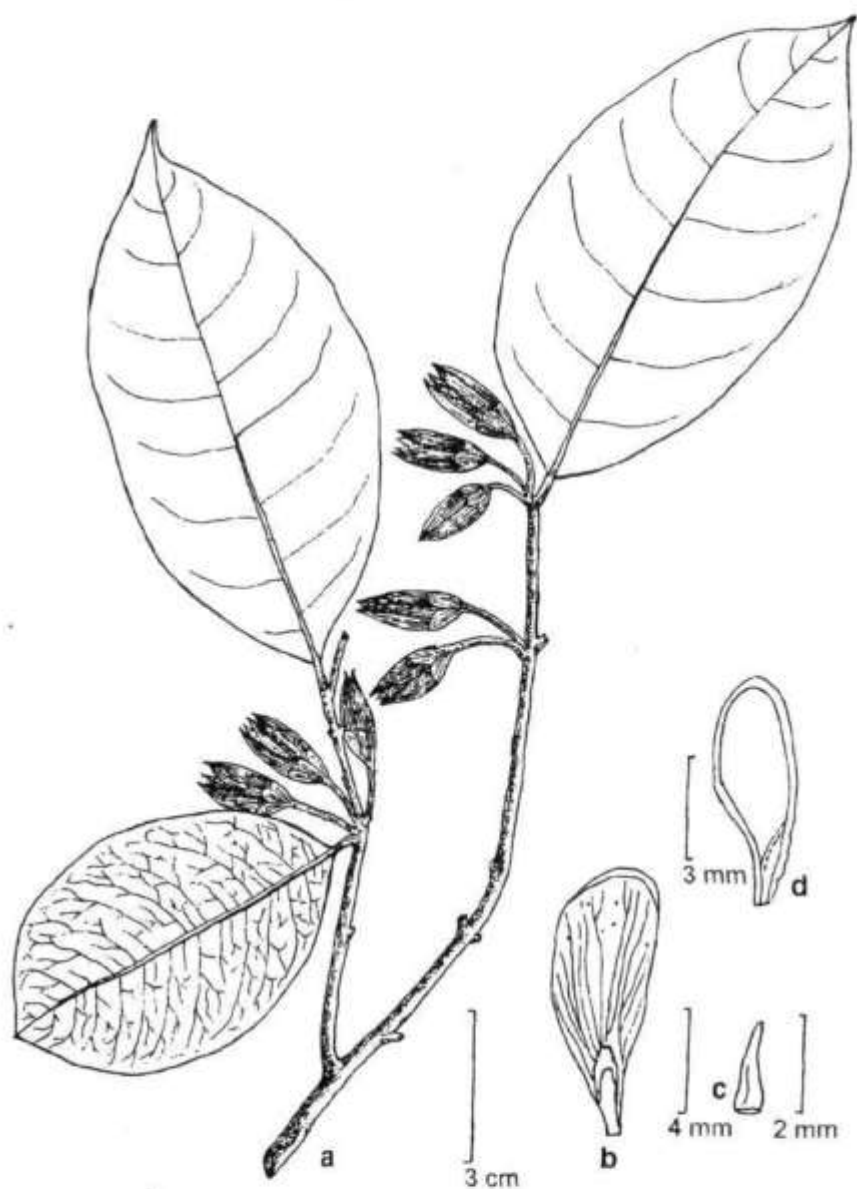


Fig. 15. *Cratoxylum formosum* (Jack) Dyer subsp. *formosum* : a. flowering twig; b. petal with basal scales; c. hypogynous scale; d. seed.

2.1. subsp. *formosum*

Fig. 15.

*Fl.* March - July; *Fr.* Aug. - Nov.*Distrib.* India: Common in deciduous forests, Andaman & Nicobar Islands (Throughout Andaman Islands).

Thailand, Vietnam, Cambodia and Malesia.

2.2. subsp. *pruniflorum* (Kurz) Gog. in *Blumea* 15: 469. 1967; S.N. Biswas in *Bull. Bot. Surv. India* 15: 167. 1973. *Tridesmis pruniflora* Kurz in *J. Asiat. Soc. Beng.* 41: 293. 1872. *Cratoxylum pruniflorum* (Kurz) Kurz in *J. Asiat. Soc. Beng.* 43: 84. 1874 & *For. Fl. Brit. Burma* 1: 84. 1877; Dyer in *Fl. Brit. India* 1: 1874 'prunifolium'. Fig. 16.

*Fl. & Fr.* March - June.*Distrib.* India: Generally in open mixed forests between 200 and 1000 m. Nagaland.

Myanmar, S. Thailand, Cambodia and S. China.

3. *Cratoxylum sumatranum* (Jack) Blume subsp. *neriifolium* (Kurz) Gog. in *Blumea* 15: 463. 1967. *C. neriifolium* Kurz in *J. Asiat. Soc. Beng.* 41: 293. 1872; Dyer in *Fl. Brit. India* 1: 257. 1874.

Trees up to 20 m tall; stems dichotomously branched from base; branchlets terete, glabrous. Leaves 3 - 12.5 x 1 - 5 cm, ovate-lanceolate, nearly cordate to cuneate or obtuse at base, acute to shortly acuminate at apex, glabrous, glaucous beneath; sessile to subsessile. Flowers small, in 2 - 3-flowered, axillary, cymose panicles. Sepals 5, 5 - 7 x 4.5 - 5 mm, elliptic-oblong, glabrous. Petals 5, bright or brick red, 6 - 7 x 4.5 - 5 mm, obovate, entire, gland-dotted. Staminal phalanges 3 with 25 or more in each, 5 - 8 mm long. Ovary 3 - 3.5 mm long, ovoid to ellipsoid; styles 3, 2.5 mm long. Capsules 9 - 10 x 3 - 4 mm, oblongoid, covered by accrescent sepals, seeds 6 - 8 in each locule. Seeds 3.5 - 5 mm long, obovate.

*Fl.* May - Aug.; *Fr.* Sept. - March.*Distrib.* India: Mizoram (S. Lushai hills); rare.

Bangladesh, Myanmar, Thailand and Vietnam.

*Notes.* Wood used for making ploughs, tool handles and for charcoal.

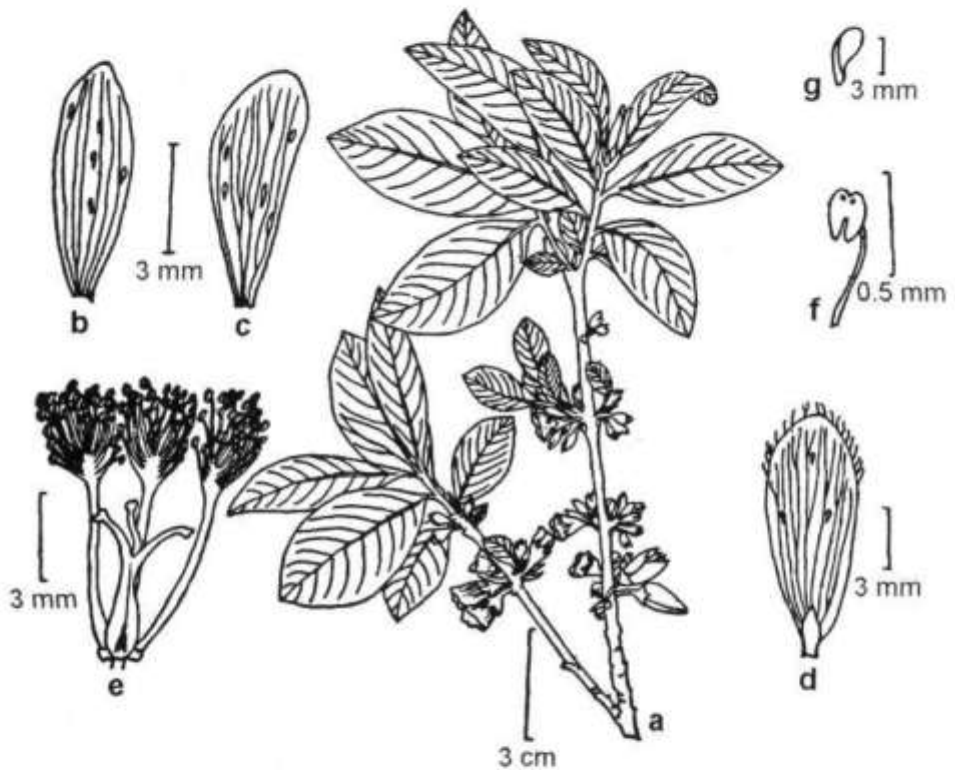


Fig. 16. *Cratoxylum formosum* (Jack) Dyer subsp. *pruniflorum* (Kurz) Gog. : a. branch with flowers and fruits; b. & c. sepals, d. petal with a basal scale; e. androecium; f. stamen; g. seed.



Chromosome numbers  $n = 7$ ,  $2n = 14$  (Tixier, P., *Rev. Cytol. Paris* 14: 1. 1953).  
Pollen grains 3-zonocolporate, psilate (Khan, H.A., *J. Palyn. Pl.* 5: 97 - 99. 1969).

## 2. *Hypericum* L.

Annual or perennial herbs, shrubs or small trees; branchlets terete or 2 - 4-angled, glabrous. Leaves simple, sessile or shortly petioled, opposite-decussate, rarely whorled, entire or gland-fringed, lamina with transparent glands containing essential oils and sometimes black or red glands containing hypericin or pseudohypericin. Flowers yellow, homostylus, solitary or in terminal monochasial to dichasial cymes or panicles. Sepals 5, quincuncial or rarely 4, decussate, coriaceous to chartaceous, glandular-punctate like leaves, caducous or persistent. Stamens 1 - 60, free or variously united, epipetalous, caducous or persistent; filaments slender, free or connate; anthers yellow or reddish, dorsifixed, connective often with black or amber gland. Ovary 1 - 5-locular, with parietal, axile or pseudo-central placentation; styles 3 - 5, free or connate, slender, often recurved at apex; ovules many, rarely few on each placenta. Capsules septicidal or dehiscent along placenta when unilocular or indehiscent. Seeds 1 - numerous, curved, cylindrical or ellipsoid, sometimes winged or carinate with testa prominently to obscurely striated.

Cosmopolitan, rare in Australia; ca 400 species; 25 in India.

**Literature.** ROBSON, N.K.B. & P. ADAMS (1968). Chromosome numbers in *Hypericum* and related genera. *Brittonia* 25: 95 - 106. ROBSON, N.K.B. (1972). Notes on Malesian species of *Hypericum* (Guttiferae). *Blumea* 20: 251 - 274. ROBSON, N.K.B. (1973) Guttiferae In: NASIR, E. & S.IALI, Fl. W. Pakistan 32: 1 - 12. ROBSON, N.K.B. (1974). Hypericaceae. In: STEENIS, C.G.G.J. VAN, Fl. Males. 1, 8: 1 - 29. ROBSON, N.K.B. (1977). Notes on some Nepalese and Indian *Hypericum*. *J. Jap. Bot.* 52: 276 - 288. ROBSON, N.K.B. (1977). Studies in the genus *Hypericum* L. (Guttiferae) I. Infrageneric classification. *Bull. Brit. Mus. (Nat. Hist.) Bot.* 5: 293 - 35.

### KEY TO THE SECTIONS

- |  |                              |
|--|------------------------------|
| 1a. Shrubs 0.6 - 2.5 m high  | Sect. 2. <i>Ascyreia</i>     |
| b. Herbs 5 - 7.5 cm high   | 2                            |
| 2a. Stamens in 3 fascicles; ovary 3-locular with axile or obscure parietal placentation; valves of capsules with vittae or vesicles. | 3                            |
| b. Stamens in 1 fascicle; ovary 1-locular with parietal placentation; valves of capsules without vittae or vesicles                  | Sect. 3. <i>Brathys</i>      |
| 3a. Plants puberulous to pubescent; sepals glandular ciliate margin of petals without gland dots                                     | Sect. 1. <i>Adenosepalum</i> |
| b. Plants glabrescent to glabrous; sepals not glandular ciliate; margin of petals with brown to black gland dots                     | Sect. 4. <i>Hypericum</i>    |

## KEY TO THE SUBSECTIONS OF SECT. BRATHYS

- 1a. Flowers solitary or in 2 - 3-chotomous cymes; stems terete subsect. 1. *Brathys*  
 b. Flowers numerous in monochasial or dichasial cymes; stems 4-lined subsect. 2. *Spachium*

## KEY TO THE SPECIES IN SECTIONS AND SUBSECTIONS

Sect. 1. *Adnosepalum* Spach

- 1a. Styles longer than ovary; sepals and bracts densely glandular ciliate 2  
 b. Styles shorter or as long as ovary; sepals and bracts sparsely glandular ciliate or bracts sometimes eciliate 3
- 2a. Leaves sessile, 1 - 5 x 0.5 - 1 mm, lanceolate or oblong-lanceolate to linear, acute to subacute at apex, cordate-amplexicaul to rounded at base; veins prominent and raised; auricled bases of leaves of 3 - 4 pairs below the peduncles glandular ciliate; capsules ovoid to ovoid-oblong 5. *H. elodeoides*  
 b. Leaves sessile or with 2 mm long petioles, 10 - 30 x 5 - 16 mm, ovate-oblong or elliptic-obovate, obtuse to rounded at apex, subcordate-amplexicaul to broadly cuneate at base; veins obscure and flat; auricled bases of leaves of only 2 pairs below peduncles glandular ciliate; capsules globose or ellipsoid 24. *H. wightianum*
- 3a. Bracts 4.5 - 5 x 2 - 2.5 mm, lanceolate, glandular ciliate, auriculate; sepals punctate with black marginal glands; flowers solitary or 2 - 12 in subcorymbose cymes, 1.5 - 4 cm across 11. *H. himalaicum*  
 b. Bracts 6 - 7 x 5 - 6 mm, elliptic to elliptic-oblong, neither ciliate nor auriculate; flowers solitary or up to 3 in cymes, 0.9 - 1.7 cm across 15. *H. monanthemum*

Sect. 2. *Ascyreia* Choisy

- 1a. Styles as long as or half as long as ovary 2  
 b. Styles always longer than ovary 8
- 2a. Leaves sessile; stamens up to 20 in each fascicle; capsules 6.5 - 7 mm long 21. *H. reptans*  
 b. Leaves subsessile; stamens ca 25 - 65 in each fascicle; capsules 6 - 18 mm long 3
- 3a. Leaves subacute or cuneate to subrotund at base, chartaceous, veins prominent; capsules 12 - 14 mm long 4  
 b. Leaves subamplexicaul to subcordate at base, coriaceous to subcoriaceous, veins obscure; capsules 9 - 11 mm long 20. *H. podocarpoides*
- 4a. Flowers 2.5 - 4 cm across; styles straight; petals narrowly to broadly obovate 5  
 b. Flowers 4.5 - 6 cm across; styles recurved; petals obliquely obovate 12. *H. hookerianum*
- 5a. Sepals 7 - 8 x 1.5 - 2 mm, lanceolate to oblanceolate, acute to subacuminate at apex 8. *H. gracillipes*  
 b. Sepals 6 - 9 x 3.5 - 5 mm, oblong or elliptic-oblong to obovate, rounded at apex 25. *H. williamsii*
- 6a. Sepals 3.5 - 8 mm, ovate-oblong to elliptic-oblong, obtuse to subobtuse at apex; styles as long as ovary 7  
 b. Sepals 7.5 - 10 mm, foliaceous, narrowly elliptic to broadly lanceolate, acute at apex; styles half as long as ovary 3. *H. choisianum*
- 7a. Lateral veins prominent on leaves; flowers solitary, ca 1.7 - cm across 22. *H. tenuicaule*

- b. Lateral veins obscure on leaves; flowers in a few-flowered corymbose cymes, ca 1.7 - 3.8 cm across **23. *H. uralum***
- 8a. Young stems and branches 2 - 4 lined becoming terete at maturity; stamens ca 20 in each fascicle 9
- b. Stems and branches always terete; stamens ca 25 or more in each fascicle 10
- 9a. Leaves with ca 2 mm long petioles, cuneate to rounded at base; sepals longer than stamens; capsules ellipsoid-oblong to globose **4. *H. dyeri***
- b. Leaves sessile, subattenuate at base; sepals shorter than stamens; capsules ovoid-oblong **2. *H. benghalense***
- 10a. Leaves closely set on stems with short internodes and dry blackish-brown to black 11
- b. Leaves lax on stems with long internodes and dry brown to dark brown 12
- 11a. Shrubs 1 - 3 m high; venation both reticulate and parallel on leaves; petals 2.5 - 3.7 x 0.7 - 1.5 cm; seeds ca 1.5 mm long **16. *H. mysurense***
- b. Suffruticose undershrubs up to 75 cm high; venation reticulate; petals 1.5 - 2 x 0.5 - 1.2 cm; seeds ca 0.8 mm long ***H. cordifolium***  
(cultivated)
- 12a. Leaf bases subamplexicaul to subcordate; capsules 1 - 2 cm long, ellipsoid to ellipsoid-oblong 13
- b. Leaf bases cuneate to subrotund; capsules 1 - 1.3 cm long, ovoid to ovoid-conical **17. *H. oblongifolium***
- 13a. Sepals 4 - 5 x 1.5 - 2 mm, entire **10. *H. griffithii***
- b. Sepals 12 - 14 x 4 - 5 mm, distantly serrate **7. *H. gaitii***

### Sect. 3. *Brathys* (Mutis ex L.f.) Choisy

#### Subsect. 1. *Brathys*

Only one species. **6. *Hypericum filicaule*** (Dyer) N. Robson

#### Subsect. 2. *Spachium* R. Keller

- 1a. Sepals narrowly oblong to elliptic or obovate, acute to rounded, stamens 10 - 25; leaf bases not clasping the stem; plants erect or prostrate annuals **14. *H. japonicum***
- b. Sepals lanceolate, ovate-lanceolate to narrowly elliptic, acute to subacute; stamens 30 - 50; leaf bases clasping the stem; plants erect, perennial or annual **9. *H. gramineum***

### Sect. 4. *Hypericum*

- 1a. Branches 2-lined to subterete 2
- b. Branches always terete 3
- 2a. Leaves 20 - 22 x 5 - 10 mm, ovate to elliptic-oblong; petals 8 - 10 mm long; sepals much shorter than capsules **18. *H. perforatum***
- b. Leaves 6 - 14 x 5 - 10 mm, oblong to obovate; petals 5 - 6 mm long; sepals as long as capsules **13. *H. humifusum***
- 3a. Leaves sessile, lamina 1.5 - 5 x 0.6 - 1.5 cm, perfoliate at base **1. *H. assamicum***
- b. Leaves petiolate (1 - 3 mm long); lamina 1 - 2.5 x 0.6 - 1.3 cm; cuneate at base **19. *H. petiolulatum***

1. *Hypericum assamicum* S.N. Biswas in Webbia 25: 671. 1971. *H. sampsonii* auct. non Hance 1865; Dyer in Fl. Brit. India 1: 255. 1874.

Herbs perennial, erect, glabrous, 20 - 40 cm high; stems often many from the stout woody base, terete, suffused with reddish purple colour. Leaves sessile, 1.5 - 5 x 0.6 - 1.5 cm, opposite, shortly connate to form a perfoliate base, oblong or oblanceolate, obtuse to rounded at apex, entire, rarely gland-crenulate, glabrous, glaucous and punctate with black glands beneath, lateral veins 2 - 3 pairs, slender, depressed above, raised and prominent beneath, somewhat parallel to margins. Flowers in 2 - 3-chotomous cymes, often forming lax corymbose panicles; pedicels 0.1 - 1 cm long; bracts 2 - 6 mm long, linear-subulate. Sepals 5, free, 3 larger ones 8 mm long, spathulate-oblanceolate, 2 smaller, ca 5 mm long, oblanceolate to narrowly oblong, abruptly subacute, punctate with black pellucid glands, gland-crenulate towards apex, persistent. Petals 5, yellowish, ca 5 mm long, oblanceolate-spathulate, subobtuse or obtuse, prominently veined, punctate with black glands, often as a marginal row. Stamens 15, in 3 fascicles; filaments 4 - 5 mm long, linear to filiform, glabrous; anthers 0.2 mm long, broadly oblong with a gland-tipped connective. Ovary 3 - 3.5 mm long; styles 3, 1 mm long, erect, free to the base; stigmas capitate. Capsules 5 - 6 mm long, subglobose, obtuse or rotund at apex, tipped with persistent styles, punctate with resinous vesicles. Seeds reddish-brown, ca 0.8 mm long, oblong, rugose with 10 - 12 longitudinal ribs and fine transverse striae.

*Fl. & Fr.* March - April.

*Distrib.* India: Assam.

Endemic.

*Notes.* This species superficially resembles *Hypericum sampsonii* Hance from China and under which it was earlier (Dyer 1874, Kanjilal *et al.*, 1934, Ohwi, Fl. Japan 1: 631. 1965) known. It can be easily distinguished from *H. sampsonii* by its shortly connate perfoliate bases of leaves, spathulate-oblong, unequal sepals, petals being shorter than sepals, ovary with parietal placentation and subglobose capsules with rounded or obtuse apex.

2. *Hypericum benghalense* S.N. Biswas in Bull. Bot. Surv. India 29: 53. 1989.

Fig. 17.

Shrubs, 8 - 130 cm high; stems spreading, stout, terete, reddish-brown; branchlets 4-lined when young, becoming 2-lined or terete at maturity. Leaves sessile, 1.5 - 4 x 0.7 - 1.6 cm, ovate to elliptic-lanceolate, subattenuate at base, acute to rarely subapiculate at apex, entire, chartaceous, glabrous on both surfaces, rarely glandular punctate, veins obscure above, prominent beneath. Flowers yellow in 1 - 3-chotomous, corymbose cymes, 1.5 cm across; bracts ca 10 mm long, linear-lanceolate, acute. Sepals 5, 6 - 8 mm

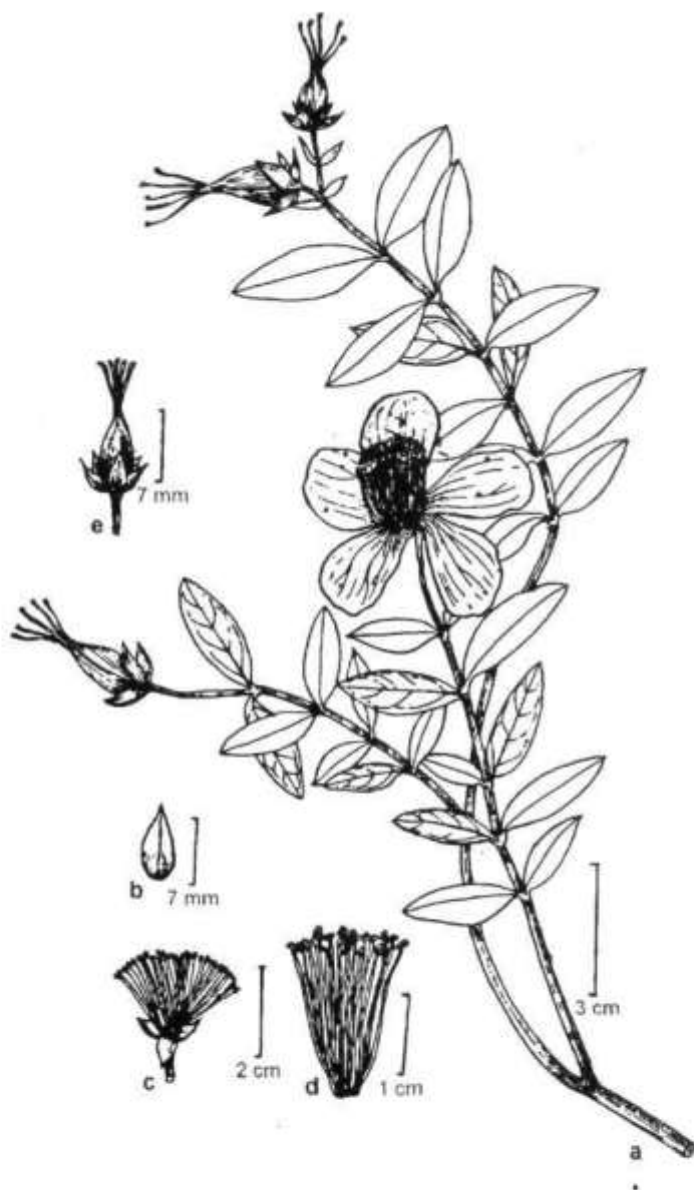


Fig. 17. *Hypericum benghalense* S.N. Biswas : a. flowering and fruiting branch; b. sepal; c. flower with petals removed; d. fascicle of stamens; e. pistil.

long, elliptic to elliptic-oblong, acuminate at apex, entire. Petals 5, 2 - 3 cm long, obovate, entire, prominently veined, sparsely gland dotted. Stamens numerous in 5 fascicles with ca 22 in each, 1.8 - 2.1 cm long; filaments unequal, glabrous. Ovary 6 - 8 mm long, ovoid-oblong; styles ca 12 mm long, free, gradually divergent. Capsules ca 1.6 cm long, ovoid-oblong with vittae. Seeds ca 10 mm long, apiculate at both ends; testa finely reticulate.

*Fl. & Fr.* June - Oct.

*Distrib.* India: West Bengal (Kalimpong); so far known from the type locality only.

**3. *Hypericum choisianum*** Wallich [Cat. No. 4805. 1831, nom. nud.] ex N. Robson in Nasir & Ali, Fl. W. Pakistan 32: 6. 1979. *H. hookerianum* Wight & Arn. var. *leschenaultii* Dyer in Fl. Brit. India 1: 254. 1874 p.p. quoad spec. & syn. *H. choisianum*. *Norysca hookeriana* (Wight & Arn.) Wight var. *leschenaultii* (Dyer) Kimura in Hara, Fl. E. Himal. 210. 1966, p.p. excl. type. **Fig. 18.**

Shrubs, up to 2 m high; stems spreading; branchlets 2 - 4-lined, becoming flattened and terete ultimately. Leaves 3 - 9 x 1 - 3.5 cm, ovate to lanceolate or oblong-lanceolate to lanceolate, broadly cuneate to rounded at base, acute and apiculate at apex, venation closely to laxl reticulate. Flowers 1 - 4 in subcorymbose cymes; 3 - 5 cm across. Sepals 6.5 - 10 mm long or longer, narrowly elliptic or broadly lanceolate to broadly ovate or elliptic, acute to apiculate, entire. Petals 2 - 2.5 cm long, obliquely obovate, 2 - 3 times longer than stamens. Stamens numerous in fascicles, ca 60 - 80 in each. Ovary 6 - 8 mm long; styles half as long as ovary, free, gradually divergent and spreading at apex. Capsules 10 - 18 mm long, ovoid, without vittae or vesicles. Seeds ca 0.9 cm long, apiculate at one end and rounded at the other, finely scalariform-reticulate.

*Fl. & Fr.* June - Sept.

*Distrib.* India: Himalayas between 2100 and 4120 m; Jammu & Kashmir (Kashmir), Himachal Pradesh and Uttar Pradesh (Garhwal) to Sikkim.

Pakistan, Nepal, Bhutan and China (Tibet).

**4. *Hypericum dyeri*** Rehder in J. Arn. Arb. 20: 422. 1939; N. Robson in K.H. Reich., Fl. Iranica 49: 4. 1968. *H. lysimachioides* Wallich [Cat. No. 4817. 1831, nom. nud.] ex Dyer in Fl. Brit. India 1: 254. 1874, non Boiss. & Noe 1853.

Hindi: *Mehandiphul*

Erect shrubs, 0.7 - 1.2 m high; stems stout, arching, 2-lined to terete, glabrous. Leaves 1.5 - 5 x 0.6 - 3 cm, ovate to lanceolate or elliptic-lanceolate, cuneate to rounded at base, acute to obtuse and apiculate at apex, reticulate, punctate with black to brown

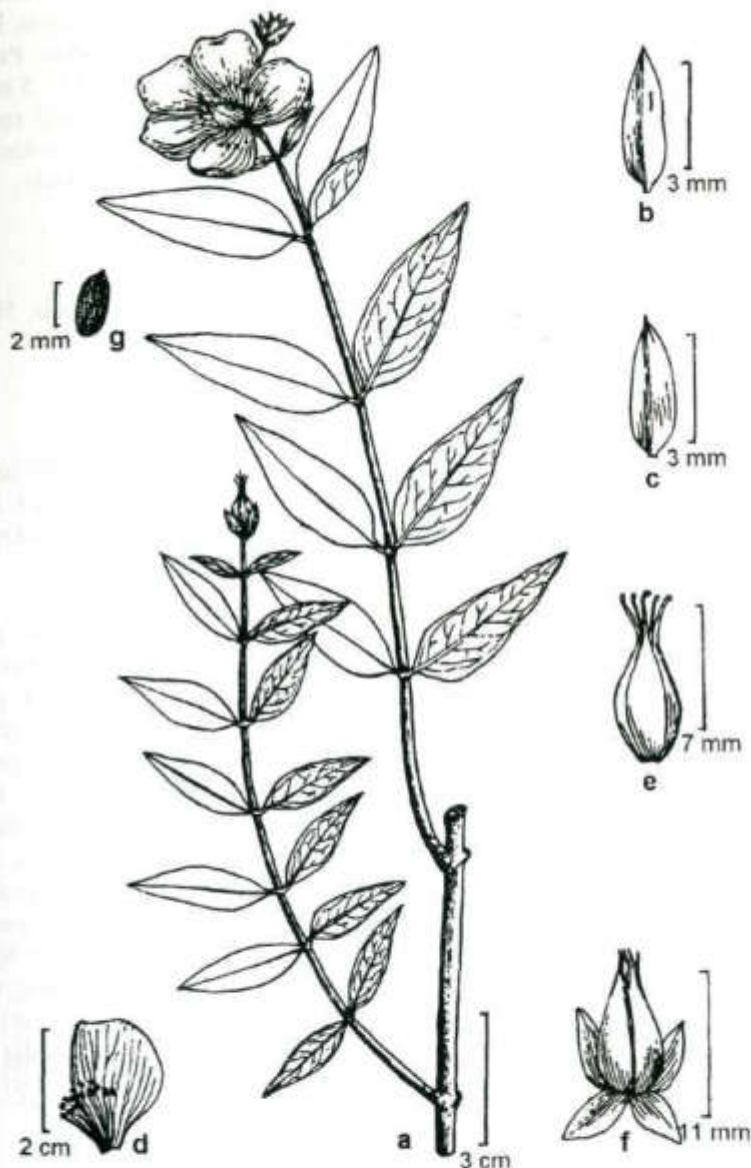


Fig. 18. *Hypericum choisianum* Wallich ex N. Robson : a. flowering branch; b. & c. sepals; d. petal with a fascicle of stamens; e. pistil; f. fruit with persistent calyx; g. seed.

glands; petioles 1 - 2 mm long. Flowers 2 - 4 or more in corymbose to subcorymbose cymes, 2 - 7 cm across; pedicels ca 1.2 cm long. Sepals 5 - 11 x 2 - 3 mm, linear to linear-lanceolate, rarely ovate-elliptic, acute, persistent, spreading in buds. Petals 11 - 20 x 3 - 4 mm. Stamens numerous in fascicles, ca 20 in each. Ovary 3.5 - 5 mm long, ellipsoid-oblong; styles longer than ovary, free, gradually divergent and spreading. Capsules 7 - 10 mm long, ellipsoid-oblong to globose with persistent styles, without vittae or vesicles. Seeds ca 1 mm long, apiculate, carinate; testa scarcely reticulate.

*Fl.* June - Aug.; *Fr.* Sept. - Nov.

*Distrib.* India: Himalayas from 900 to 2500 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal (Darjeeling).

Pakistan, Nepal and Bhutan.

**5. *Hypericum elodeoides*** Choisy in DC., Prodr 1: 551. 1824; Dyer in Fl. Brit. India 1: 255. 1874. *H. napaulense* Choisy in DC., Prodr. 1: 557. 1824; N. Robson in J. Jap. Bot. 52: 285. 1977. *H. adenophorum* Wallich [Cat. No. 4812. 1831, nom. nud.] ex Dyer in Fl. Brit. India 1: 256. 1874, pro syn. **Fig. 19.**

Perennial herbs, 15 - 75 cm high; stems erect, simple stoloniferous, terete, glabrous. Leaves sessile, clasping, 15 - 50 x 5 - 18 mm, lanceolate to ovate-lanceolate or oblong-lanceolate, cordate-amplexicaul to rounded at base, acute to obtuse at apex, glabrous, glaucous beneath; upper most 2 - 3 pairs of leaves below cymes usually with glandular-ciliate auricles and with intramarginal black glands; lateral veins 3 - 4 pairs, prominent and convergent towards apex. Flowers 3 - 15 in terminal corymbose racemes, 1 - 6.5 cm across; pedicels 4 - 10 mm long; bracts 5 - 7 mm long, linear-lanceolate, glandular-ciliate and intramarginally punctate with black glands. Sepals 5 - 7 x 1 - 1.5 mm, narrowly elliptic, lanceolate to linear-lanceolate, acute, prominently black gland streaked beneath and glandular-ciliate. Petals 6 - 11 mm long, oblanceolate to spatulate, intramarginally punctate with a line of black glands. Stamens numerous in 3 fascicle with ca 30 in each; filaments 6 - 7 mm long; anther connective gland-tipped. Ovary 2.5 - 3 mm long, narrowly ovoid to ovoid-oblong, 3-locular; styles 4 - 4.5 mm long. Capsules 4 - 6.5 x 4 - 5.5 mm, ovoid to ovoid-oblong with longitudinal vittae. Seeds ca 0.6 mm long, oblong rounded at both ends; testa scalariform-reticulate.

#### KEY TO THE SUBSPECIES

- 1a. Sepals and bracts glandular-ciliate; bracts and upper most leaves glandular-auriculate; leaves acute to subacute, prominently nerved beneath with conspicuous pellucid gland dots 5.1. subsp. **elodeoides**
- b. Sepals and bracts entire or eciliate; bracts and upper most leaves not glandular auriculate; leaves obtuse to rounded, inconspicuously nerved beneath with obscure gland dots 5.2. subsp. **wardii**





Fig. 19. *Hypericum elodeoides* Choisy : a. flowering branch; b. sepal; c. petal.

**5.1. subsp. *elodeoides***

*Fl.* June - Aug.; *Fr.* Oct. - Nov.

*Distrib.* India: Himalayas from Jammu & Kashmir to Arunachal Pradesh and Meghalaya.

China (Yunnan).

**5.2. subsp. *wardii*** N. Robson in J. Jap. Bot. 52: 286. 1972.

*Distrib.* India: Manipur (Mt. Sirohi ca 2400 m).

Myanmar (Mt. Victoria between 2475 and 2700 m).

*Notes.* It has been collected only once in 1948.

**6. *Hypericum filicaule*** (Dyer) N. Robson in Bull. Brit. Mus. Nat. Hist. Bot. 5: 305. 1977. *Ascyrum filicaule* Dyer in Fl. Brit. India 1: 252. 1874.

Perennial herbs, 6 - 15 cm high; stems simple, slender, creeping, occasionally decumbent at base, rooting at basal nodes, terete, glabrous. Leaves sessile to subsessile, 5 - 15 x 4 - 9 mm, broadly elliptic to obovate, obtuse to attenuate at base, obtuse at subacute at apex, entire or crispy, glabrescent to white puberulent, sparsely punctate gland-dotted beneath, veins obscure above and prominent beneath. Flowers 4.5 - 5 cm across, solitary, terminal; pedicels ca 1 mm long, glabrous. Sepals 4 (2 + 2), 4 - 6 x 1 - 1.5 mm, narrowly elliptic, cuneate at base, acute at apex, serrulate towards apex. Petals 4, 5 - 6.5 x 1.3 - 1.5 mm, broadly lanceolate, acute to acuminate at apex, entire. Stamens numerous in whorls, 3 - 4.2 mm long; filaments filiform. Ovary ca 3 mm long, ovoid; styles 4, 1 - 2 mm long; stigmas capitate. Capsules 3.5 mm long (when young), ovoid-oblong, without vittae or vesicles.

*Fl.* July - Aug.; *Fr.* Oct. - Nov.

*Distrib.* India: Temperate E. Himalayas between 3500 and 4000 m. Sikkim.

Endemic.

**7. *Hypericum gaitii*** Haines in J. Asiat. Soc. Beng. n.s. 15: 311. 1919 & Bot. Bihar & Orissa 1: 52. 1925. **Fig. 20.**

Shrubs, erect, much-branched, glabrous, 1 - 2 m high; stems stout, terete, reddish brown. Leaves sessile, 4 - 8 x 1 - 2.5 cm, elliptic-oblong, oblong-lanceolate to oblanceolate, subamplexicaul at base, subacute at apex, entire, chartaceous, glabrous, glaucous

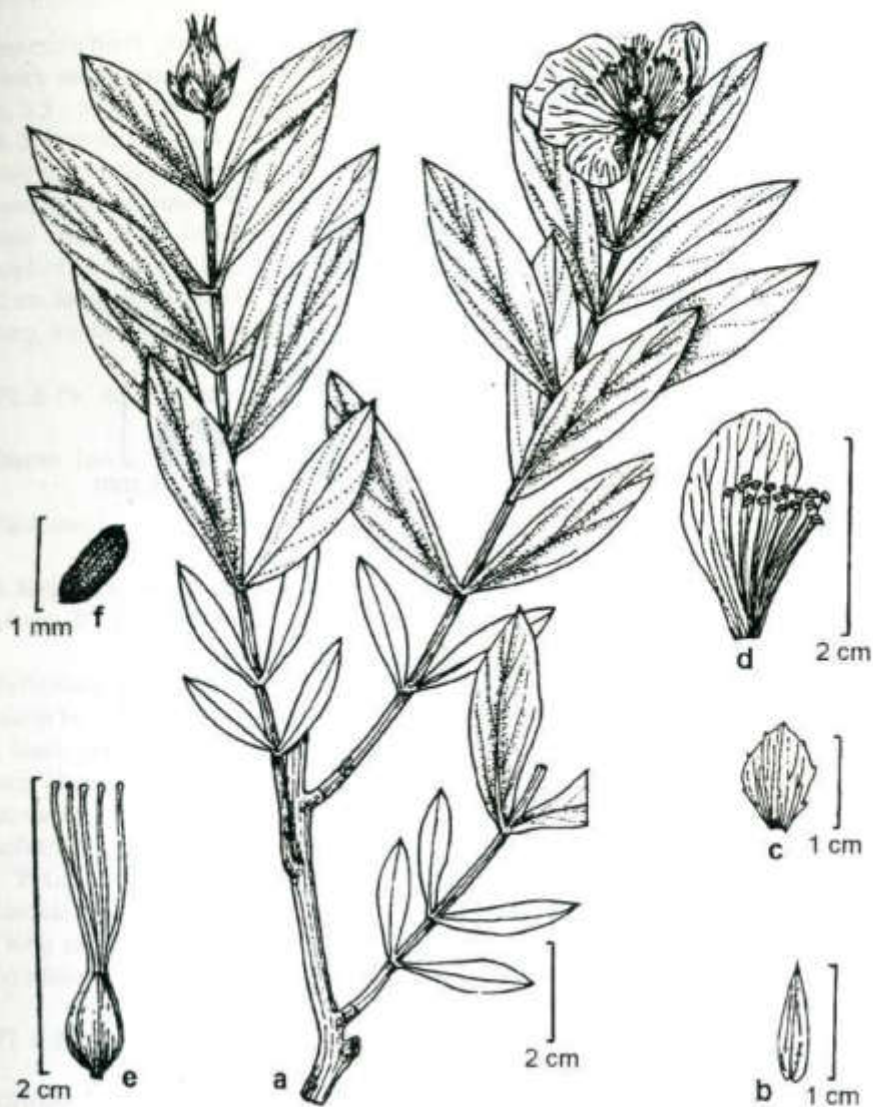


Fig. 20. *Hypericum gaitii* Haines : a. branch showing flower and fruit; b. bract; c. sepal; d. petal with a fascicle of stamens; e. pistil; f. seed.

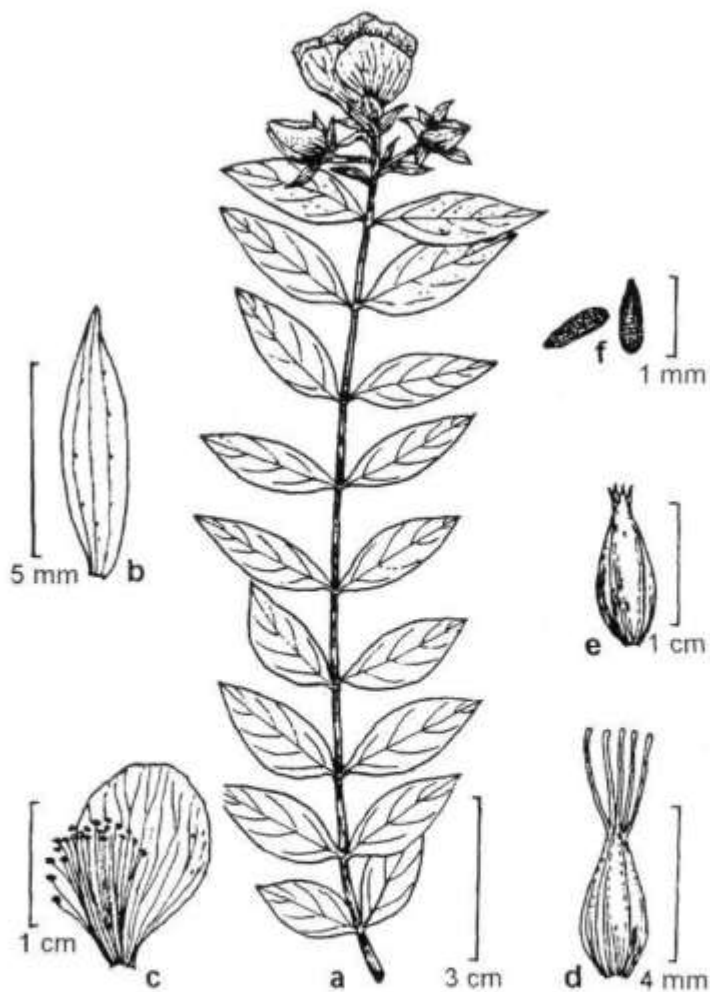


Fig. 21. *Hypericum gracilipes* Stapf ex C.E.C. Fischer : a. flowering branch; b. sepal; c. petal with a fascicle of stamens; d. pistil; e. fruit; f. seeds.

and punctate black glandular beneath, lateral veins 2 - 3 pairs, parallel, arching towards apex with an intramarginal vein. Flowers yellow, 5 - 6 in 1 - 2-chotomous, terminal cymes, 3.5 - 5 cm across; pedicels 7 - 12 mm long in flowers, 15 - 20 mm long in fruits. Sepals 5, free to the base, 10 - 14 x 4 - 8 mm, ovate to ovate-lanceolate, acute at apex, distantly serrulate, black glandular punctate. Petals 2.4 - 2.8 cm long, obliquely obovate or obovate, prominently veined, black glandular punctate. Stamens numerous in 5 fascicles with ca 25 in each; filaments 1.4 - 1.6 cm long. Ovary 6 - 7 mm long, ellipsoid-oblong; styles 5, 1 - 1.5 cm long, slender, erect, free; stigmas capitate. Capsules 1.5 - 2 cm long, ellipsoid-oblong, tipped with persistent styles. Seeds numerous, ca 1.2 mm long, linear-oblong, acute to subacute at both ends, scalariform-reticulate.

*Fl. & Fr.* April - June.

*Distrib.* India: Bihar, Orissa and Madhya Pradesh.

Endemic.

**8. *Hypericum gracilipes*** Stapf ex C. Fischer in Bull. Misc. Inform. 1940: 32. 1940; N. Robson & Long in Grierson & Long, Fl. Bhutan 1: 375. 1984. **Fig. 21.**

Suffruticose shrubs, 70 - 80 cm high; stems and branches terete, glabrous, suffused with deep brown colour. Leaves 2 - 3.5 x 0.8 - 1.5 cm, lanceolate to broadly cuneate at base, black glandular punctate beneath, veins 2 - 3 pairs arising below the middle, obscure above, prominent beneath; petioles 0.5 - 1.5 mm long. Flowers 2 - 5 in dichotomous cymes, 2.5 - 3.5 cm across; pedicels 8 - 10 mm long; bracts 9 - 10 mm long, lanceolate. Sepals 7 - 8 x 1.5 - 2 mm, lanceolate to oblanceolate, acute to subacute at apex. Petals 1 - 1.5 x 1 - 1.2 cm, broadly obovate, rounded at apex. Stamens numerous in 5 fascicles with ca 30 in each, 6 - 6.5 mm long. Ovary 6 - 6.5 mm long, ellipsoid; styles 5, as long as ovary, slender, straight; stigmas capitate. Capsules ca 1.3 cm in diam., tipped with persistent styles. Seeds 0.8 mm long; testa scalariform-reticulate.

*Fl. & Fr.* June - July.

*Distrib.* India: West Bengal (Darjeeling), Sikkim, Meghalaya and Nagaland.

Endemic.

**9. *Hypericum gramineum*** G. Forster, Fl. Ins. Austr. 53. 1786; N. Robson & Long in Grierson & Long, Fl. Bhutan 1: 374. 1984. *H. lalandii* auct. non Choisy 1824; Dyer in Fl. Brit. India 1: 256. 1874. **Fig. 22.**

Annual or perennial herbs, 5 - 75 cm high; stems erect or rarely decumbent, branching from the base but unbranched below cymes, 4-lined, glabrous. Leaves sessile, closely appressed to the stem, 4 - 12 x 1 - 3 mm, ovate, linear-lanceolate or oblong,

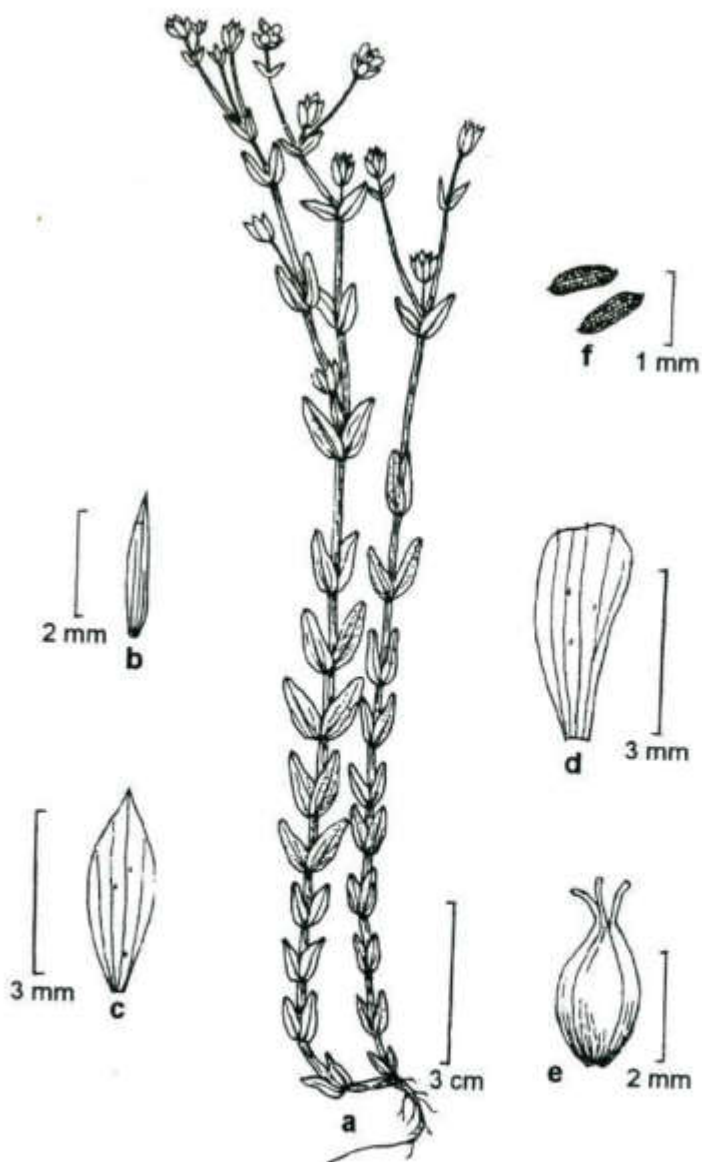


Fig. 22. *Hypericum gramineum* G. Forster : a. habit; b. bract; c. sepal; d. petal; e. pistil; f. seed.

cordate-amplexicaul to rounded or sometimes cuneate at base, obtuse to rounded at apex, glaucous beneath, laminar glands pale to brown, small and dense above, large and sparse beneath, intramarginal glands obscure. Flowers orange, ca 30 in lax dichasial or monochasial cymes, 1 - 2 cm across; pedicels 2 - 2.5 mm long; bracts 2.5 mm long, linear-lanceolate, acute. Sepals subequal, free, imbricate, 3 - 6 x 1 - 4.5 mm, lanceolate, ovate-lanceolate to narrowly elliptic, acute to apiculate, entire, 3 - 5-nerved with prominent midvein; laminar glands translucent, linear towards base, punctate towards apex, marginal glands obscure. Petals pale orange or bright orange, 3.5 - 7 x 2 - 4 mm, obovate to oblanceolate, mucronulate to rounded at apex, entire, persistent. Stamens ca 30 - 50, not in defined fascicles, 2.5 - 4 mm long; anthers yellow with apical gland. Ovary 1.5 - 2.5 mm, narrowly ovoid to ellipsoid; styles 3, rarely 4, 0.7 - 2 mm long, divergent; stigmas capitate. Capsules 2.5 - 6.5 x 1 - 3.5 mm, narrowly ovoid, without vittae and vesicles. Seeds ca 0.6 mm long, oblong, apiculate at one end; testa, scalariform-reticulate.

*Fl. & Fr.* June - Aug.

*Distrib.* India: Meghalaya.

Bhutan, Vietnam, Taiwan, China (Yunnan), New Guinea, Australia, New Zealand and New Caledonia.

**10. *Hypericum griffithii* Hook. f. & Thomson ex Dyer in Fl. Brit. India 1: 254. 1874; emend. S.N. Biswas in Bull. Bot. Surv. India 13: 160. 1971.**

Shrubs, ca 1 - 3 m high; stems stout, terete, dark reddish brown. Leaves sessile, 4 - 10.5 x 2.5 - 5.5 cm, broadly ovate to ovate-oblong, subcordate or subamplexicaul at base, obtuse with a minute mucro to sharply acute at apex, entire, glabrous on both surfaces, thinly coriaceous, delicately reticulate, sparsely black glandular punctate beneath, veins depressed above and raised beneath; lateral veins 6 - 8 pairs, arching towards apex with intramarginal veins. Flowers up to 20 in trichotomous, terminal corymbose cymes, 4 - 10 cm across; pedicels 8 - 20 mm long; bracts 2.5 - 3.5 mm long, lanceolate, acute at apex. Sepals 5, free, 4 - 5 x 1.5 - 2 cm, triangular to ovate-lanceolate, acute to acuminate at apex, chartaceous, punctate glandular towards margin, persistent. Petals 5, membranous, yellow, 1.8 - 2 x 1 cm, spatulate-obovate, prominently veined, black glandular punctate. Stamens numerous in 5 fascicles with ca 20 in each, 8 - 9 mm long; filaments unequal; anthers up to 0.7 mm long, oblong, dorsifixed. Ovary 5 - 7.5 mm long, ellipsoid-oblong, 5-locular, with ovules on axile placentation; styles 5, 8.5 - 9.5 mm long, free, erect; stigmas capitate. Capsules 10 - 15 x 7 - 10 mm, globose, ellipsoid to ellipsoid-oblong, tipped with persistent styles. Seeds ca 0.9 mm long, oblong, acute at both ends, scalariform-reticulate, brown.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Arunachal Pradesh.

Bhutan and China (Tibet).

**11. *Hypericum himalaicum*** N. Robson in J. Jap. Bot. 52: 287. 1977. *H. pallens* D. Don, Prodr. 219. 1825, nom. illeg. p.p. excl. type, non Banks & Solander 1794. *H. setosum* Wallich [Cat. No. 4814. 1831, nom. nud.] ex Dyer in Fl. Brit. India 1: 256. 1874, pro syn., non L. 1753. *H. napaulense* auct. non Choisy, 1824; Dyer in Fl. Brit. India 1: 256. 1874, p.p. *H. wightianum* auct. non Wallich ex Wight & Arn., 1834; Banerjee in J. Bombay Nat. Hist. Soc. 51. 774. 1953. *H. humifusum* auct. non L. 1753; Kimura in Hara, Fl. E. Himal. 209. 1966.

Perennial herbs; stems 10 - 40 cm long, erect or decumbent or creeping, rooting at basal nodes, more or less terete, eglandular. Leaves sessile or with 1 - 2 mm long petioles, 1 - 2 x 0.5 - 1.5 cm, ovate, oblong or elliptic-oblong, cordate, rounded to cuneate at base, obtuse to rounded or rarely retuse at apex, entire, glaucous and prominently reticulate beneath, obscurely pellucid punctate, especially along margins beneath, veins 3 - 4 pairs, arching upwards. Flowers solitary or up to 12 in axillary, subcorymbose cymes, 1.5 - 4 cm across; pedicels 2 - 4 mm long; bracts 4.5 - 5 mm long, lanceolate, auriculate, glandular-ciliate, punctate with black marginal glands. Sepals 5, 4.5 - 6 x 1 - 2 mm, ovate-lanceolate to elliptic-lanceolate, black glandular-ciliate. Petals yellow, 6 - 9 x 2 - 3 mm, oblong-oblancoate, persistent. Stamens numerous in fascicles with 10 - 25 in each, persistent; anthers apiculate with black glands. Ovary 2 - 3.5 x 1.5 - 2 mm, ovoid; styles always 3, 2 - 2.5 mm long. Capsules 4 - 8.5 x 2.5 - 6 mm, ellipsoid, longitudinally vittate. Seeds minute, oblong, rounded at both ends, testa densely scalariform-reticulate.

*Fl. & Fr.* July - Aug.

*Distrib.* India: Himalayas from 912 to 3500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and West Bengal (Darjeeling).

Nepal and Bhutan.

**12. *Hypericum hookerianum*** Wight & Arn., Prodr. 99. 1834; Dyer in Fl. Brit. India 1: 254. 1874, p.p. excl. var. *leschenaultii*. *Norysca hookeriana* (Wight & Arn.) Wight, Ill. Ind. Bot. 1: 113. 1838.

*Nep.*: *Mehandiphul*.

Shurbs glabrous, 2 - 2.5 m high; stems stout, terete; branchlets terete or slightly angular or compressed. Leaves with petioles up to 2 mm long, 2 - 9 x 1 - 3.5 cm, ovate or ovate-oblong to broadly lanceolate, subrotund to cuneate at base, obtuse to subacute, sometimes obtuse to rounded, mucronulate at apex, entire, glabrous on both surfaces, punctate, black glandular above. Flowers showy, yellow, solitary or 3 - 10 in 1 - 3-chotomous, corymbose or subcorymbose cymes, 4.5 - 6 cm across; bracts caducous.



Sepals 5, 6 - 10 x 5 - 8 mm, obovate-elliptic to obovate or suborbicular, subobtuse to rotund at apex, entire or closely dentate towards apex and distantly towards base, persistent. Petals 5, 1.5 - 2 x 2 - 2.5 cm, obliquely obovate, black and brown glandular punctate. Stamens 6 - 10 mm long, numerous, in 5 fascicles; filaments unequal, glabrous. Ovary 5 - 10 mm long, ovoid-oblong; styles 5, free. Capsules 1 - 1.5 cm long, ovoid-oblong to ovoid, tipped with persistent styles. Seeds 0.5 mm long, shortly apiculate, scalariform-reticulate, brownish-black.

## KEY TO THE VARIETIES

- 1a. Sepals entire, obtuse to rounded and mucronate to mucronulate at apex 2  
 b. Sepals closely dentate towards apex and distantly towards base, acute at apex 12.1. var. *dentatum*  
 2a. Leaves ovate-oblong to broadly lanceolate, mucronate to mucronulate at apex 12.2. var. *hookerianum*  
 b. Leaves ovate, obtuse to rounded at apex 12.3. var. *lobbii*

**12.1. var. *dentatum*** S.N. Biswas in Bull. Bot. Surv. India 25: 195. 1985. Fig. 23.

*Fl. & Fr.* June - Sept.

*Distrib.* India: Sikkim, Meghalaya and Tamil Nadu (in Shola forests).

Endemic.

**12.2. var. *hookerianum***

*Kh.*: *Lalyn-heh, Mat-iar-stem.*

*Fl.* April - June; *Fr.* Oct. - Nov.

*Distrib.* India: Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh and Nagaland, Manipur, Meghalaya, Karnataka and Tamil Nadu (in Shola forests).

Nepal, Bhutan and Mynamar.

**12.3. var. *lobbii*** (N. Robson) S.N. Biswas, *comb. et stat. nov.* *Hypericum lobbii* N. Robson in J. Roy. Hort. Soc. 95: 496. 1970. *Hypericum oblongifolium* Hook. f. in Curtis's Bot. Mag. t. 4949. 1856, non Choisy 1821.

*Fl.* April - June; *Fr.* Oct. - Nov.

*Distrib.* India: Meghalaya (Khasi hills).

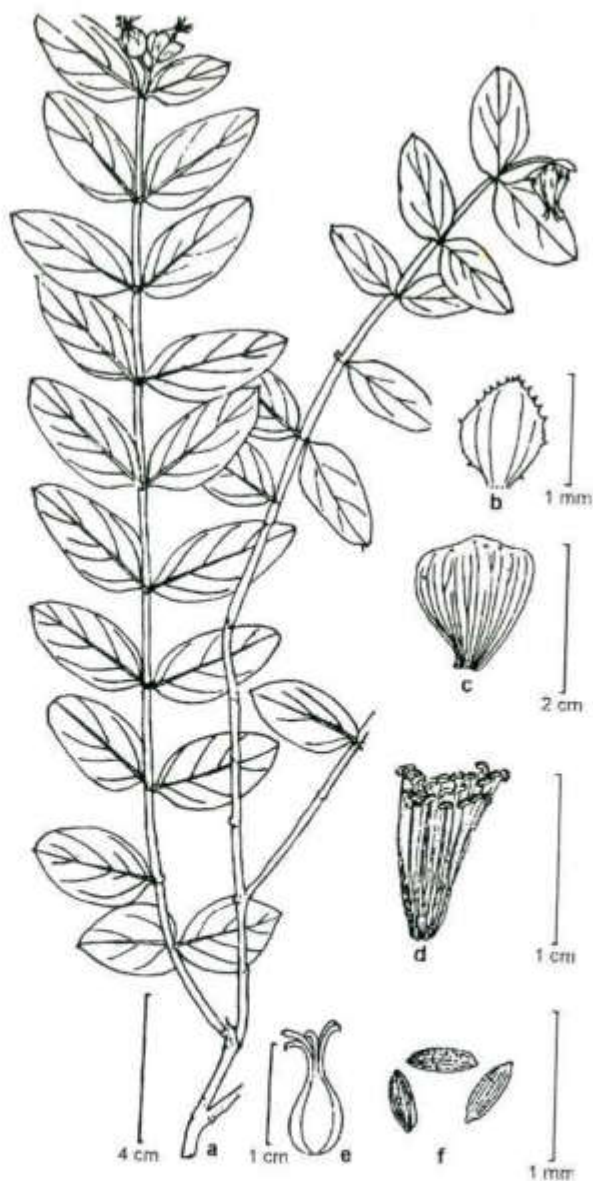


Fig. 23. *Hypericum hookerianum* Wight & Arn. var. *dentatum* S.N. Biswas :  
 a. flowering branch; b. sepal; c. petal; d. fascicle of stamens; e. pistil;  
 f. seeds.

## Endemic.

*Note.* This variety is known by a single collection of *T. Lobb s.n.* from Mafflong in Khasi hills of Meghalaya. Despite intensive botanising in and around this locality it has not been re-collected so far.

13. *Hypericum humifusum* L., Sp. Pl. 2: 785. 1753; Dyer in Fl. Brit. India 1: 255. 1874.

Herbs, perennial, decumbent or procumbent, glabrous, 5 - 25 cm high; stems subterete to 2-lined, reddish-purple, rooting at basal nodes. Leaves sessile or subsessile, 3.5 - 14 x 3 - 10 mm, broadly oblong, suborbicular, elliptic, ovate, obovate to lanceolate, rounded to cordate and glandular ciliate at base, obtuse to rounded or rarely retuse at apex, minutely pellucid gland-dotted beneath, veins obscure above, prominent and flat beneath. Flowers 1 - 3 in terminal, corymbose cymes, 6 - 12 mm across, pedicels 1.5 - 5.5 mm long; bracts foliaceous, ca 4 mm long, ovate, acute, punctate, black gland-dotted. Sepals 2.5 - 4 x 1 - 2.5 mm, ovate to broadly lanceolate, punctate with black intramarginal glands. Petals 3 - 6.5 mm long, oblanceolate, obtuse, occasionally black gland-dotted near apex and margin. Ovary 2.5 - 3 mm long, subglobose or ovoid; styles 3, ca 2 mm long, free; stigmas capitate. Capsules 3.5 - 5 x 2.5 - 3 mm, globose or ovoid-ellipsoid, as long as or longer than sepals. Seeds minute, oblong, rounded at both ends, testa scalariform-reticulate.

## KEY TO THE SUBSPECIES

- 1a. Leaves 6 - 14 x 5 - 10 mm, oblong or obovate to oblanceolate; pedicels 1.5 - 1.8 mm long; sepals 3.5 - 4 x 2.2 mm, ovate to ovate-lanceolate; capsules 4 - 4.5 x 3.2 mm, globose 13.1 subsp. *humifusum*  
 b. Leaves 3.5 - 9 x 3 - 8 mm, suborbicular; pedicels 3 - 5.5 mm long; sepals 2.7 x 1.5 mm, lanceolate; capsules 3.5 - 5 x 2.5 - 3 mm, ovate-elliptic 13.2 subsp. *suborbiculatum*

13.1. subsp. *humifusum*

*Fl. & Fr.* Sept. - Dec.

*Distrib.* India: Karnataka and Tamil Nadu.

W. & C. Europe, C. Italy, N. Albania, S. Romania and C.I.S.

13.2. subsp. *suborbiculatum* S.N. Biswas in Bull. Bot. Surv. India 29: 53. 1989.

Fig. 24.

*Fl. & Fr.* July - Sept.

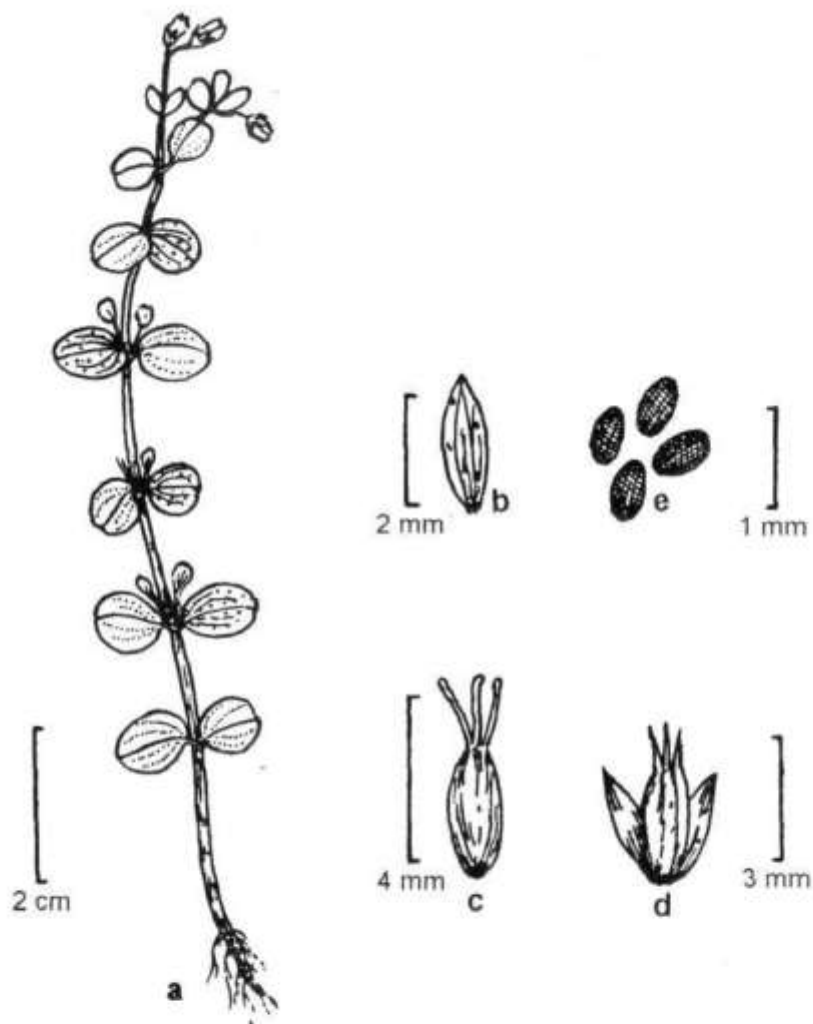


Fig. 24. *Hypericum humifusum* L. subsp. *suborbiculatum* S.N. Biswas : a. habit; b. sepal; c. pistil; d. fruit with persistent calyx; e. seeds.

*Distrib.* India: West Bengal(Darjeeling).

Nepal.

**14. *Hypericum japonicum*** Thunb. ex Murray, Syst. Veg. ed. 14: 702. July 1784; Thunb., Fl. Jap. 295, t. 31. Aug. 1784; Dyer in Fl. Brit. India 1: 256. 1874; Fyson, Fl. S. Ind. Hill. Stat. 2: t. 32. 1932 incl. var. *majus*. **Fig. 25.**

Annual herbs, 6 - 30 cm high; stems erect, decumbent or prostrate, rooting at basal nodes, dichotomously branched, branches 4-lined, glabrous. Leaves sessile, 3 - 9 x 1 - 5 mm, elliptic to ovate or oblanceolate, cordate-amplexicaul to attenuate at base, obtuse to rounded at apex, pellucid punctate along margins. Flowers yellow, 1 - many in dichasial or monochasial cymes, 8 - 10 mm across; pedicels 5 - 7 mm long; bracts 2 - 2.5 mm long, linear-lanceolate. Sepals 5, free, 3 - 4.5 x 1 - 2.5 mm, outer 2 ovate, inner 3 oblong to oblanceolate, acute or rounded, entire, prominently 2-3-veined, punctate with pellucid black glands along margins, persistent. Petals yellow, as long as or shorter than sepals, elliptic to obovate, persistent. Stamens 5 - 30 in apparently 3 fascicles, obscurely united into a ring at base, 2.5 - 3 mm long. Ovary 2 - 3 mm long, ovoid to subglobose, unilocular; styles 3, free, up to 1.2 mm long. Capsules 4 - 4.5 mm long, ovoid, as long as persistent sepals, without vittae or vesicles. Seeds oblong; testa ribbed, transverse-striate.

*Fl.* Almost throughout the year; *Fr.* Nov. - Feb.

*Distrib.* India: Chiefly in Himalayas, N.E. region and Western Ghats from 600 to 2500 m. Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Meghalaya, Mizoram, Manipur, Orissa, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, N. Thailand, Vietnam, Korea, China, Taiwan and Malesia.

*Notes.* This is one of the very widely distributed and extremely variable species. Although a number of segregate species and infraspecific taxa are published, it is almost impossible to clearly distinguish them as the variations are continuous. Robson (in Fl. Males. 1, 8: 28. 1974) distinguished 5 varieties based on combination of a number of characters and geographical distribution, but even among these 5 variants there is overlapping of characters, therefore, it is best to consider this taxon as a species complex rather than segregating them based on some unreliable characters.

**15. *Hypericum monanthemum*** Hook. f. & Thomson ex Dyer in Fl. Brit. India 1: 256. 1874.

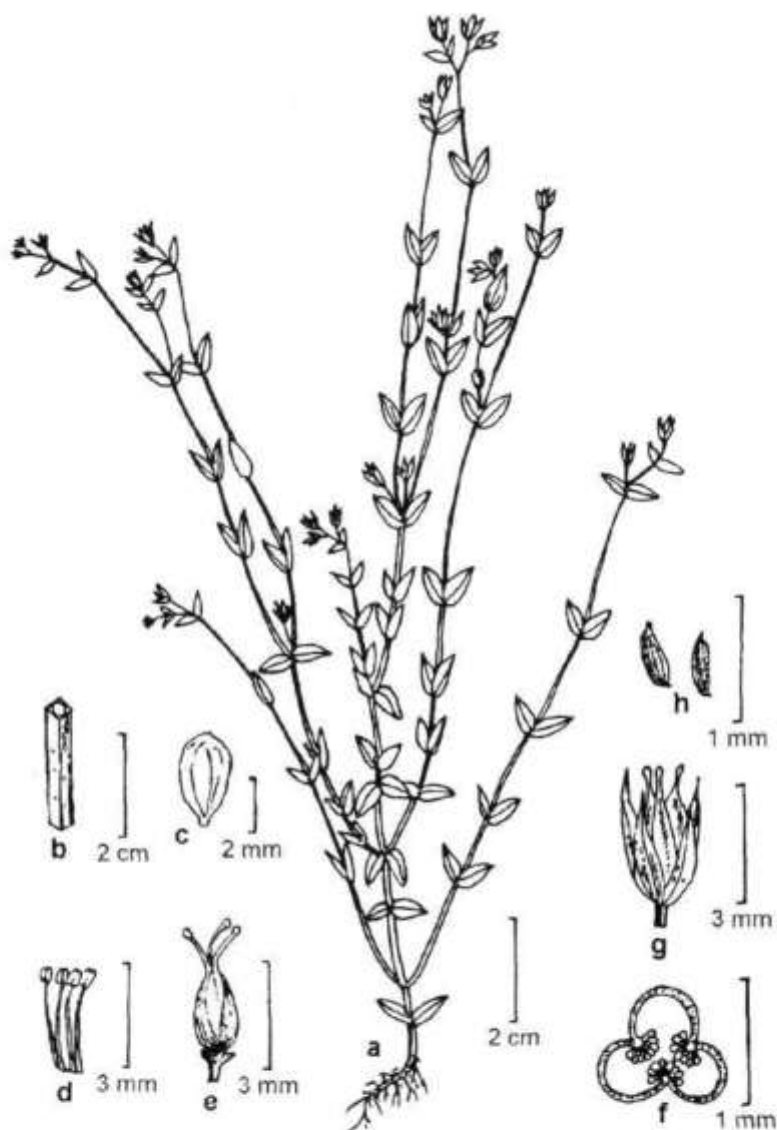


Fig. 25. *Hypericum japonicum* Thunb. ex Murray. : a. habit; b. portion of stem; c. petal; d. stamens; e. pistil; f. t.s. of ovary; g. fruit with persistent sepals; h. seeds.

Perennial, erect herbs, 10 - 30 cm high; stems often unbranched, subterete to 2-lined, slender, pale reddish-brown. Leaves sessile or with 1 - 1.5 mm long petioles, 7 - 17 x 4 - 11 mm, elliptic to elliptic-oblong, subamplexicaul or rounded to broadly cuneate at base, obtuse to rounded at apex, entire, glaucous beneath, veins 3 - 4 pairs, arching upwards, convergent towards apex, prominently reticulate, pellucid punctate above, scattered or with a line of punctate black glands beneath. Flowers often 4-merous, solitary or 2 - 3 in cymes, 9 - 17 cm across, subsessile; bracts 6 - 7 x 5 - 6 mm, elliptic or elliptic-oblong, ciliate and punctate with black glands. Sepals 5 - 6 x 2 - 3 mm, elliptic or broadly lanceolate, acute, glandular ciliate, streaked glandular towards middle. Petals 8.5 - 9.5 mm long, oblanceolate or globose. Stamens longer than pistil. Ovary 2.5 - 3 mm long, ovoid to subglobose; styles 3, very rarely 4, 1.8 - 2.2 mm long. Capsules 8 - 9 x 4 - 4.5 mm, ovoid to subglobose. Seeds oblong, rounded at both ends, testa scalariform-reticulate.

*Fl. & Fr.* June - Aug.

*Distrib.* India: In E. Himalayas, on exposed slopes between 1520 and 3850 m. West Bengal (Darjeeling), Sikkim and Assam.

Nepal and Bhutan.

**16. *Hypericum mysoreense*** Wight & Arn., Prodr. 99. 1834; Dyer in Fl. Brit. India 1: 253. 1874 '*mysoreense*'. *Norysca mysorensis* (Wight & Arn.) Wight, Icon. Pl. Ind. Orient. 3: t. 56. 1838. **Fig. 26.**

Erect, glabrous shrubs, 1 - 3 m high; stems stout, terete, brown to reddish-brown; branchlets obscurely 4-lined. Leaves sessile, ca 1.5 x 0.4 - 1.5 cm, elliptic-lanceolate to oblanceolate, attenuate to subamplexicaul at base with small auricles, acute at apex, entire, glabrous on both surfaces, main veins 1 - 2, arising from the base, parallel, prominent; lateral veins 3 - 4 pairs, arching downwards. Flowers golden yellow, 3.5 - 8 cm across; solitary or in 2 - 5-flowered terminal cymes, pedicels 1 - 2 cm long; bracts foliaceous. Sepals 5, 6.5 - 10 x 2.5 - 3.5 mm, ovate to ovate-oblong, acute at apex with a prominent midrib, sparsely black gland-dotted. Petals 2 - 4 x 0.7 - 1.5 cm, obovate to obliquely obovate, membranous towards margin, sparsely raised black glandular punctate. Stamens numerous in 5 fascicles with ca 40 - 50 in each; filaments 1.3 - 1.7 cm long, spreading; anthers globular. Ovary 6 - 7 mm long, ovoid, ovules numerous on axile placentation; styles 1 - 1.5 cm long, free or connate at base, erect; stigmas capitate. Capsules 11 - 15 x 6 - 7.5 mm, ovoid, 5-valved with filiform beak. Seeds numerous, ca 1.5 mm long, oblong; testa scalariform-reticulate.

*Fl.* Throughout the year (peaking in April - May).

*Distrib.* India: In open grasslands between 800 and 2100 m. Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.



Fig. 26. *Hypericum mysurense* Wight & Arn.



Sri Lanka and Tropical Africa.

**17. *Hypericum oblongifolium*** Choisy, Prodr. Monogr. Hyperic. 42, t. 4. 1821. *H. cernuum* Roxb. [Hort. Beng. 59. 1814, nom. nud.] ex D. Don, Prodr. 218. 1825; Dyer in Fl. Brit. India 1: 253. 1874.

Kasm.: *Pingniara*, *Piuli*.

Erect, glabrous shrubs, 1 - 2 m high; stems stout, procumbent or ascending, sometimes arching; branchlets 4-lined when young, terete when mature. Leaves sessile, 2 - 10 x 1 - 4 cm, oblong, elliptic to ovate-oblong or ovate-lanceolate, acute to cuneate at base, obtuse to subacute or rarely rounded at apex, entire, glabrous above, glaucous beneath, black glandular punctate on both surfaces; lateral veins 3 - 6 pairs, arching downwards forming a intramarginal vein, prominent and raised beneath. Flowers solitary or 2 - 6, in terminal, 1 - 5-chotomous corymbose cymes, 2.5 - 8 cm across; pedicels 1 - 3.5 cm long; bracts 1 - 9 mm long, lanceolate or linear-lanceolate, acute to acuminate at apex. Sepals 5 - 11 x 2 - 4 mm, ovate to elliptic-lanceolate, acute and apiculate to rarely obtuse to rounded at apex, entire, chartaceous, persistent, erect in bud, spreading in fruits. Petals 2 - 3 x 1 - 1.2 cm, narrowly obovate to obliquely obovate, prominently veined, sparsely black or brown glandular punctate. Stamens numerous in 5 fascicles, with ca 30 in each; filaments ca 1.6 cm long, filiform. Ovary 5 - 8 mm long, ovoid, 5-locular with ovules on axile placentation; styles 9 - 13 mm long, free, erect; stigmas capitate. Capsules 1 - 1.5 cm long, ovoid to ovoid-conical, devoid of vittae and vesicles. Seeds numerous, ca 1.2 mm long, acute to apiculate at ends, linear-foveolate to scalariform-reticulate.

*Fl.* Throughout the year; *Fr.* May - June.

*Distrib.* India: Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh.

Pakistan, Afghanistan and Nepal.

**18. *Hypericum perforatum*** L., Sp. Pl. 2: 785. 1753; Dyer in Fl. Brit. India 1: 255. 1874. **Fig. 27.**

Hindi.: *Basant*; Kash.: *Mongolu*; Punj.: *Dendlu*; Eng.: *Common St. John's weed*, *Kalamath weed*.

Perennial, glabrous herbs, 30 - 45 cm high; rootstock woody; branches ascending, subterete to 2-lined with black glands on raised lines. Leaves sessile or subsessile, 2 - 2.2 x 0.5 - 1 cm, ovate to elliptic-oblong, cuneate to rounded at base, obtuse to rounded and mucronate at apex, entire, punctate black gland-dotted or blotched along margins. Flowers yellow, solitary or many in terminal, trichotomously branched, corymbose or subcorymbose cymes, 2 - 2.5 cm across. Sepals 2.5 - 8 mm long, ovate-lanceolate to

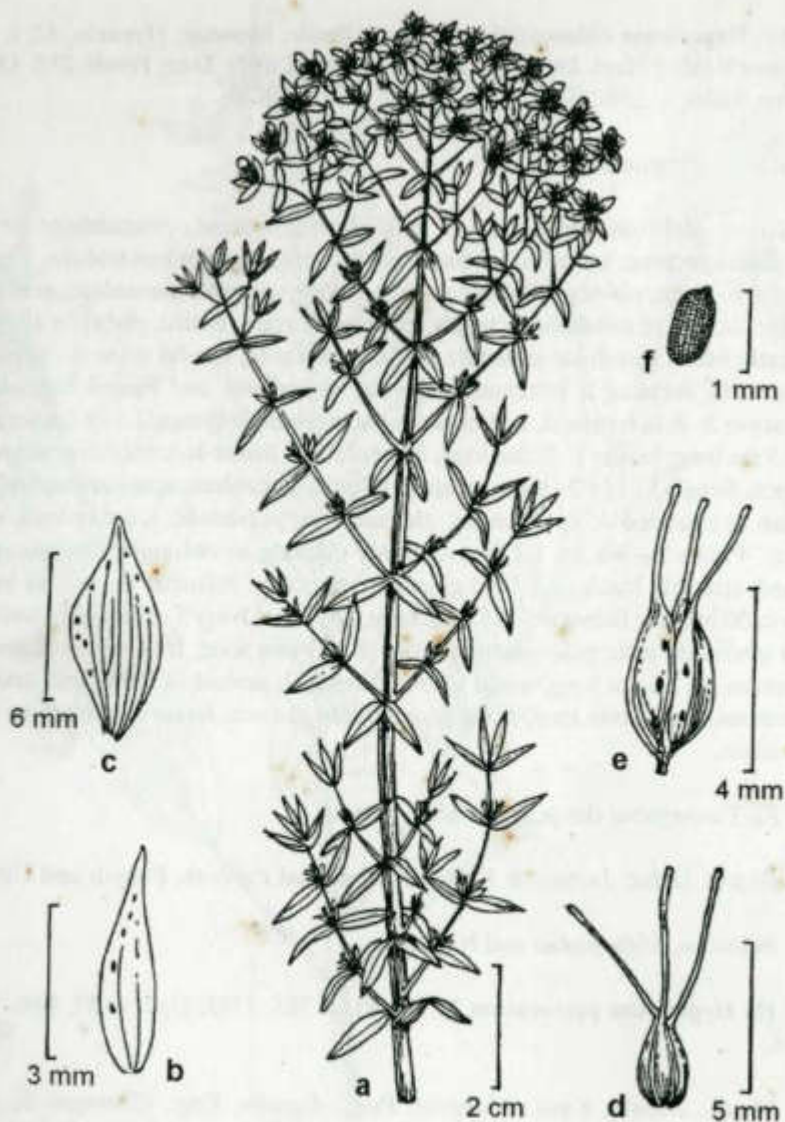


Fig. 27. *Hypericum perforatum* L. : a. flowering branch; b. sepal; c. petal; d. pistil; e. capsule with persistent styles; f. seed.

lanceolate, acute to acuminate or shortly aristate at apex, entire, with or without punctate black glands. Petals 8 - 10 mm long, narrowly oblanceolate, crenulate towards apex, punctate, black glandular or streaked along margin. Stamens numerous in 3 fascicles. Ovary 2 - 3.5 mm long, ovoid-conical, 3-locular; styles twice the length of ovary; stigmas capitate. Capsules 4.5 - 8.5 mm long, ovoid or pyramidal with dorsal vittae and lateral vesicles. Seeds ca 1 mm long, apiculate at one end, rounded at the other, testa scalariform-reticulate.

*Fl. & Fr.* June - Oct.

*Distrib.* India: In W. Himalayas from 1300 to 2800 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Afghanistan, Iran, Iraq, W. Syria, C. Asia, Russia(Siberia), Europe, N. Africa; introduced in E. Asia, America and Australia.

*Notes.* This species is reported to possess astringent, expectorant and diuretic properties and has been used in pulmonary disorders, diarrhoea and urinary troubles. It is also used externally for treating wounds, sores, ulcers, rheumatism and lumbago by employing an oil extracted by infusion of flowers in olive oil. An ointment made from aqueous extract of the plant is used as hair restorer.

This species is reported to be toxic to livestock when eaten in excess. Toxicity is attributed to 'hypericin' which causes haemolysis of red blood cells.

**19. *Hypericum petiolulatum* Hook. f. & Thomson ex Dyer in Fl. Brit. India 1: 255. 1874.**

Annual, prostrate or decumbent herbs, 20 - 40 cm high; stems and branches slender, terete, glabrous, usually reddish purple, rooting at basal nodes. Leaves 1 - 2.5 x 0.5 - 1.5 cm, ovate to ovate-elliptic or elliptic-lanceolate, cuneate to attenuate or rounded at base, obtuse to rounded at apex, glabrous, glaucous beneath, laminar glands pale with a few black, large usually prominent ones beneath, intramarginal ones much denser, lateral veins 2 - 3 pairs, slender, depressed above, raised beneath; petioles 1 - 3 mm long. Flowers yellow, 1 - 3 in terminal and axillary, lax cymes, 4 - 10 mm across; pedicels 8 - 15 mm long, slender. Sepals 2.5 - 3.5 mm long, linear, lanceolate to oblong-lanceolate, acute, entire, punctate black gland-dotted, persistent. Petals ca 4.5 - 5 x 1 - 1.5 mm, oblong-lanceolate to spatulate, subobtuse to obtuse at apex, entire, chartaceous, prominently veined, with or without punctate black or brown glandular along margins. Stamens numerous in 3 fascicles with ca 20 in each; filaments 3 - 3.5 mm long, glabrous; anthers yellow, oblong, with or without gland-tipped connective. Ovary 1.5 - 3 mm long, ellipsoid, ellipsoid-oblong to subglobose; styles 3, 1 - 1.7 mm long, free, erect; stigmas capitate. Capsules 4 - 5 mm long, broadly ovoid to globose or ellipsoid-

oblong, longitudinally vittate. Seeds numerous, ca 0.7 mm long, oblong, obtuse to rounded at ends; testa scalariform-reticulate.

*Fl.* May - June; *Fr.* July - Sept.

*Distrib.* India: In E. Himalayas between 1800 and 2200 m. Sikkim and West Bengal (Darjeeling).

Nepal, Bhutan, Myanmar, China and Indonesia.

**20. *Hypericum podocarpoides*** N. Robson in J. Jap. Bot. 52: 276. 1977. *H. acutum* Wallich [ Cat. No. 4807. 1831, nom. nud. ] ex Dyer in Fl. Brit. India 1: 253. 1874, non Moench 1784. *H. cordifolium* auct. non Choisy, 1824; Dyer in Fl. Brit. India 1: 253. 1874 p.p. quoad syn. *H. acutum* Wallich. *H. hookerianum* Wight & Arn. var. *linearis* M.L. Banerji in J. Ind. Bot. Soc. 31: 152. 1952.

Erect, glabrous shrubs, 1 - 1.5 m high; stems and branches stout, terete. Leaves sessile, 2 - 5.5 x 0.5 - 1.5 cm, linear to narrowly lanceolate or oblong-lanceolate, subamplexicaul to subcordate at base, acute to subacuminate at apex, glaucous beneath, coriaceous to subcoriaceous, laminar glands black punctate, veins obscure. Flowers yellow, ca 8 - 10 in subcorymbose cymes, 3 - 6.2 cm across; pedicels 1 - 2 cm long; bracts 5.5 - 12 x 1.5 - 3 mm, ovate-lanceolate, acute, foliaceous. Sepals 5, free, 9.5 - 12.5 x 2.5 - 4 mm, lanceolate, acute at apex, sparsely black glandular punctate. Petals 5, ca 1.5 cm long, narrowly obovate, punctate with raised glands, chartaceous. Stamens numerous in 5-fascicles with ca 16 in each; filaments 9 - 12 mm long, unequal; anthers ca 0.8 x 0.8 mm. Ovary 4.5 - 6 mm long, ovoid, narrowed into a short stipe at base; styles 5, 3.5 - 6 mm long, unequal, erect, recurved at tips. Capsules 9 - 11 mm long, ovoid-ellipsoid, tipped with persistent styles. Seeds numerous, ca 0.8 mm long, narrowly oblong, apiculate at both ends; testa scalariform-reticulate.

*Fl.* June - July; *Fr.* Aug. - Oct.

*Distrib.* India: In W. Himalaya between 1300 and 2000 m. Uttar Pradesh.

Nepal.

**21. *Hypericum reptans*** Hook. f. & Thomson ex Dyer in Fl. Brit. India 1: 255. 1874.

Prostrate, glabrous undershrubs or shrubs; stems suberect or decumbent, creeping, rooting at basal nodes; branchlets slender, 2-lined. Leaves sessile, 8 - 12 x 3 - 5 mm, broadly elliptic or elliptic-oblong to ovate-oblong, attenuate or acute at base, obtuse to rounded at apex, entire, glabrous, sparsely punctate with black gland dots or streaks. Flowers yellow, solitary, terminal, ca 3 cm across. Sepals 5, free, 8.5 - 9.5 x 3 - 4 mm, obovate, obscurely crenulate towards apex. Petals 5, 13 - 15 x 12 mm, obliquely obovate,

prominently dichotomously veined, membranous, sparsely punctate with black glands. Stamens numerous in fascicles with ca 17 in each; filaments ca 5 mm long, unequal, glabrous; anthers ca 0.8 mm long. Ovary 4 - 5 mm long, globose to subglobose; styles 5, 3 - 3.7 mm long, free, recurved at apex; stigmas capitate. Capsules 6.5 - 7 x 6 mm, globose, somewhat fleshy, indehiscent. Seeds numerous, ca 0.7 mm long, ovate to ovate-oblong, apiculate at both ends; testa scalariform-reticulate.

*Fl.* July - Aug.; *Fr.* Sept. - Oct.

*Distrib.* India. E. Himalayas between 2700 and 3000m . Sikkim.

Nepal, Myanmar and China (Yunnan).

**22. *Hypericum tenuicaule*** Hook. f. & Thomson ex Dyer in Fl. Brit. India 1: 254. 1874.

Shrubs, ca 1 m high; stems and branches diffuse, slender, terete, glabrous, reddish brown. Leaves subsessile, 1.8 - 3 x 0.7 - 1.3 cm, ovate to ovate-elliptic, cuneate to attenuate at base, acute to subobtusate at apex, entire, glabrous on both surfaces, sparsely punctate, gland-dotted, lateral veins 3 - 4 pairs, arching upwards, prominent. Flowers yellow, terminal, solitary or in cymes, ca 1.8 cm across; pedicels 1 - 2 cm long; bracts ca 1.2 mm long, linear - lanceolate, acute at apex. Sepals 5, free, 3.5 - 5 x 1.5 - 2.5 mm, obovate - oblong to oblong, subobtusate at apex, punctate, gland-dotted along margins, persistent. Petals 5, 1 - 1.3 cm long, obliquely obovate, prominently veined, punctate with black glands. Stamens numerous in 5 fascicles with ca 25 in each; filaments 5 - 6 mm long, unequal, glabrous; anthers ca 0.5 - 0.7 mm long, oblong. Ovary 5 - 6.5 x 2.5 - 3 mm, ellipsoid-oblong; styles 5, about as long as ovary.

*Fl. & Fr.* Aug. - Sept.

*Distrib.* India: In E. Himalayas between 2100 and 2500 m. Sikkim, Assam and Nagaland.

Endemic.

**23. *Hypericum uralum*** Buch.-Ham. ex D. Don in Sims, Bot. Mag. t. 2375. 1823 & Prodr. 218. 1825. *H. patulum* auct. non Thunb. ex Murray; Wallich [ Cat. No. 4809. 1831, nom. nud.] ex Dyer in Fl. Brit. India 1: 254. 1874. *Norysca urala* (Buch.-Ham. ex D. Don) K. Koch, Hort. Dendrodl. 66. 1853; Kimura in Hara, Fl. E. Himal. 210. 1966.

Asm.: *La-syn-rit*; Bhoj.: *Thumbul*; Kh.: *Dieng-syn-tiwsanum*, *Dieng-Soh-Salam*; Nep.: *Urilo*.

Shrubs, up to 2.5 m high; stems and branches 4-lined when young, 2-lined or terete when mature. Leaves subsessile, 1.5 - 2.5 x 0.5 - 1.5 cm, lanceolate to ovate-lanceolate, cuneate at base, subacute to obtuse at apex, minutely apiculate, glaucous beneath, lateral veins obscure, ascending and convergent at apex. Flowers yellow or golden yellow in few-flowered corymbose cymes, 1.5 - 4 cm across. Sepals 5.5 - 8 x 3.5 - 4.5 mm, elliptic to elliptic-oblong, obtuse to subrotund at apex, entire, punctate, black gland-dotted. Petals 1 - 1.5 x 0.5 - 1 cm, suborbicular to obovate, entire, caducous, punctate, pale gland-streaked. Stamens numerous in 5 fascicles with ca 40 - 50 in each, caducous; filaments ca 5 mm long; anthers bright orange red. Ovary 3 - 6 mm long, ovoid to globose; styles 5, as long as ovary, connate at base, recurved near apex. Capsules 7 - 10 mm long, ovoid to globose, without vittae or vesicles. Seeds ca 0.5 mm long; testa scalariform-reticulate.

*Fl. & Fr.* July - Oct.

*Distrib.* India: In Himalayas between 1500 and 3350 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal (Darjeeling), Sikkim, Arunachal Pradesh, Assam, Meghalaya, Manipur and Nagaland.

Nepal, Bhutan, China (Tibet, S.W. China), Myanmar, Thailand and Indonesia.

*Notes.* The seeds are employed as an aromatic stimulant and are also used for treating dog bites and bee stings.

**24. *Hypericum wightianum*** Wallich [ Cat. No. 4010. 1831, nom. nud. ] ex Wight & Arn., Prodr. 99. 1834; Dunn in Gamble Fl. Pres. Madras 70. 1915. *H. napaulense* auct. non Choisy 1824; Dyer in Fl. Brit. India 1: 256. 1874, p.p. quoad syn. *H. wightianum* et spec. Western Peninsula.

**Fig. 28.**

Perennial, erect herbs, 10 - 40 cm high; stems decumbent, prostrate or rarely ascending, rooting at basal nodes, terete. Leaves sessile or with 1 - 1.5 mm long petioles, 1 - 3 x 0.5 - 1.5 cm, ovate, elliptic, obovate or ovate-elliptic to oblong, subcordate-amplexicaul to broadly cuneate at base, subobtuse or obtuse at apex, chartaceous, intramarginally with black glands, veins prominent below and obscure above. Flowers yellow with red spots, 20 - 25 in terminal, corymbose cymes, 1 - 5 cm across; pedicels 2 - 3 mm long; bracts 4 - 5.5 mm long, ovate lanceolate to ovate-oblong, acute, glandular-ciliate. Sepals 4 - 6 x 2 - 3 mm, narrowly oblong to lanceolate, acute to subacute at apex, punctate with black gland dots or streaks along margin. Petals 5.5 - 9.5 mm long, oblanceolate-spathulate, subobtuse at apex, prominently veined, punctate with intramarginal black glands or streaks, persistent. Stamens many in 3 fascicles with ca 15 in each, as long as petals. Ovary 1.5 - 2.5 mm long, ovoid or globose to ellipsoid-oblong, 3-loculed; styles 2 - 4 mm long, free, divergent. Capsules 4 - 12 mm long, globose to ellipsoid with longitudinal vittae. Seeds ca 0.7 mm long, oblong, sometimes concave on one side, rounded at both ends; testa scalariform-reticulate.

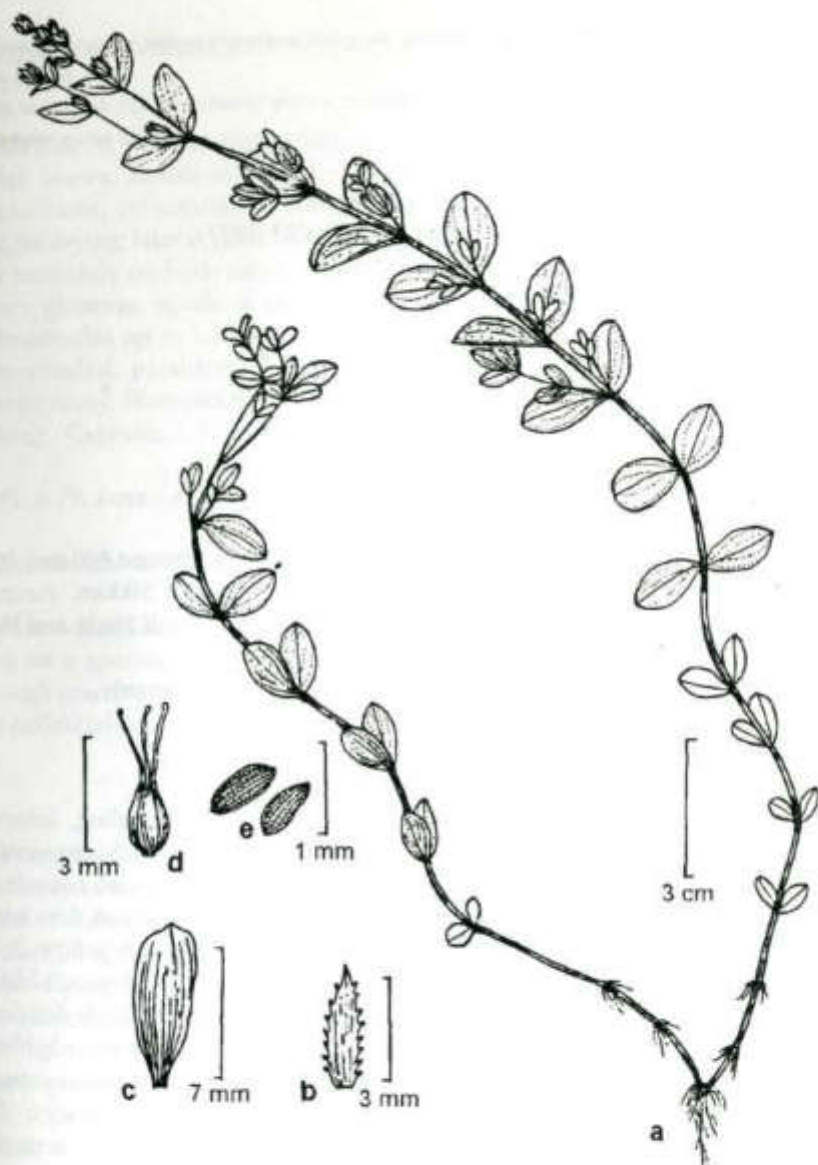


Fig. 28. *Hypericum wightianum* Wallich ex Wight & Arn. subsp. *wightianum* : a. habit; b. sepal; c. petal; d. pistil; e. seeds.

## KEY TO THE SUBSPECIES

- 1a. Capsules ovoid; sepals narrowly oblong or oblong-lanceolate; axillary branches irregular or absent  
24. 1. subsp. **axillare**
- b. Capsules subglobose or globose; sepals oblong to elliptic; axillary branches usually developed, short, more or less regular  
24.2 subsp. **wightianum**

**24.1. subsp. axillare** N. Robson in J. Jap. Bot. 52: 287. 1977

*Distrib.* India : Arunachal Pradesh.

China.

**24.2. subsp. wightianum**

Fl. & Fr. April - Aug.

*Distrib.* India: Himalayas, N.E. region and Western Ghats between 600 and 3650m. Jammu & Kashmir, Uttar Pradesh, West Bengal (Darjeeling), Sikkim, Arunachal Pradesh, Assam, Manipur, Nagaland, Meghalaya, Karnataka, Tamil Nadu and Kerala.

Pakistan, Nepal, Bhutan, Myanmar, Thailand and China (Yunnan).

**25. *Hypericum williamsii*** N. Robson in J. Jap. Bot. 52: 279. 1977.

Glabrous shrubs, 70 - 130 cm high; stems terete; branches ascending, internodes 1 - 2 cm long. Leaves with 0.5 - 2 mm long petioles, 2 - 5 x 1 - 2.5 cm, ovate to obovate - oblong or lanceolate, cuneate to rounded at base, obtuse to rounded and apiculate at apex, chartaceous, glaucous beneath, punctate with gland dots on both surfaces, densely so on lower surfaces, lateral veins 3 - 4 pairs. Flowers yellow, 2 - 16 in terminal, corymbose cymes, 3 - 4 across. Sepals 5, 6 - 9 x 3 - 5.5 mm, oblong or elliptic-oblong or obovate, rounded or rarely apiculate, entire or minutely denticulate, chartaceous, caducous after anthesis. Petals 5, 15 - 20 x 13 - 15 mm, narrowly obovate, entire or obscurely denticulate, incurved, caducous after anthesis. Stamens numerous in 5 fascicles with ca 45 - 70 in each; filaments 9 - 12 mm long, caducous. Ovary 6 - 7 x 4.5 - 5 mm, ovoid or ellipsoid-ovoid, 5-locular; styles 5, 5.5 - 7 mm long, erect, recurved at apex. Capsules 13 x 9 - 10 mm, ovoid.

Fl. & Fr. June - July.

*Distrib.* India: Sikkim.

Nepal.



## EXCLUDED SPECIES

**Hypericum bellum** Linn J. Arn. Arb. 25: 308. 1944; Robson in J. Roy. Hort. Soc. 95: 491. 1970.

Shrubs, 30 - 60 cm high, glabrous with horizontal rhizomes; stems erect, terete, reddish brown, simple or branched from the base. Leaves sessile, 3 - 5 x 2 - 4 cm, ovate-cordate, subcordate to cordate at base, rounded to emarginate at apex, olive green on drying; lateral veins 2 - 4 pairs on both sides ascending near margins, conspicuously reticulate on both sides. Inflorescences terminal, 2 - 3-flowered umbels, rarely solitary, glabrous, sessile or on 1.2 cm long peduncles; pedicels 1 - 2.5 cm long; bracts and bracteoles up to 1.2 x 0.5 cm, ovate-oblong, acuminate. Sepals 5 - 7 x 3 - 7 mm, ovate-rounded, persistent. Petals golden yellow, 1.8 x 1 - 3 cm, obovate, rounded. Stamens many; filaments up to 7 mm long. Ovary 6 - 7 mm long, ovoid; styles 5, free, 3 mm long. Capsules 1.2 - 1.4 cm long, ovoid with persistent styles.

*Fl. & Fr.* June - Aug.

*Distrib.* China (Yunnan), mainly from type locality.

*Notes.* Robson (1970) casually mentioned the distribution from Assam probably based on a specimen Walong (Assam) Kingdon-ward 20218, 25.9.1950 (BM, n.v.). A thorough search of materials from Indian herbaria proved unsuccessful. It seems to have been collected only once from that locality.

### 3. *Triadenum* Rafin.

Perennial herbs, glabrous with pale or black glands. Leaves opposite, entire. Inflorescence terminal and axillary cymes. Flowers bisexual, 5-merous. Sepals 5, quinquecuneate. Petals 5, white (in Indian species), imbricate, deciduous. Stamens in 3 fascicles (2 + 2 + 1), 1 antipetalous and 2 antisepalous, persistent, stamens 3 in each fascicle, with slender filaments ca 1/3 connate at the base; anthers versatile, with a pale gland on connective; staminodes absent; sterile fascicles (hypogynous scales) 3, alternating with fertile fascicles, entire, scale-like (in Indian species). Ovary trilobular with many ovules on axile placentation; styles 3, free, slender; stigmas capitate. Capsules septicidal with vittae. Seeds carinate, testa reticulate-pitted; embryo slender, straight with distinct cotyledons.

Temperate regions of Asia, Russia (Eastern Siberia), Eastern North America, Canada, ca 6 species; one in India.

***Triadenum breviflorum*** (Wallich ex Dyer) Kimura in Nakai & Honda, Nova Fl. Japan 10: 79. 1951. *Hypericum breviflorum* Wallich [Cat. No. 4816. 1832, nom. nud.] ex Dyer in Fl. Brit. India 1: 257. 1874.

Fig. 29.

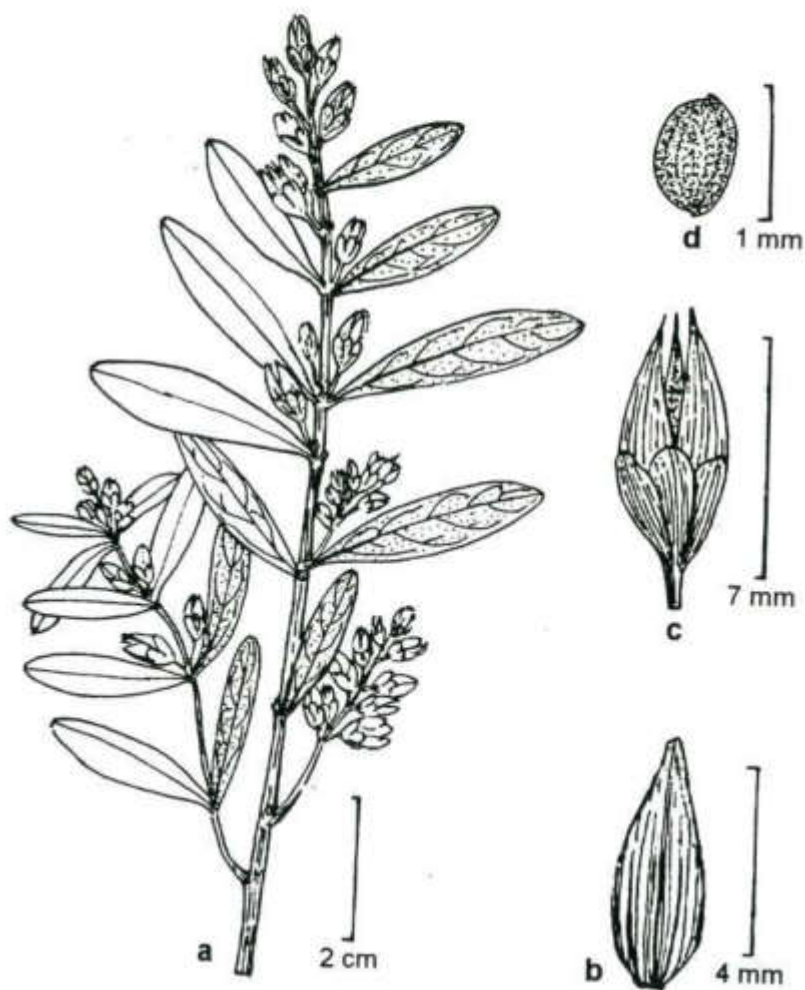


Fig. 29. *Triadenum breviflorum* (Wallich ex Dyer) Kimura : a. branch with flowers and fruits; b. sepal; c. fruit with persistent calyx; d. seed.

Perennial herbs or undershrubs up to 60 cm high; stems usually simple, terete. Leaves subsessile, 2 - 3.5 x 0.4 - 0.6 cm, oblong-elliptic to oblong-oblancoolate, narrowed at base, obtuse to subacute at apex, chartaceous with pale gland dots. Flowers white, 1 - 3 in axillary and terminal cymes, 6 mm across; peduncles 1.5 - 5 mm. Sepals 5, 3 - 4.5 mm long, oblong-ovate to oblong, obtuse at apex, entire with pale glandular streaks. Petals 5, 5 - 6.5 mm long, oblong, punctate with pale brown glandular dots. Stamens 9 in 3 fascicles; filaments connate up to 1/3; hypogynous scales ca 1.5 mm long. Ovary 3.5 mm long, ovoid-oblong; styles ca 1 mm long, spreading at apex. Capsules ovoid, ca 7 x 3 - 3.5. Seeds ca 1 mm long, reddish-brown, oblong, rounded, densely reticulate, obscurely carinate.

*Fl.* Feb. - April; *Fr.* July - Oct.

*Distrib.* India: Meghalaya (Khasi hills); rare.

Bangladesh, Taiwan and Japan.

*Notes.* The Japanese species *Triadenum japonicum* (Blume) Makino is superficially allied to *T. breviflorum* (Wallich ex Dyer) Kimura in many characters but differs in leaf shape, inflorescence and petal colour.

#### CULTIVATED SPECIES

1. ***Hypericum androsaemum*** L., Sp. Pl. 784. 1753; Bailey, Man Cult. Pl. 677. 1958.

Semievergreen shrubs with 2-lined stems. Sepals 8 - 15 mm long, unequal, persistent. Styles shorter than ovary. Berries 7 - 10 mm long, ellipsoid to globose.

Cultivated in gardens of Darjeeling (West Bengal).

Native of Europe.

2. ***Hypericum calycinum*** L., Mant. Pl. 1: 106. 1767.

Stems 4-lined. Capsules ca 20 mm, ovoid.

Cultivated in gardens of Darjeeling (West Bengal).

Native of Europe.

3. ***Hypericum cistifolium*** Lam., Encycl. 4: 158. 1797. *H. rosmarinifolium* Lam., Encycl. 4: 159. 1797.

Stoloniferous undershrubs, ca 1 m high. Leaves narrowly oblong to linear-lanceolate. Sepals ovate to lanceolate. Berries subglobose to ovoid-globose.

Cultivated in gardens of Darjeeling (West Bengal).

Native of eastern North America, Central America and Bahamas.

**4. *Hypericum cordifolium*** Choisy in DC., Prodr. 1: 545. 1824; Dyer in Fl. Brit. India 1: 253. 1874.

Erect, glabrous shrubs, up to 75 cm high; stems terete, purple. Leaves sessile, 1.5 - 3 cm long, oblong or elliptic-oblong to elliptic-lanceolate, amplexicaul and cordate at base, acute or shortly acuminate at apex. Flowers 3.5 - 5 cm across in corymbose cymes; pedicels 8 - 12 mm long; bracts 7 - 8 mm long, ovate, acute to acuminate. Sepals 5, 6 - 9 x 3 - 4 mm, ovate-lanceolate, acute to acuminate at apex, streaked with punctate glands. Petals 5, 1.5 - 2 x 0.8 - 1.2 cm, obovate, punctate with raised glands. Stamens numerous in 5 fascicles with 25 in each. Capsules 9 - 11 mm long, ellipsoid-oblong, tipped with persistent styles. Seeds ca 0.8 mm long, oblong, acute at both ends; testa scalariform-reticulate.

Cultivated in gardens of Darjeeling and Kurseong (West Bengal). Native of Nepal.

**5. *Hypericum densiflorum*** Pursh, Fl. Am. Sept. 2: 376. 1814; Rehder, Man. Cult. Trees & Shrubs 640. 1949. *H. prolificum* L. var. *densiflorum* (Pursh) A. Gray, Man. Bot. ed. 2, 50. 1856.

Erect, much-branched, glabrous shrubs, ca 2 m high. Sepals oblong to elliptic-oblong. Berries 4 - 6 x 3 mm, ovoid.

Cultivated in gardens of Darjeeling (West Bengal).

Native of North America.

**6. *Hypericum monogynum*** L., Sp. Pl. ed. 2. 1107. 1763; *H. chinense* L., Syst. Nat. ed 10. 1184. 1759, non Osbeck. 1757; Haines, Bot. Bihar & Orissa 2: 52. 1921.

Erect, much branched, glabrous shrubs, ca 1 m high. Leaves sessile, elliptic to oblanceolate-elliptic, obtuse at apex, minutely pellucid punctate. Flowers 5 cm across.

Cultivated in gardens of India.

Native of China.

**7. *Hypericum olympicum*** L., Sp. Pl. 784. 1753; Bailey, Man. Cult. Pl. 677. 1958.

Flowers 2 - 6 cm across in few-flowered cymes. Sepals and petals generally eglandular. Stamens in 3 fascicles. Styles 3.

Cultivated in gardens of Darjeeling (West Bengal).

Native of S.E. Europe and Asia minor.

## CLUSIACEAE

(Guttiferae nom. alt.)

N.P. Singh

Evergreen trees or shrubs with milky, white, greenish or yellow sap, often resinous; oil glands or passages in leaves and other parts always present. Leaves opposite, decussate, rarely verticillate, simple, entire, usually coriaceous, sometimes membranous, rarely stipulate, venation characteristic on drying. Inflorescence terminal or axillary, fascicled, racemose or paniced, often reduced to solitary flowers; bracts and bracteoles various. Flowers regular, white, yellow, pinkish or red, hypogynous, unisexual or polygamous or bisexual; the perianth cyclical or spiral, often decussate. Sepals 2 - 6, imbricate or decussate, persistent or caducous. Petals 2 - 6, rarely more or absent, imbricate, contorted or decussate. Stamens mostly numerous, almost free or variously connate, 1 - 6-adelphous, as many as petals; reduced to staminodes in female flowers, staminodes mostly fewer than stamens or absent; anthers various, dehiscent transversely, vertically or circumscissile. Ovary superior, 1 - many-loculed with 1 - 4 erect (basal), axile or rarely parietal placentation; styles slender, short or absent, rarely 2; stigmas various, free or connate, sometimes peltate or lobed, sessile or subsessile. Fruit baccate, capsular or drupaceous, often indehiscent, pulpy or not. Seeds large, without albumen; embryo either with large radicle and small cotyledons or vice-versa.

Pantropical, chiefly in Asia and America, rare in Africa; ca 40 genera and ca 1000 species; 5 genera and 53 species in India.

*Literature.* MAHESHWARI, J.K. (1964, 1965 & 1972). Taxonomic studies on Indian Guttiferae I, II & III and Morpho-taxonomic studies on Indian Guttiferae: Bull. Bot. Surv. India 2: 139 - 148; 5:335 - 343; 6: 107 - 135 and In: MURTHY, Y.S. et al. Adv. Pl. Morph. 137 - 152, respectively. SEETHARAM, Y.N. (1985). Clusiaceae: Palynology and Systematics. Travaux de la sec. Sci. et Tech. XXI: 59. (Inst. Francis de Pondicherry).

*Notes.* This family is of much economic importance and provide many kinds of valuable timber, useful gums and resins and edible fruits. Some species have medicinal value while others are cultivated as ornamentals and for fruits. Several species are endemic in India.

### KEY TO THE GENERA

- 1a. Stigmas more or less sessile, broadly peltate, entire or radiately lobed; ovary bi- to plurilocular, locules 1-ovuled; fruits baccate; cotyledons absent or minute; stamens connate in various ways; petiole base usually foveolate 2. *Garcinia*

- b. Styles distinct, long, slender with peltate, entire, 2 - 4-fid or -lobed or acute stigmas; ovary usually uni- to bilocular, rarely 2 - 4-locular, locules 1 - 2- or 4-ovuled; fruits drupaceous or capsular; cotyledons large, well developed; stamens free or connate at base only; petiole base not foveolate 2
- 2a. Leaves with numerous, very close, straight, parallel lateral veins with no minor veins; ovary unilocular with a solitary ovule **1. Calophyllum**
- b. Leaf venation not as above, lateral veins often arcuate and forking and with minor veins; if as above then with much fewer, parallel laterals; ovary otherwise 3
- 3a. Sepals 2, ovary 2 - 4-locular; stigma 2 - 4-lobed; fruit a drupe, pulpy **3. Mammea**
- b. Sepals 4 - 5; ovary 1 - 2-locular; stigmas acute, incised or 4-fid; fruit a capsule or a drupe, not pulpy 4
- 4a. Sepals and petals 4 each; style 1; stigmas incised to 4-fid **4. Mesua**
- b. Sepals 4 - 5; petals 5 - 6; styles 2; stigma acute **5. Poeciloneuron**

### 1. *Calophyllum* L.

Small to medium-sized (rarely larger), evergreen trees; wood pale reddish-brown with characteristic darker streaks, ornamental, hard, strong and moderately durable; bark smooth with characteristic diamond or boat-shaped, lenticellate fissures on immature trees and longitudinally fissured, anastomosing ridges on mature trees, grey or yellowish-brown, inner bark pink or reddish, laminated with colourless, yellow or milky-white, varnish-like exudate; branchlets generally quadrangular, sometimes flattened; buds puberulous with minute, rusty, uniseriate hairs. Leaves opposite decussate, opposite juvenile stage, simple, entire, glossy, often coriaceous, exstipulate; lateral nerves numerous, slender, close together and parallel, usually at right angles to the midrib, but alternating with and usually more prominent than latex canals; petiolate; young leaves usually brightly coloured. Inflorescences copiously produced, axillary or terminal, paniculate or racemose, sometimes fascicled; axes terminated by flowers. Flowers bisexual or polygamous (male & bisexual), pretty, small to medium-sized, hypogynous, usually homochlamydeous, pedicellate (1 -) 3 - numerous; bracts usually deciduous. Perianth lobes 4 - 8, imbricate, tile-like, outer 1 or 2 pairs rarely much different from others. Sepals 2 or 4, decussate. Petals 2 - 4 or more or absent, resembling sepals. Stamens numerous, at most obscurely fasciated; filaments slender, free or slightly connate at base, often flexuous; anthers erect, ovate or oblong, bilocular, basifixed, dehiscing longitudinally. Ovary superior, unilocular; ovule solitary, anatropous, basal; styles slender, rather long; stigmas peltate. Fruits drupe-like or an indehiscent drupe; exocarp thin, membranous; mesocarp dry, subspongy (fibrous); endocarp crustaceous (testa consisting of stony layer and usually transient spongy layer). Seed single, erect, globose or ovoid, exalbuminous, radicle on one side; cotyledons large, thick and fleshy, cells filled with oil.

Tropical Asia, with some in America; ca 187 species, 8 species in India.

*Literature.* MAHESHWARI, J.K. (1960). Taxonomic studies on Indian Guttiferae - I. The genus *Calophyllum* Linn. Bull. Bot. Surv. India 2: 139 - 148, ff. 1 - 4, tt. 1 - 2, map 1. STEVENS, P.F. (1980). A

revision of the old world species of *Calophyllum* (Guttiferae), *J. Arn. Arb.* 61: 117 - 699.

*Notes.* Its chief centre of development is in Malaysia, where as many as 106 species occur. In India 2 species (*C. apetalum* Willd. and *C. austroindium* Kosterm. ex P. Stevens) are endemic to the Western Ghats, while others are wides. However, within India 4 species are restricted to Andaman & Nicobar Islands and 1 each to Western Ghats and North-Eastern India. The species yield excellent commercial timber, usually strong and for construction work. In earlier days fine spars for the ship building trade were made from the wood of *Calophyllum* species. Fruits of some species yield oil used in medicine or for burning purposes.

#### KEY TO THE SPECIES

- |  |  |
|--|--|
| 1a. Leaves more than 25 x 7 cm; fruits large (over 8 x 4 cm)   | 5. <i>C. macrocarpum</i>                   |
| b. Leaves less than 25 x 7 cm; fruits small (up to 5 x 3 cm)   | 2  |
| 2a. Inflorescences terminal or axillary  | 6. <i>C. polyanthum</i>                    |
| b. Inflorescences always axillary  | 3  |
| 3a. Lamina usually over 13 x 5 cm; stone generally with a basal plug   | 4  |
| b. Lamina up to 13 x 5 cm; stone without a plug  | 5  |
| 4a. Lamina with less than 10 lateral veins; petals present; fruits 2.5 - 5 x 2.5 - 4 cm  | 4. <i>C. inophyllum</i>                    |
| b. Lamina with more than 12 lateral veins; petals absent; fruits 1 - 1.6 x 0.8 - 1 cm  | 7. <i>C. soulattri</i>                     |
| 5a. Terminal buds more than 6.5 mm long; lamina with 12 - 20 lateral veins; pedicels 4 - 6 mm long   | 3. <i>C. calaba</i> var. <i>bracteatum</i> |
| b. Terminal buds up to 6.5 mm long; lamina with less than 12 lateral veins, rarely up to 15; pedicels 7 - 25 mm long                                       | 6  |
| 6a. Sepals always 4; petals absent; lamina less than 2 times longer than broad; terminal buds 3 - 6.5 mm long; internodes 5 - 20 mm long                   | 1. <i>C. apetalum</i>                      |
| b. Sepals 4, rarely 6; petals 4, sometimes 1 - 6; lamina about or over 2 times longer than broad; terminal buds 1.5 - 4 mm long; internodes 5 - 50 mm long | 7  |
| 7a. Petioles 4 - 14 mm long; fruits 6.5 - 16 mm long; lamina 4 - 13 cm long  | 8. <i>C. tetrapterum</i>                   |
| b. Petioles 2 - 3.5 mm long; fruits 3 - 3.3 cm long; lamina 3 - 7 cm long  | 2. <i>C. austroindicum</i>                 |

1. *Calophyllum apetalum* Willd., *Ges. Naturf. Freunde Berlin Mag.* 5: 79, 1811, p.p. *C. decipiens* Wight, *Icon. Pl. Ind. Orient.* 1: t. 106, 1839 & *Ill. Ind. Bot.* 1: 128, 1840, non Thwaites, 1858. *C. wightianum* Wallich ex Planch. & Triana in *Ann. Sci. Nat. ser.* 4, 15: 256, 1861; T. Anderson in *Fl. Brit. India* 1: 274, 1874. *C. spurium* Choisy in *DC. Mem. Soc. Phys. Hist. Nat. Paris* 1: 229, 1823. *C. calaboides* G. Don, *Gen. Hist.* 1: 622, 1831.

Guj.: *Sarpuna*; Kan.: *Irai* or *Holehonne*, *Kull-ponne*, *Kalpoon*, *Kiri-honne*; Mal.: *Cherupinna*, *Attupunna*, *Katta-punna*, *Pora-punna*, *Manja-punna*; Mar.: *Bobbi*; Sans.: *Jothishmathi*; Tam.: *Siru-binnai*, *Cherupinnei*, *Sirupunna*; Eng.: *The Poon spar of Travancore*.



Trees, up to 30 m tall; bole cylindrical, 30 cm in girth; wood pale reddish-white to reddish-brown with darker streaks and characteristic odour, moderately heavy; bark yellowish, very thick and characteristic with boat-shaped furrows and lenticels; exudate white, sticky or yellowish resinous fluid, branchlets glabrous, often pruinose, 2 - 4 cm across, internodes 0.5 - 2 cm long; terminal buds plump, 3 - 6.5 mm long, hairy, uppermost pair of axillary buds rounded, ca 0.5 mm long. Leaves 5 - 20 x 2.5 - 5 cm, ovate, obovate or oblong to elliptic, subtruncate to rounded to rarely acute to cuneate at base, usually abruptly narrowed at very base, obtuse-retuse or emarginate at apex, slightly recurved along margins, shiny on both surfaces, glabrous, rigidly coriaceous; venation close, veins most prominent on lower surface, midrib obscure towards apex, prominent beneath, lateral veins 5 - 9, at an acute angle with midrib ( $50 - 65^\circ$ ), 5 mm apart; petioles 6 mm long, deeply canaliculate above, almost glabrous. Racemes 4 - 7 cm long, axillary from the upper foliate axils and sometimes from scars of defoliated axils, shorter than leaves, 5 - 13-flowered, glabrous to slightly puberulous towards base when young; peduncles ca 1 cm long, slender. Flowers white, 1 - 2.5 cm in diam., bisexual; bracts ca 4 mm long, ovate or boat-shaped, caducous, near the insertion of pedicel on racemes; pedicels slender, 7 - 15 mm long, glabrous. Sepals 4, rarely 3, prominently veined, membranous, deflexed, subequal, biseriate, ovate or 2 outer 3.5 - 6 x 3.3 - 5.5 mm, broadly ovate to orbicular, two inner 6 - 9 x 3.5 - 5 mm, boat-shaped, elliptic to obovate, white, petaloid. Petals absent, rarely 2, 4 or 5, small, caducous during anthesis. Stamens numerous (40 - 85), many seriate; filaments ca 5 mm long, almost free; anthers 1.3 - 2.5 mm long, oblong, rounded or mucronulate at apex. Ovary ca 1.5 mm long; styles flexuous, ca 3.5 mm long, longer than stamens; stigmas peltate, ca 3-radiate with crenulate margin or entire, 1 - 1.5 mm across. Drupes 1 - 2 x 1 cm, ovoid, elliptic or ellipsoid, apiculate or not, smooth, red when ripe, drying greyish-green; stone 7.5 - 13 x 5 - 7 mm, ovoid to ellipsoid, smooth.

*Fl. & Fr.* Sept. - May.

*Distrib.* India: Common along the banks of rivers and streams in evergreen forests and backwaters on west coast at low elevations up to 600 m, sometimes up to 1300 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* Sometimes the edges of the leaves are transformed into large, hollow, irregularly shaped, winged galls. Wood is durable, used for construction, bridges, boats, oil-mills, cabinet work, building purposes and also for making match boxes. Seed oil greenish-yellow with a characteristic odour and bitter taste, used for treating rheumatism, leprosy, as fuel for lamps and as septic poison. The resin is used as a vulnerary, resolute and anodyne. Ripe fruits are sweet and eaten locally.

2. *Calophyllum austroindicum* Kosterm. ex P. Stevens in J. Arn. Arb. 61: 250, f. 8 g-i, 1980. *C. trapezifolium* auct. non Thwaites, 1858; Bourd., For. Trees Travancore 28. 1908.

Trees, 25 - 30 m tall; trunk ca 1 m in girth; branchlets glabrous, 4-angled to subulate, internodes 0.5 - 3 cm long; terminal bud plump, 2.8 - 3.5 mm long, tomentose. Leaves 3 - 7 x 1.2 - 3.5 cm, elliptic or trapeziform to obovate, narrowly cuneate to acute at base, rounded, retuse or subacute at apex, rigid, almost glabrous when mature, midrib prominent beneath, lateral veins 5 - 10 (- 15), 5 mm apart, parallel, fine, more or less prominent on both surfaces, raised, angle of divergence 40 - 65°; petioles canaliculate above, almost glabrous. Racemes axillary, 7 - 17-flowered, glabrous; rachis 3 - 7.5 cm long, robust, glabrous or sparsely pubescent towards base. Flowers white, ca 2 cm in diam., bisexual; bracts unknown; pedicels 6 - 18 mm long, glabrous. Sepals 4, subequal, outer 2 smaller than inner, 3.7 - 5 x 3.5 - 6 mm, suborbicular, inner ones ca 6 x 4 mm. Petals 4, rarely 6, 4.5 - 8 x 1.5 - 4 mm, elliptic, oblong to obovate. Stamens numerous (ca 100 - 125); filaments ca 2.5 mm long; anthers 0.7 - 1.3 mm long, elliptic to oblong. Ovary 1.5 - 1.8 mm long, globose, styles slender, 1.5 - 2 mm long; stigmas peltate, 0.7 - 1 mm across, 3-radiate. Berries 3 - 3.3 x 1.6 - 2.3 cm, ovoid, rostrate at apex, green, purple (?) when mature; stone ca 2.5 x 15 cm, ellipsoid, smooth.

*Fl. & Fr.* Nov. - June.

*Distrib.* India: In forests of Western Ghats between 600 and 1530 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

3. *Calophyllum calaba* L. var. *bracteatum* (Wight) P. Stevens in J. Arn. Arb. 61: 261, f. 13. 1980. *C. burmannii* Wight var. *bracteatum* Wight, Ill. Ind. Bot. 1: 129. 1840. *C. retusum* auct. non Wallich ex Choisy 1849; T. Anderson in Fl. Brit. India 1: 272., 1874, *p.p.* *C. amoenum* Wallich ex Choisy, Desc. Guffif. Inde 42. 1849 & in Mem. Soc. Phys. Hist. Nat. Geneve 12: 421. 1851; Parkinson, For. Fl. Andamans 87. 1923. *C. kunstleri* auct. non King 1890, Mahesh. in Bull. Bot. Surv. India 2: 141. 1960; M.K.V. Rao in J. Econ. Tax. Bot. 8: 112. 1986.

Fig. 30.

Trees, 6 - 30 m tall; trunk up to 1.5 m in girth; sapwood brown to whitish; heartwood reddish to dark-brown; bark yellowish to fawn-brown or fuscous-brown, smooth, with strong, horizontal fissures; exudate yellow, yellowish-brown or almost white, watery, jelly-like; branchlets ferruginous, farinose-tomentose; terminal bud plump to conical, 7 - 11 mm long, puberulent; extra-axillary buds present. Leaves 3 - 12 x 1.5 - 5 cm, elliptic, oblong-elliptic or ovate-elliptic to ovate, sometimes lanceolate, acute to rounded at base, obtuse or shortly acuminate at apex, rarely rotundate or retuse, base shiny above, glabrous; midrib prominent on both surfaces, lateral veins parallel, close, rather making an obtuse or acute angle with midrib; petioles 1 - 5 mm long, canaliculate above, minutely

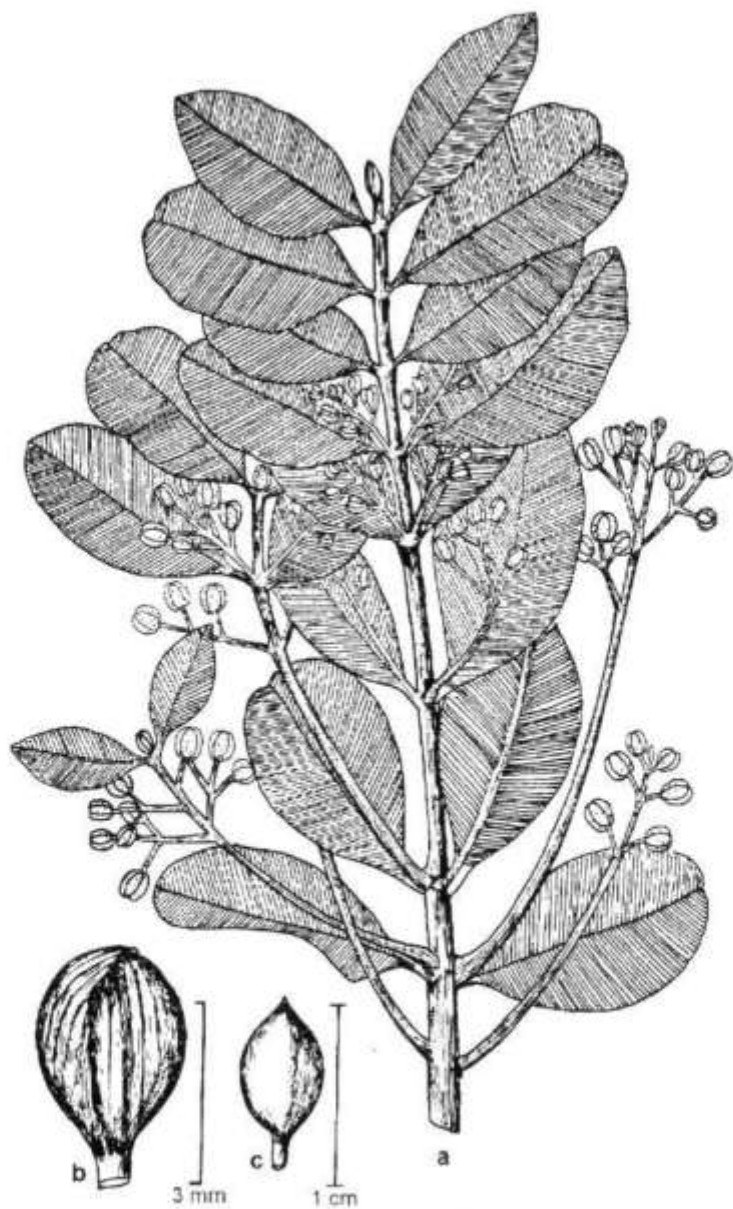


Fig. 30. *Calophyllum calaba* L. var. *bracteatum* (Wight) P. Stevens: a. flowering branch showing flower buds; b. flower bud; c. young fruit.

velutinous, soon glabrescent; new leaves pinkish-yellow. Racemes ca 1 - 3 cm long, axillary, umbellate or fascicled, 3 - 7 (- 12)-flowered; peduncles compressed, very short, nearly articulate at base, velutinous or puberulent, especially near base. Flowers white, or light yellow, bisexual, scented, 6 - 7 mm in diam.; bracts 4, prominent, broadly elliptic to ovate, 2 - 5 mm long, caducous; pedicels slender. Sepals 4, outer pair 3 - 4.5 x 2.5 - 4.5 mm, elliptic, oblong to ovate, puberulent outside, reflexed in open flowers, inner pair 3.5 - 7.5 x 2.5 mm, obovate to elliptic or oblong. Petals absent. Stamens numerous (20 - 95); filaments 2 - 3.5 mm long; anthers 0.4 - 1.5 mm long, oblong. Ovary 0.8 - 1.5 mm long; styles 1.5 - 3.5 mm long; stigmas peltate- infundibular, 0.4 - 1 mm across, sometimes 3 - 4-radiate. Fruits 7 - 15 mm in diam., pisiform or globose, white or yellow, reddish-brown when dry, coarsely wrinkled, smooth when ripe; stone 5 - 11 x 5 - 8 mm, spherical to ovoid or ellipsoid, smooth.

*Fl. & Fr.* Oct. - May.

*Distrib.* India: Common in lowland to hilly mixed rain forests. Andaman & Nicobar Islands (Andaman Islands).

Vietnam to Borneo.

*Notes.* Wood used for making implement handles, furniture, for construction purposes etc. Fruits edible.

4. *Calyphyllum inophyllum* L., Sp. Pl. 513. 1753; T. Anderson in Fl. Brit. India 1: 273. 1874. *C. bintagor* Roxb., Fl. Ind. 2: 606. 1832. *C. blumei* Wight, Ill. Ind. Bot. 1: 128. 1840.

Beng. & Hindi: *Sultana champa*; Guj. (Kutch): *Udi*; Kan.: *Vuma, Nonne or Honne*; Mal.: *Pinna or Punna*; Mar.: *Undi, Surangi, Wumaka*; Or.: *Poonang*; Sans.: *Nagchampa, Panch-kasara, Punnaga*; Tam.: *Pinnai*; Tel.: *Poona or Puna*; Eng.: *The Dielo Oil Tree, The Alexandrian Laurel*.

Trees, up to 20 m tall with spreading crown; trunk 1.5 m in girth, wood reddish-white to brown, heavy; bark brown to pale grey (blackish) and fawn, smooth, often mottled with wide boat-shaped fissures; exudate milky or yellow, clear, very sticky; branchlets compressed or slightly flattened, glabrous; internodes (0.4-) 1 - 3 (- 5) cm long; terminal buds 4 - 10 mm long, nearly triangular, plump, finely rusty tomentose. Leaves variable in size, 15 - 20 x 5 - 9 cm, broadly elliptic-oblong or obovate, often broadest a little above middle, cuneate to rounded and finally decurrent at base, rounded or shallowly emarginate, retuse or subacute at apex, thinly coriaceous, dark green, glabrous, shiny; midrib prominent below, venation distinct, close, raised on both surfaces giving the blade a striate appearance; lateral veins 4 - 20, ca 5 mm apart; petioles 1 - 1.5 cm long, sometimes longer, glabrous, stout, flat. Racemes 5 - 13 cm long, axillary, 5 - 15-flowered, glabrous. Flowers polygamous, bisexual, ca 2 cm in diam., marble white,

fragrant; bracts 3 - 4 mm long, ovate, soon deciduous; pedicels (1 -) 1.5 - 4.5 (- 6.3) cm long, glabrous. Sepals 4, reflexed, 2 outer ones 5.5 - 10 x 4.5 - 8 mm, ovate to suborbicular, concave, inner petaloid, 9 - 15 x 7.5 - 10 mm, subelliptic. Petals usually 4 (or 3 - 5), reflexed, 9 - 16 x 5 - 10 mm, obovate to elliptic or oblong, rarely glabrous. Stamens numerous, (175 -) 210 - 360 (- 440); filaments creamy, 5 - 7 mm long, connate up to 2 mm into 4 - 6 bundles; anthers 0.7 - 2 mm long, rounded or retuse at apex, yellow when young, brownish at maturity. Ovary 1.5 - 3.5 mm long, depressed globose, stipitate, pink or light purple after pollination; styles much longer than ovary, 4.5 - 9 mm long, twisted; stigmas peltate, 3 - 5-radiate, 0.7 - 2 mm across. Drupes ca 2.5 - 5 x 2.5 - 4 cm, globose or spherical to obovoid, shortly apiculate, smooth, yellowish, brownish-green or pale brownish ochraceous, pulpy; pericarp thick; stone ca 2 cm in diam., subspherical, rounded at apex, smooth, basal plug 4 - 10 mm long.

*Fl. & Fr.* Dec. - Oct.; probably flowers throughout the year with several flushes.

*Distrib.* India: A littoral species, common on sandy coast and laterite soils just above the high tide line, sometimes up to 200 m often leaning out over sea. Orissa, Maharashtra, Karnataka, Tamil Nadu, Kerala, Lakshadweep and Andaman & Nicobar Islands.

Tropical E. Africa to Taiwan, the Ryukyu & Live Islands and New Caledonia; native of East Africa, often planted within and outside the limits.

*Notes.* Cultivated as an ornamental and for shade throughout India. The timber is durable under water and is used for making knees for boats, railway sleepers, for construction and for domestic vessels and bowls etc. Seed oil known variously as Wundi, Pinnay, Domba or Dilo oil, is used in medicine (skin diseases and rheumatism), for burning, for painting wood and also as a lubricant, a substitute for castor oil. It also produces the genuine Mariae Balsam and the yellowish-green resin, 'Tacamahaca' the gum from wounded bark is used as a purgative and an emetic and applied to wounds and ulcers. The leaves soaked in water are applied to inflamed eyes. The decoction of flowers is given to cure syphilis, eczema and insanity. Fruits eaten by bats and squirrels. Bark boiled in water is used for dyeing fish nets.

**5. *Calophyllum macrocarpum* Hook. f., Fl. Brit. India 1: 273. 1874; N.P. Singh in Ind. J. For. Addl. ser 1: 305. 1990.**

Trees, 15 - 20 m tall; sapwood light brown, heartwood dark brown, hard, outer bark yellowish brown, becoming dark brown to blackish; exudate orange and clear or pinkish and gummy; branchlets robust, 2.5 - 5 mm across, drying dark brown to blackish with transient, sparse, brown, 0.5 mm long hairs; internodes 0.5 - 2.5 (-5) cm long, glabrous; terminal buds plump, 3.5 - 5.5 cm long with brown, short tomentum. Leaves ca 30 x 8.5 cm, (linear-) oblong to elliptic (-lanceolate), acute at base, narrowed into a slender petiole, usually shortly and bluntly acuminate at apex, barely undulate, glabrous or sparsely tomentose on raised midrib below, coriaceous, venation prominent on both

surfaces; lateral veins 5 - 10, ca 5 mm apart; petioles 2.5 - 5.3 cm long, flat to shallowly concave above, convex below, glabrous. Racemes axillary, 1.2 - 4.5 cm long, 7 - 15-flowered, occasionally 3-flowered, minutely puberulous or densely brown tomentose towards base. Flowers bisexual, 2.5 cm in diam.; pedicels 1 - 3.2 cm long, finely tomentose to glabrous. Sepals 4, 2 outer 9 - 13 x 7.5 - 11 mm, broadly oblong or ovate obtuse, concave, glabrous or puberulent outside; 2 inner 11 - 15 x 2.5 - 8 mm, petaloid, oblong, obtuse, usually with a band of indumentum outside at base. Petals 4, 11 - 15 x 2.5 - 8 mm, ovate to elliptic or ligulate or linear-spathulate. Stamens numerous (ca 230 - 340), very short, filaments up to 6 mm long, connate up to 1.2 mm; anthers oblong, 1 - 2 mm long, more or less retuse at apex. Ovary 1.8 - 2.3 mm long; styles 3.5 - 6 mm long; stigmas peltate, 3 - radiate, 1.3 - 1.5 mm across. Drupes 8 - 12.7 x 4.5 - 6 cm, ellipsoid, narrowed at both ends, acute at apex, drying dark brown, irregularly and coarsely wrinkled, regularly and finely longitudinally striate; outer layer 3 - 8 mm thick, sweet; stone 3.7 - 6.7 x 2.2 - 3.4 cm, ellipsoid, rounded at apex, borne in the centre of fruit with fibrous zone, 2 - 2.5 cm long, between stone and base of fruit, smooth.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Common along rivers in interior forests on rocky loamy soils at sea level. Andaman & Nicobar Islands (Great Nicobar).

S. Thailand and Malaya to Bornea.

**6. *Calophyllum polyanthum*** Wallich ex Choisy, *Descr. Guttif. Inde* 43. 1849 & in *Mem. Soc. Phys. Hist. Nat. Geneve* 12: 423. 1851; T. Anderson in *Fl. Brit. India* 1: 274. 1874. *C. elatum* Beddome, *Fl. Sylv.* 22, t. 2. 1869. *C. tomentosum* auct. non Wight; T. Anderson in *Fl. Brit. India* 1: 274. 1874, p.p. *C. angustifolium* Dalz. & Gibs., *Bombay Fl.* 32. 1861, non Roxb. 1832.

**Fig. 31.**

*Asm.*: Dieng-karu, Pongoo, Sentebel; *Beng.*: Kandeb; *Kan.*: Kuve, Bobbi, Siri Poone, Shrihonay, Surhoni; *Lep.*: Sunglyer; *Mal.*: Katta pinna, Pinnapai, Viri; *Mar.*: Pun, Negari; *Nep.*: Kironli; *Tam.*: Katta pinnei, Pongu; *Cach.*: Telo; *Eng.*: The Poonspar or sirpoon tree.

Trees, 7 - 45 m tall; trunk ca 1.5 m girth; wood pale reddish-white to light reddish-brown with dark streaks, strong, elastic, ornamental; bark yellow, grey to brown or black, exfoliating in longitudinal, oblong flakes; branchlets, buds and panicles obscurely tomentose or subglabrous; internodes 0.5 - 4 (- 5) cm long; terminal bud plump, 7 - 10 (- 14) mm long, puberulent. Leaves 10 - 15 x 3 - 4 cm, ovate to elliptic to oblong-lanceolate, acute or cuneate narrowed into marginal petiole at base, obtuse or acute to acuminate at apex, undulate, shiny, coriaceous, glabrous, sparsely puberulous on prominent midrib when young; lateral veins minute, 9 - 16 (- 24), 5 mm apart, distinct on both surfaces, horizontal, nearly perpendicular to midrib; petioles 1 - 2 cm long, canaliculate above, pubescent, soon glabrescent; young leaves red. Racemes simple or paniculate terminal

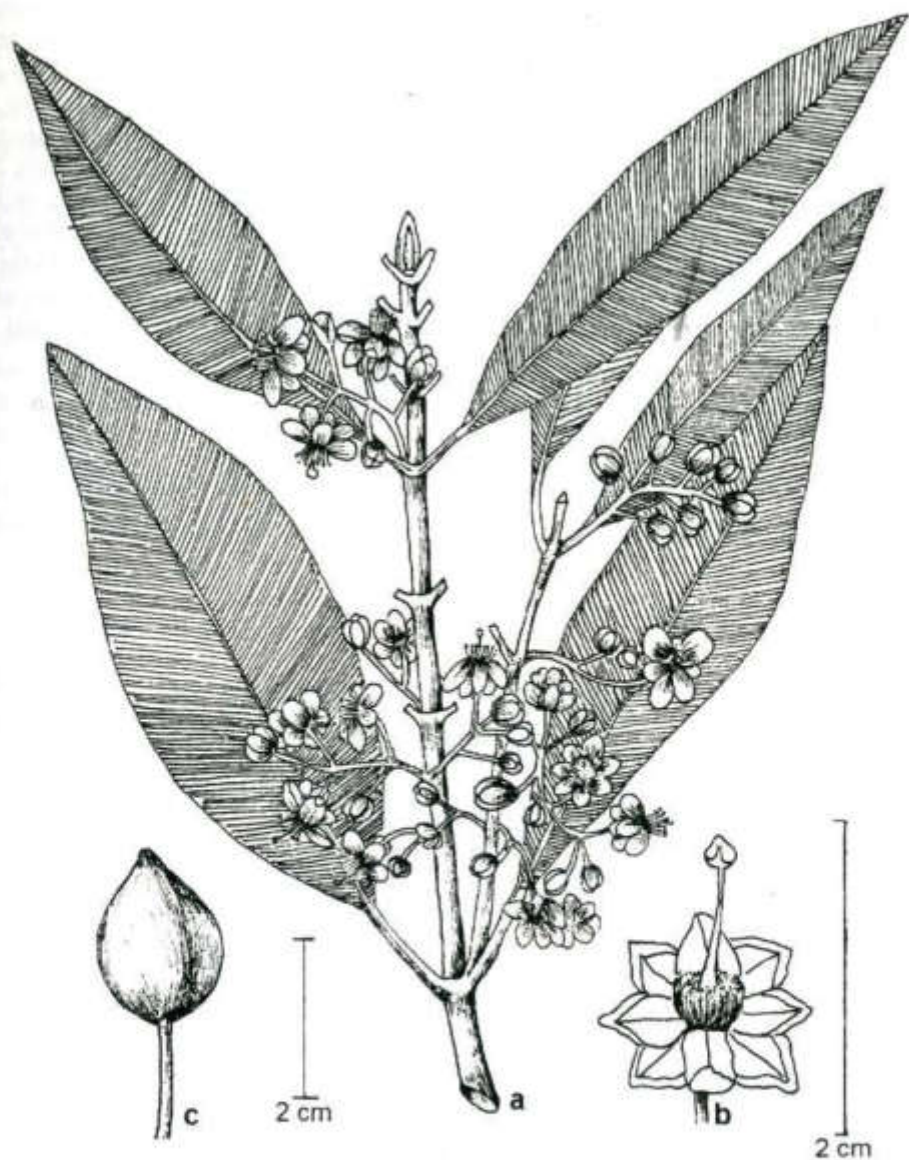


Fig. 31. *Calophyllum polyanthum* Wallich ex Choisy: a. flowering branch; b. flower; c. fruit.

and axillary, as long as leaves, ca 16 cm long. Flowers 1 - 2 cm in diam., polygamous, tetramerous, scented; ebracteate or bracts soon deciduous; pedicels 4 - 10 (- 18) mm long, puberulent. Sepals 4, ciliolate, unequal, outer ones ovate to suborbicular, 2 - 4 x 2 - 3.5 mm, puberulent on outside, inner ones 4 - 8 x 3.5 - 6 mm, ovate-obovate to oblong-ovate, petaloid. Petals 4, spreading, longer than sepals, obovate-oblong, reflexed-obtuse, concave. Stamens numerous (ca 140 - 320), yellow; filaments filiform, 2.5 - 4 mm long, connate at base; anthers 0.4 - 1 mm long and more or less elliptic, or 1.7 mm long, oblong, 2-loculed. Ovary 1.2 - 2.5 mm long, ovoid, 1-loculed with 1 erect ovule; styles 2 - 3 mm long, slender, flexuous; stigmas peltate, 0.7 - 1.2 mm across, 2 - 3-lobed. Drupes 2.5 - 3 x 2 cm, subglobose or ovoid to subovoid, blunt or shortly acuminate, smooth; yellow or dark purple at maturity; stone 1.9 - 2.6 x 1.5 - 1.8 cm, obovoid to ellipsoid, smooth. Seed elliptic or ovoid, brown.

*Fl. & Fr.* Jan. - July; sometimes up to Nov.

*Distrib.* India: In tropical wet evergreen forests of Western Ghats particularly in sholas and in Northeastern states in forests up to 1800 m. West Bengal, Sikkim, Assam, Meghalaya, Karnataka, Tamil Nadu and Kerala.

Thailand and South Western China.

*Notes.* Wood is antitermitic, used to furnish poonspars of commerce, ceiling boards, rafters, planking, cheap furniture, ship building, bridge building, general construction and paper pulp, etc. The timber is also used for making tea chests, tent poles, mathematical instruments, construction of ghat roads particularly leading to the sea coast. Seed oil used for illuminating purpose. Fruits edible.

**7. *Calophyllum soulattri*** Burm.f., *Fl. Ind.* 2: 121. 1768; Sastri et al., *Wealth of India* 2: 20. 1950, p.p.; Mahesh. in *Bull. Bot. Surv. India* 2: 142. 1960. *C. spectabile* auct. non Willd.; T. Anderson in *Fl. Brit. India* 1: 271. 1874, p.p. *C. tetrapetalum* Roxb. ex G. Don, *Gen. Hist.* 1: 622. 1831. Mahesh. in *Bull. Bot. Surv. India* 2: 146. 1960, p.p. *C. moonii* Wight, *Icon. Pl. Ind. Orient.* t. 111. 1839 & *Ill. Ind. Bot.* 1: 129. 1840. *C. wallichiana* auct. non Planch. & Triana 1861; T. Anderson in *Fl. Brit. India* 1: 273. 1874, p.p. Mahesh. in *Bull. Bot. Surv. India* 2: 146. 1960, p.p.

Hindi: *Lalchuni* or *Lalchini*; And.: *Dakar-talada*; Eng.: *The Nicobar Canoe Tree*.

Trees, 20 - 40 m tall; trunk ca 3 m girth; wood reddish-white to pale reddish-brown, moderately heavy; bark greyish to brownish, smooth but with distant, shallow, boat-shaped fissures, often slightly flaky and scaly; exudate usually white, watery but soon becoming creamy-yellow and sticky on exposure; branchlets 4 - or 2 - 6-angled, sometimes terete, subglabrous or tomentose, pale yellow; internodes 1.5 - 10 cm long; terminal buds cylindrical or conical, pointed, 1 - 2 cm long, coarsely ferruginous-tomentose. Leaves very variable in size, 15 - 25 x 4 - 7 cm, ovate to ovate-oblong, sometimes



elliptic-oblong, usually broadest just above base, cuneate at base, acute to acuminate at apex, above shiny, dull beneath, rarely tomentose especially on midrib; lateral veins 12 - 28, 5 mm apart, fine, raised, close, indistinct, almost horizontal; petioles 1.5 - 2 cm long, canaliculate or broadly concave above, glabrous or rusty tomentose. Racemes ca 3 - 4 cm long, axillary, very rarely terminal, subumbellate, 7 - 21-flowered, shortly pedunculate or subsessile, white or ferruginous tomentose. Flowers white, ca 12 - 15 mm in diam., scented; usually 4 at each node; bracts ca 6 mm long, ovate, tomentose on lower surface, deciduous; pedicels 1 - 2.8 cm long, slender, glabrous. Sepals 4, glabrous, unequal in 2 whorls, outer pair 4.5 - 6 x 3 - 5 mm, ovate, rarely tomentose outside, inner pair 5 - 9 x 3 - 5 mm, nearly obovate. Petals absent. Stamens numerous (ca 40 - 140); filaments ca 4 mm long, slender; anthers 0.7 - 2.5 mm long, oblong, yellow. Ovary 1 - 2 mm long, ovoid, glabrous; styles 1.5 - 2.5 mm long; stigmas peltate, 3-radiate, 0.4 - 0.7 mm across, reddish. Drupes 10 - 16 x 8 - 15 mm, globose, mucronate with persistent style base, smooth; pericarp thick; stone 0.7 - 1.1 x 0.65 - 1 cm, smooth, subspherical, basal plug sometimes present; ripe fruit purplish-black, sourish, with a stout, glabrous pedicel.

*Fl. & Fr.* March - Oct.

*Distrib.* India: In rain forests up to 300 m. prefers drained habitat but sometimes occurs in swamp forests. Andaman & Nicobar Islands.

Vietnam to Australia, the Solomon & Palau Islands; more or less naturalized on the Mascarenes. Native of S.E. Asia and the Philippines.

*Notes.* The timber is strong and elastic but not durable, is used for masts and spears and considered suitable for planking, rafters, boxes and joining work; used in building barracks in the Andaman Islands. Fruits are edible but are eaten only in small quantities. Seed oil sometimes used like that of *C. inophyllum*.

**8. *Calophyllum tetrapterum*** Miq., Pl. Jungh. 291. 1854. *C. floribundum* Hook.f., Fl. Brit. India 1: 272. 1874, p.p. *C. pulcherrimum* auct. non Wallich ex Choisy, 1849; T. Anderson in Fl. Brit. India 1: 271. 1874, p.p.

Trees, 6 - 30 m tall; trunk ca 38 cm in girth; bark whitish to yellowish or brown, closely fissured; exudate clear to opaque, yellow, rarely white, sticky; branchlets slightly compressed, usually strongly 4-angled, glabrous; internodes 0.5 - 5 cm long; terminal bud plump, 1.5 - 4 mm long, somewhat tomentose; uppermost pair of axillary buds rounded, 0.5 - 1.5 mm long. Leaves 4 - 13 x 1.5 - 5 cm, elliptic to obovate, cuneate to acute at base, acuminate or acute at apex, distinctly pale along margins, chartaceous, glabrous or sparsely pubescent on midrib beneath; midrib usually sharply raised; lateral veins (5 -) 8 - 14 (- 15), ca 5 mm apart, making an acute angle with midrib; petioles deeply canaliculate above, glabrous to transiently puberulent below. Racemes 2 - 65 cm long, axillary, 3 - 11-flowered, slender, glabrous or pubescent. Flowers scented, sometimes foetid, usually 2 at each node; bracts ca 2 cm long, rarely foliaceous, soon caducous;

pedicels 0.5 - 2 cm long, usually very slender, glabrous, often thickened in fruits. Sepals 4, outer pair 2 - 5 x 2 - 4 mm, ovate to broadly elliptic, sometimes papillate or puberulent on back near apex, inner pair elliptic to ligulate. Petals absent or 4, rarely 1 - 3 or 6, similar to inner sepals. Stamens numerous (ca 25 - 105); filaments ca 4.5 mm long; anthers 0.7 - 1.2 mm long, nearly oblong, shallowly retuse at apex. Ovary 0.8 - 1.3 mm long; styles 3.5 mm long; stigmas peltate, ca 0.4 mm across, slightly lobed. Drupes 6.5 - 16 x 5 - 12 mm, ellipsoid to spherical, apiculate or rounded at apex, wrinkled when young, sometimes smooth when mature, yellowish or bluish-green; stone 5.5 - 11 x 5 - 10 mm, ellipsoid to spherical, smooth.

*Fl. & Fr.* Dec. - May

*Distrib.* India: Usually in well drained, mixed forests, often on sandy soils. Andaman & Nicobar Islands (S. Andamans).

Cambodia to Borneo.

*Notes.* Three varieties are known under this species. The Indian plants belong to var. *tetrapterum*.

## 2. *Garcinia* L.

Trees or shrubs, usually symmetrical, glabrous; latex in branches, bark and fruits often yellow, sometimes white, resinous, thick, sticky, abundant; stems straight with horizontal or pendulous, usually opposite branches; wood moderately hard, yellowish-white, red or grey. Leaves opposite or rarely ternate, simple, entire, coriaceous or submembranous, more or less lanceolate or oblong, very rarely stipulate, usually glabrous; midrib prominent; lateral nerves irregular with short parallel ones in between; petioles thin with raised margin; new leaves appear in flushes at intervals. Flowers solitary or in cymes, usually small, heterochlamydeous, 4 - 5-merous; female or pseudobisexual flowers always lesser in number. Sepals 4, decussate or 5 (- 6) imbricate, usually persistent. Petals 4, seldom 5, alternate with sepals, imbricate or contorted. Male flowers: Stamens numerous, rarely few and definite, free or connate into 1 - 5 bundles or phalanges or in a central entire or 4 - 5-lobed mass or column, usually surrounding a rudimentary pistil; anthers various, erect or peltate, sessile or on short thick filaments, 2-loculed, rarely 4 - many-loculed, dehiscing by longitudinal slits, pores or circumscissile; rudimentary pistil variously formed or absent. Female flowers usually solitary and larger than male flowers; staminodes minute, free or united, in a single row with filaments connate into a ring at base or in short bundles or phalanges; ovary 2 - 12-loculed; ovules erect or lateral; styles very short or absent; stigmas lobed or furrowed with as many lobes as locules of ovary (2 - 12) or stigmatic mass marginally incised, smooth or papillate. Fruit a fleshy berry with coriaceous rind, 1 - 12-seeded. Seeds oblong or ovoid, embedded in whitish, juicy pulp which may be taken as aril or arilloide.

Tropics of the Old World, especially Asia and Africa; ca 200 species; 35 in India.

*Literature.* MAHESHWARI, J.K. (1965). Taxonomic studies on Indian Guttiferae III. The genus *Garcinia* Linn. s.l. Bull. Bot. Surv. India 6: 107 - 135, tt. 1 - 3.

*Notes.* Malesia and Africa with large number of endemic species appear to be its two main centres of development. 17 species are endemic in India, of which 7 are in Western Ghats, 6 in Andaman & Nicobar Islands and 4 in north-east India. They prefer evergreen and semievergreen forests but some thrive in relatively low rainfall area. However, none have so far reached even the foot of Western Himalayas. Many species are now cultivated worldwide including 3 in India. These are some of the slowest growing tropical trees known. Parthenocarpy is reported in some species. The flowers of most wild species appear to be nocturnal with strong odour. Dispersal is mostly by arboreal mammals. Some species are valued for their timber and some for pigment called 'Gamboge', resin of some is medicinal, fruits of several species are edible, sometimes considered as a delicacy and are very tasty besides many species have beautiful flowers and foliage.

#### KEY TO THE SPECIES

- |  |                            |
|--|----------------------------|
| 1a. Sepals and petals 5, or rarely petals 4 or sepals 6  | 2                          |
| b. Sepals and petals always 4  | 7                          |
| 2a. Flowers larger in axillary umbels, 18 - 27 mm in diam.; stigmatic lobes 3  | 32. <i>G. talbotii</i>     |
| b. Flowers smaller, in axillary fascicles, usually under 18 mm in diam.; stigmatic lobes or rays 5, rarely 6   | 3                          |
| 3a. Flowers ca 8 mm in diam.; sepals and petals always 5; rudimentary pistil in male flowers, if present fungiform with a narrow base and capitate apex                              | 3. <i>G. andamanica</i>    |
| b. Flowers more than 10 mm in diam.; sepals and petals sometimes variable; rudimentary pistil in male flowers mostly absent; if rarely present, non-fungiform, short and cylindrical | 4                          |
| 4a. Branchlets twiggy, slender, often 6-ribbed; ovary 3 - 4-locular  | 30. <i>G. spicata</i>      |
| b. Branchlets somewhat thick, compressed, 4 - 6-gonous or winged on drying; ovary 5-locular, rarely less   | 5                          |
| 5a. Petioles short, ca 1 - 1.5 cm long; pedicels ca 1 cm long; sepal tips not ciliate; petals ovate, almost closed; berries ellipsoid, ca 3 x 2 cm                                   | 10. <i>G. dulcis</i>       |
| b. Petioles 1 - 5 cm long; pedicels ca 1.5 - 5 cm long; sepal tips ciliate; petals orbicular, expanded; berries globose or subglobose, ca 6.5 cm in diam. or more                    | 6                          |
| 6a. Leaves up to 45 cm long; petioles 1 - 2.5 cm long; pedicels ca 2.5 cm long; berries ca 6.5 cm in diam.   | 35. <i>G. xanthochymus</i> |
| b. Leaves 30 - 60 cm long; petioles 2.5 - 5 cm long; pedicels 1.5 - 5 cm long; berries more than 6.5 cm diam.  | 24. <i>G. nervosa</i>      |
| 7a. Flowers always in fascicles; petals 3 times the size of sepals   | 7. <i>G. cadelliana</i>    |
| b. Flowers either in fascicles, panicles or solitary; petals not more than 2 times the size of sepals (except 3 times in <i>G. sopsopla</i> )  | 8                          |

- 8a. Anther dehiscence longitudinal, pyriform or by 2 short clefts; rudimentary pistil various, often fungi-form; ovary bi- to multilocular; stigma smooth or rough, entire or lobed 9
- b. Anther dehiscence transverse, circumscissile, or by 2 or 4 clefts; rudimentary pistil absent or minute; ovary tri- to multilocular; stigma rough or glandular, lobed 23
- 9a. Ovary bilocular 10
- b. Ovary tri- to multilocular 14
- 10a. Leaves stipulate with ca 2 cm long petiole; berries oblong, ca 40 x 8 - 15 (-17) mm **31. G. stipulata**
- b. Leaves exstipulate with less than 1 cm long petioles; berries globose or ellipsoid, much shorter, if longer, then much stouter 11
- 11a. Leaves oblong; female inflorescences 5 - 6-flowered **15. G. keenania**
- b. Leaves not oblong; female inflorescences 1 - 3-flowered 12
- 12a. Leaves 10 - 20 cm long; female inflorescences 3-flowered; berries ca 4.2 x 3.5 cm **4. G. anomala**
- b. Leaves less than 12 cm long; female flowers solitary or geminate; berries less than 2.5 cm in diam.; 13
- 13a. Leaf apices acuminate, base narrowed; petioles ca 3 (-5) mm long; stamens ca 16 in a globose mass around pistillode; staminodes also ca 16 in a ring around ovary; berries globose, ca 2.5 cm in diam.; trees **13. G. imbertii**
- b. Leaf apices long obtuse or notched, base acute; petioles ca 5 - 10 mm long; stamens indefinite in 4 distinct bundles; staminodes few, opposite to petals; berries ellipsoid, ca 12 x 8 - 9 mm; shrubs or small trees **21. G. merguensis**
- 14a. Shrubs; male flowers solitary, terminal, on tetragonous rather thick pedicels **17. G. kurzii**
- b. Trees; male flowers usually more than 1 on rather thin pedicels (rarely thick, stout in *G. pedunculata*) 15
- 15a. Male flowers in terminal, pedunculate, bracteate, trichotomous, 8 - 12-flowered panicles, on 6 - 7 cm long, stout pedicels; stigmatic rays 8 - 12; berries 8 - 12-locular, round, smooth, large, 7 - 11 cm in diam. and weighing ca 0.9 kg each **25. G. pedunculata**
- b. Male flowers various, in cymes and fascicles but not as above, on much shorter and slender pedicels; stigmatic rays less in number or stigma otherwise; berries small, not as above 16
- 16a. Male flowers more than 2.5 cm in diam.; berries more than 5 cm in diam. 17
- b. Male flowers less than 2.5 cm in diam.; berries less than 3 cm in diam. 20
- 17a. Male flowers in terminal clusters of few-flowered cymes, blood red, ca 3 cm in diam., with stamens forming a globose mass; female flowers with 12 - 16-locular ovary and undulate, thick stigma; berries yellowish-green 8 - 10 cm in diam. **5. G. atroviridis**
- b. Male flowers in terminal fascicles of 3 - 9, yellowish-red or yellow, ca 3 - 5 cm in diam., with stamens in 4-lobed masses; female or bisexual flowers with 4 - 8-locular ovary and 5 - 8-lobed or crenate stigma; berries less than 8 cm in diam. 18
- 18a. Male flowers bracteate; bisexual flowers with 18 - 20 mm long pedicels and many stamens; berries globose, ca 7 cm in diam., dark purplish-brown **G. mangostana**(cultivated)
- b. Male flowers ebracteate; female flowers with shorter, less than 10 mm long pedicels and without stamens or staminodes; berries less than 7 cm in diam. 19
- 19a. Leaves 4 - 18 cm long, ovate-elliptic, obtuse and short acuminate at apex, acute or subacute at base; male flowers with obovate petals; staminal phalanges opposite sepals and unlobed rudimentary pistil; ovary 4-locular; stigma broad, shallowly 5 - 7-crenate, glandular **2. G. affinis**

- b. Leaves oblong or elliptic-oblong, narrowed at both ends; 15 - 25 cm long, male flowers with rotundate, slightly clawed petals; staminal masses opposite to petals and rudimentary pistil with broad, blunt lobes; ovary 6 - 8-locular; stigma convex, 6 - 8-lobed **29. *G. speciosa***
- 20a. Male flowers ca 1 cm in diam.; stigma entire 21
- b. Male flowers ca 2.5 cm in diam.; stigma rayed or lobed 22
- 21a. Male flowers bracteate, petals almost as long as sepals; female flowers 4 - 10 in umbellate cymes and without staminodes **6. *G. brevirostris***
- b. Male flowers ebracteate, petals twice as long as sepals; female flowers solitary or geminate, with free staminodes **33. *G. travancorica***
- 22a. Male flowers with 15 mm long pedicels, staminal lobes opposite petals and rudimentary pistil unlobed **16. *G. kingii***
- b. Male flowers with 5 - 10 mm long pedicels, staminal lobes opposite to sepals and rudimentary pistil 8-lobed **12. *G. hombroniana***
- 23a. Male flowers in terminal panicles; female flowers in terminal spicate racemes; leaves 13 - 20 cm long **28. *G. sopsopia***
- b. Male and female flowers 1 - 3 or in axillary and terminal fascicles or umbels; leaves less than 15 cm long 24
- 24a. Male flowers usually 1 - 3; stamens usually definite (except in *G. loniceroides* and *G. morella*); berries generally smooth 25
- b. Male flowers many; stamens usually indefinite, sometimes less and definite; berries generally grooved or lobed (rarely smooth in *G. indica*) 31
- 25a. Stamens in male flowers less than 20 26
- b. Stamens in male flowers more than 20 28
- 26a. Stigmas small, verrucose; leaves lanceolate or elliptic-oblong, acuminate to cuspidate **1. *G. acuminata***
- b. Stigmas large, 4-lobed, coronate; leaves not as above 27
- 27a. Leaves linear-lanceolate, obtusely acuminate, thick, with 16 - 20 pairs of lateral veins **34. *G. wightii***
- b. Leaves elliptic, abruptly and shortly caudate-acuminate or subacute, thin, with 8 - 10 pairs of lateral veins **8. *G. calycina***
- 28a. Leaves elliptic to elliptic-oblong, lanceolate or obovate, 3.5 cm broad; petioles 8 - 20 mm long; stigmas smooth or tubercled 29
- b. Leaves narrowly lanceolate or oblong-lanceolate, 2.5 cm or less broad; petioles up to 12 mm long; stigmas tubercled or tuberculately wrinkled 30
- 29a. Leaves with 7 - 8 pairs of lateral veins; petioles 1 - 2 cm long; pedicels 6 mm long; stigmas minute, dot-like, smooth; berries 4 - 5 cm in diam., 2 or more seeded **22. *G. microstigma***
- b. Leaves with 8 - 12 pairs of lateral veins; petioles usually under 1 cm long; flowers almost sessile; stigmas large, 4-lobed, tuberculate; berries 2 - 3 cm in diam., 4-seeded **23. *G. morella***
- 30a. Male flowers 1 - 2, sessile, with more than 20 stamens; petioles 5 - 12 mm long **19. *G. lanceaefolia***
- b. Male flowers usually 3, rarely more, with ca 4 - 5 mm long pedicels and numerous stamens; petioles ca 6 mm long **20. *G. loniceroides***
- 31a. Leaves obovate, oblong or ovate-oblong to lanceolate; male flowers in umbels or heads; staminodes not in bundles, clusters or fascicles 32
- b. Leaves obovate-oblong, oblong or elliptic to lanceolate; male flowers in fascicles; staminodes in bundles, clusters or fascicles 33

- 32a. Male flowers in sessile heads, with 12 - 40 stamens; ovary covered with fleshy scales; stigmas peltate; berries subglobose or ellipsoid, dark red, 3 - 4 -locular, sharply tubercled or echinate  
27. *G. rubro-echinata*
- b. Male flowers in pedunculate umbels, with numerous stamens; ovary smooth; stigmas with 6 - 8 spreading, glandular rays; berries globular, dark purple-brown, smooth, with 6 - 8 vertical grooves near apex  
18. *G. kydia*
- 33a. Bisexual or female flowers up to 5; berries vertically grooved; petals twice the size of sepals 34  
b. Female flowers solitary; berries smooth or lobed; petals slightly longer than sepals 35
- 34a. Leaves oblong, elliptic or lanceolate; stamens 12 - 20 or more, monadelphous; bisexual flowers with 10 - 20 stamens; ovary 8 - 11-locular; stigmatic rays 8 - 11, coronate; berries up to 7 cm in diam. with 6 - 8 vertical grooves ending about middle, mamillate  
11. *G. gummi-gutta*
- b. Leaves broadly lanceolate; stamens numerous; female flowers with staminodes in 4 clusters of 3 - 8; ovary 6 - 8-locular; stigmatic rays 6 - 8, papillose; berries 2 - 4 cm in diam. with 4 - 8 vertical grooves from base to apex, not mamillate  
9. *G. cowa*
- 35a. Male flowers sessile, aggregated in the axils of fallen leaves with ca 24 stamens closely packed on a fleshy receptacle, anthers circumscissile; staminodes in female flowers ca 24 in 6 - 7- androus fascicles; ovary 4-locular; stigmatic lobes 11 - 13, glandular; berries 3 - 4-lobed, ca 2 cm in diam. 26. *G. pictoria*
- b. Male flowers 4 - 8, in axillary and terminal fascicles on 6 - 8 mm long pedicels; stamens numerous forming a short, capitate column, anthers dehiscent longitudinally; staminodes in female flowers 10 - 18 in 4 unequal, 2 - 3-seriate phalanges; ovary 4 - 8-locular; stigmatic rays 4 - 8, tuberculate; berries smooth, entire, ca 3 cm in diam.  
14. *G. indica*

1. *Garcinia acuminata* Planch. & Triana in Ann. Sci. Nat. ser. 4, 14: 355. 1860; Mahesh. in Bull. Bot. Surv. India 6: 133. 1965. *G. elliptica* Wallich ex Pierre, Fl. Forest. Cochinch. Fasc. 6: 33. t. 86B. 1883. *G. morella* auct non Desr. 1789; T. Anderson in Fl. Brit. India 1: 264. 1874, p.p.

Lus.: *Thoikoy*; Kuki: *Korbomba*

Trees, up to 20 m tall with lax crown; branchlets terete; young ones quadrato-compressed, yellowish-brown; bark dark brown. Leaves 11 - 15 x 3 - 6.2 cm, lanceolate or elliptic-oblong, acute at base, acutely acuminate to cuspidate at apex, repand, chartaceous, lateral veins slender, 10 - 20, slightly arcuate, obliquely parallel; petioles ca 1 cm long, slender, furrowed above. Male flowers axillary, solitary or fascicled, yellow, ca 4 - 5 mm in diam., subsessile. Sepals 4, orbicular, outer pair ca 1 mm long, inner ca 2 mm long. Petals 4, ca 2 - 3 mm long, orbicular or obovate, yellow, thick, imbricate or contorted. Stamens ca 16, inserted on top of a short androphore; filaments short, confluent in a ring; anthers horizontal, often bent down at ends. Rudimentary pistil absent. Female flowers: Ovary globose, usually tetralocular. Berries 2 - 2.5 x 1.5 - 2 cm, globose or slightly elongate, smooth, seated on persistent sepals and crowned by stigma.

*Fl. & Fr.* (Sept.-) Dec. - June.

*Distrib.* India: In evergreen forests from 610 to 1220 m. West Bengal, Assam, Meghalaya, Arunachal Pradesh, Mizoram and Tripura.

Bangladesh and Thailand.

*Notes.* The gum is used as a dye and medicine. The seeds yield a fatty oil which can be used for illuminating purposes and as a substitute for ghee.

**2. *Garcinia affinis*** Wallich [Cat. No. 4852. 1831, p.p.] ex Pierre, Fl. Forest. Cochinch. Fasc. 6: 16, t. 78C, 79G. 1883, non Wight & Arn. 1834. *G. cornea* auct. non L.; Choisy, Descr. Guttif. Inde 53. 1849; T. Anderson in Fl. Brit. India 1: 260. 1874. p.p.

Kh.: *Dieng-soh-Kwang-rit*; Garo: *Thekakhaksi*

Trees, 6 - 10 m tall; branchlets robust, compressed-tetragonous; wood brown or reddish-brown, hard, heavy; bark grey, exfoliating in large, more or less round flakes, cut exudes white gum. Leaves 4 - 18 x 3 - 10 cm, ovate-elliptic, acute to subacute at base, obtuse to short acuminate at apex, chartaceous, shiny, entire; lateral veins ca 18 - 24 pairs, filiform, straight or forked; petioles 1 - 2 cm long, channelled above with ligule clasping stem at base. Male flowers: 3 - 9 in fascicles at apices of branchlets, pale green or pale yellow, ca 3 cm in diam., buds globose; pedicels 9 - 10 mm long. Sepals 4, 9 - 11 x 7 - 12 mm, outer broader than inner, suborbicular or inner obovate, concave, coriaceous. Petals 13 - 15 x 8 - 10 mm, somewhat longer and thinner than sepals, concave. Androphore central, thick, phalanges short, centre produced in rudimentary pistil; anthers indefinite, bilocular, sessile or subsessile. Female flowers: Solitary or geminate, terminal; pedicels ca 5 mm long, stout. Ovary short, broad, turbinate, smooth; median style short, thick; stigmas 6 - 7 mm broad, convex, coronate. Berries ca 3 cm in diam., ovate-oblong, smooth, purpurascens, bright red or dark purple, mamillate, crowned by stigma; pericarp spongy, pulp hardly of pleasant taste, 2 - 4-seeded. Seeds oblong, laterally compressed, 1 - 2 cm long.

*Fl. & Fr.* Nov. - June (- Aug.)

*Distrib.* India: In tropical forests. Assam, Meghalaya; sometimes cultivated in West Bengal and Kerala.

Bangladesh and Myanmar.

*Notes.* It yields an inferior sort of gamboge of uncertain use. The fruits are said to be edible.

**3. *Garcinia andamanica*** King in J. Asiat. Soc. Beng. 59: 170, t. 160. 1890; Parkinson, For. Fl. Andaman 89. 1923.

Trees, 6 - 12 m tall, sometimes up to 20 m; branchlets 4 - 6-gonous, thick, pubescent, dried ones appear to be narrowly winged; latex cream-coloured or milky. Leaves 14 - 25 x 9 - 14 cm, ovate or oblong-ovate, often inequilateral, obtuse, rotundate or subcordate at base, irregularly repand, coriaceous, shiny; lateral veins 14 - 16 pairs, prominent; petioles, 1 - 1.5 cm long, stout, pubescent. Inflorescences dense from short branches. Flowers white or pale. Sepals 5, ovate, rotundate, imbricate, coriaceous, pubescent without. Petals 5, larger than sepals, rotundate, clawed, imbricate, glabrous. Male flowers: Stamens in 5, thick, fleshy bundles opposite to petals; anthers minute, subglobose, introrse. Disc of 5 broad, corrugated glands, much shorter than and alternating with staminal bundles. Female flowers: Ovary globose, 5-locular; stigma 5-lobed, persistent. Berries 2.5 - 4 x 2 - 3 cm, globose or oval, smooth, bright-yellow, shortly apiculate.

#### KEY TO THE VARIETIES

- 1a. Leaves glabrous on both surfaces, with rotundate or subcordate base 3.1. var. **andamanica**  
 b. Leaves pubescent beneath, tapering at base 3.2. var. **pubescens**

#### 3.1. var. **andamanica**

And.: *Madaw-mu*

*Fl. & Fr.* Jan. - July.

*Distrib.* India: Prefers damp places and proximity to water courses, almost at sea level. Andaman & Nicobar Islands (Andaman Islands).

Endemic.

3.2. var. **pubescens** King in J. Asiat. Soc. Beng. 9: 170. 1890.

Young bark blackish. Leaves broadly oblong to oblong-ovate; lateral nerves ca 1 cm apart; petioles ca 2.5 cm long or more, stout, pubescent. Young fruits whitish-green, mature ca 4 x 3.5 cm.

*Fl. & Fr.* Jan. - July

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands).

Myanmar.

4. **Garcinia anomala** Planch. & Triana in Ann. Soc. Nat. ser. 4, 14: 329. 1860; T. Anderson in Fl. Brit. India 1: 266. 1874.



Garo.: *Thechu*; Jain.: *Dieng-sa-slung*, *Dieng-soh-lang-sain*; Kh.: *Dieng-soh-Kwang*, *Soh-lain-Khlaw*; Man.: *Haibung*.

Trees, 10 - 15 m tall; branchlets robust, subverticillate; bark brown or grey, rough, exudes yellowish when cut. Leaves 10 - 20 x 3.5 - 8.5 cm, elliptic or oblong-lanceolate, obtuse or rotundate at base, shortly acuminate at apex, repand, coriaceous, dark green; lateral veins slender, 15 - 25, prominent, obliquely parallel, tertiary veins oblique, transverse or laxly reticulate, anastomosing within the margin; petioles up to 18 mm long, channelled with a fleshy, sheathing ligule at base. Cymes ca 1 cm long, axillary, bracteate, 3-flowered; shortly pedunculate. Flowers 12 - 20 mm in diam., yellowish or pale green, pedicels 3 - 4 mm long, stout; bracts 2, foliaceous, ca 8 mm long, sometimes up to 2 cm, opposite; bracteoles 2, 2 - 3 mm long, opposite, almost concave, caducous. Sepals 4, decussate, 8 - 10 mm long, orbicular, concave. Petals 4, yellowish-white, ca 12 mm long, obliquely oblong, more or less concave, margin fimbriate. Stamens indefinite, monadelphous in an annular mass surrounding pistillode; filaments short, free, compressed; anthers bilocular, horse-shoe-shaped, dehiscence vertical, introrse below, extrorse above. Rudimentary pistil short, thick, columnar or slightly obconic; stigmas conical, rugose, coronate. Female flowers: Similar to male flowers but slightly smaller (ca 1/3). Sepals persistent. Petals whitish-green, deciduous. Staminodes many, filaments united into an annular ring at the base of ovary, shorter than ovary. Ovary bilocular, oblong, apex slightly attenuated, locules 1-ovuled; stigmas disciform, coronate, margin reflexed, striate, irregularly lobulate, persistent. Berries 4.2 x 3.5 cm, ellipsoid, pruinose, smooth, dark olive green, orange-yellow when ripe, crowned by the short, thick stigma and supported by recurved sepals, 1 - 2-seeded. Seeds 8 x 6 mm.

*Fl. & Fr.* Nov. - Aug.

*Distrib.* India: In evergreen forests at between 900-1800 m. Assam, Meghalaya, Mizoram and Nagaland.

Bangladesh and Myanmar.

5. *Garcinia atroviridis* Griffith ex T. Anderson in Fl. Brit. India 1: 266. 1874.

Trees, 12 - 18 m tall, graceful; branchlets robust, terete, smooth; bark black or blackish when dry. Leaves 12 - 25 x 5 - 8 cm, oblong-lanceolate, cuneate and narrowed into a marginated petiole at base, shortly acuminate at apex, thickly coriaceous, dark green, shiny, midrib prominent below, lateral veins ca 40, spreading, ca 4 mm apart, anastomosing near margin with a fine intramarginal vein; pedicels 15 - 25 mm long, reddish. Male flowers: sometimes panicked, on up to 17 mm long peduncles; pedicels 7 - 20 mm long, unequal. Sepals 4, fleshy, concave, subequal, outer pair 15 x 9.5 mm, orbicular or transversely oblong, inner pair 16 x 11 mm, broadly oblong or orbicular, margins thin, streaked with red inside. Petals 4, blood red, orbicular-obovate, concave, fleshy, apex recurved, larger than sepals. Stamens indefinite, forming a globose mass;

filaments slender, inserted in whorls on a thin, annular, fleshy receptacle, almost equalling anthers; anthers narrowly oblong, bilocular, dehiscence longitudinal. Rudimentary styles cylindrical; stigmas large, convex. Female flowers: Terminal, solitary, rarely paired, ca 3 cm in diam. similar to male flowers; pedicels ca 2.5 cm long; petals smaller; staminodes small, on a thin, fleshy, wavy annulus surrounding the ovary. Ovary oblong, smooth, subcylindrical; stigmas fleshy, sessile, convex, edges undulate, deep red, minutely tubercled, broader than ovary, peltate. Berries 8 - 10 cm in diam. globular, yellowish-green, base slightly 9-sulcate, crowned by concave, ribbed stigma; outer rind firm textured; pulp thin, translucent, surrounding seeds.

*Distrib.* India: Assam and Arunachal Pradesh.

Myanmar, Thailand, Malay Peninsula and Malacca.

*Notes.* The fruits are said to be edible; used as a fixative with alum in dyeing silk fabrics; the sour outer rind is used in preparation of curries. A decoction of leaves and roots is used in the treatment of ear aches.

6. *Garcinia brevirostris* Scheff. in Tijdschr. Nederl. Ind. 31: 350. 1870 & in Flora 53: 241. 1870; Mahesh. in Bull. Bot. Surv. India 6: 120. 1965. *G. eugenifolia* Wallich ex T. Anderson in Fl. Brit. India 1: 268. 1874.

Small trees; branchlets tetragonous; wood hard, yellow; bark grey brown. Leaves 6 - 8 x 2.8 - 3.5 cm, broadly elliptic-lanceolate, obtuse or acute at base, acute or acuminate at apex, entire or narrowly subrepand, subcoriaceous, shiny above, pale and opaque beneath; lateral veins inconspicuous; petioles ca 8 mm long. Male flowers: In short, dense, axillary or terminal cymes; pedicels ca 5 mm long; bracts minute. Sepals 4, orbicular, outer pair small, inner almost equal to petals. Petals 4, orbicular, thin, with a circular, thickened with coloured fleshy spot near base. Stamens indefinite in 4 distinct bundles, suberect; anthers minute, orbicular-oblong, bilocular, dehiscence vertical. Rudimentary pistil slender; stigmas large, hemispheric. Female flowers: In short cymes. Sepals 4, minute, scaly. Petals smaller, ciliate. Ovary short, terete; stigmas broad, peltate, revolute, covering nearly entire ovary. Berries in fascicles of 2 - 4, ca 2 cm in diam., globular, smooth, brown, crowned by papillose stigma.

*Distrib.* India: In primary forests on the slopes of hills. Andaman & Nicobar Islands (Andaman Islands), West Bengal (rare).

Myanmar, Singapore, Indonesia and Malay Peninsula.

*Notes.* The timber is used in house building.

7. *Garcinia cadelliana* King in J. Asiat. Soc. Beng. 59: 154. 1890; Parkinson, For. Fl. Andaman 90 1923. *G. lanessanii* Pierre var. *cadelliana* (King) Vesque in DC., Monogr. Phan. 8: 32. 1893.

Trees, ca 9 m tall; branchlets slender, terete, brownish-yellow. Leaves 8.5 - 14 x 4 - 7.5 cm, elliptic-oblong, cuneate at base, more or less acute at apex, thinly coriaceous, shiny, entire; lateral nerves 10 - 12 pairs, thin, somewhat obscure, interarching near margins; petioles 6 - 9 mm long; stout. Male flowers: In dense 3 - 8-flowered, axillary fascicles, ca 6 mm across; buds globose; pedicels stout, ca 2.5 mm long, bracteolate. Sepals 4, small, almost orbicular, outer pair 1.5 x 1.5 mm, inner pair 2 x 1.5 mm, fleshy, with thin margin. Petals 4, ca 5 mm long, obovate-orbicular, fleshy, concave. Stamens indefinite, in 4 bundles, almost on both sides of 4 fleshy, stalked processes opposite to petals; anthers oblong, sessile, 2-loculed, dehiscence longitudinal. Rudimentary pistil slender, ca 3 mm long, fungiform; styles cylindric, as long as staminal bundles; stigmas ca 2.5 mm broad, convex above, entire, warty, papillose or strongly glandular, much pitted below. Female flowers and fruits unknown.

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands).

Endemic.

*Notes.* Not recollected after its type collection. It is best kept as a distinct species until fresh collections are made.

8. *Garcinia calycina* Kurz in J. Bot. 13: 324. 1875; Mahesh. in Bull. Bot. Surv. India 6: 134. 1965.

Shrubs, up to 4.6 m tall; branchlets slender, tetragonous, pale green when dry. Leaves 9 - 13 x 3 - 6 cm, elliptic, cuneate at base, abruptly short caudate-acuminate or subacute, shiny above, pale beneath; lateral veins 8 - 10 pairs, forming bold intramarginal arches, intermediate nerves numerous, slightly prominent beneath; petioles 8 - 12 mm long. Male flowers: Axillary, solitary or 2 - 3 in fascicles, ca 4 mm in diam.; pedicels 4 mm long. Sepals 4, ca 2 mm in diam. orbicular, concave, equal. Petals 4, ca 2 mm in diam., orbicular, concave, veined. Stamens less than 20 in a single, convex group; filaments short, uniseriate; anthers elongate, plurilocular, bent like a horse-shoe over apex of connective and dehiscing along convexity, locules confluent. Rudimentary pistil absent. Female flowers: Axillary, solitary, subsessile, larger than male flowers. Sepals ovate, outer pair larger than inner. Staminodes ca 12, distinct, short, squarish. Ovary hidden by hemispheric, lacunose stigma, usually 4-locular. Berries (immature) ca 10 x 5 mm, ovoid-oblong, smooth, 4-seeded, with sepals persistent at its base and crowned by sessile stigma.

*Fl. & Fr.* Jan. - March.

*Distrib.* India: Andaman & Nicobar Islands (Kamorta Island).

Endemic.

9. *Garcinia cowa* Roxb. ex DC., Prodr. 1: 561. 1824; T. Anderson in Fl. Brit. India 1: 262. 1874. p.p. *G. roxburghii* Wight, Ill. Ind. Bot. 1: 125. 1840, p.p. *Oxycarpus gangetica* Buch.-Ham. in Mem. Wern. Soc. 5: 344. 1826.

Asm.: *Kau-thekeera, kaugach*; Beng.: *Kowa, Kau*; Duffla: *Blachung-Changme*; Garo: *Tekra, Rengram*; Hindi: *Kattaphal*; Or.: *Sarbana*; Mani. & Naga: *Kau*; Eng.: *The Cowa fruit, The Cowa moangosteen*.

Deciduous trees, 9 - 18 m tall with oval crown; bark greyish-brown outside, almost smooth, inside red, soon reddish-brown, exuding yellow gum; wood greyish-white, moderately hard; branchlets more or less 4-angular; drooping with lower ones reaching ground. Leaves 8 - 17 x 2.5 - 7 cm, broadly lanceolate, acute at both ends, apex sometimes acuminate, membranous, dull when dry, lateral veins ca 12 - 16 pairs, slender, rather straight, 2.5 - 4 mm apart, inarching with an intramarginal nerve; stipules minute, fugaceous, leaving a stipular scar; petioles 8 - 13 mm long. Male flowers: 3 - 8 in axillary or terminal fascicles, rather stout. Sepals 4, ca 4 - 6 mm long, unequal, broadly ovate, fleshy, yellow. Petals 4, ca 8 - 10 mm long, oblong, yellow flushed pink or red. Stamens numerous on a convex, fleshy receptacle; anthers oblong, tetragonous, bilocular, on very short filaments, dehiscence vertical by 4 clefts. Rudimentary pistil absent. Female flowers: 2 - 3 (- 5) in terminal fascicles, larger than male flowers, ca 1.5 cm in diam., yellow; pedicels short. Staminodes in a ring round the ovary, with unequal filaments. Ovary subglobose; stigma sessile, flat, deeply divided into 6 - 8 wedge-shaped rays. Berries 2 - 4 cm in diam., depressed, globose, smooth, dark yellow; pericarp thin. Seeds 4 - 8, 13 - 20 mm long, oblong with a soft aril.

*Fl. & Fr.* Dec. - Sept.

*Distrib.* India: Frequent in evergreen, semievergreen and tropical forests up to 1200 m. sometimes along streams. Bihar, West Bengal, Sikkim, Assam, Nagaland, Tripura, Meghalaya, Orissa and Andaman & Nicobar Islands (Andaman Islands); sometimes cultivated in Botanic gardens.

Bangladesh, Myanmar, China and Thailand.

*Notes.* This species yields an inferior gamboge used in preparation of a yellow varnish. The ripe, acidic fruit is eaten and is pleasant in flavour and to taste but contains a yellow, sticky juice which gives a very uncomfortable feeling in the mouth. The sliced fruits are sundried and preserved in Assam for treating dysentery. Elephants also relish the fruits. The young leaves are cooked and eaten as a vegetable.

**10. *Garcinia dulcis* (Roxb.) Kurz** in J. Asiat. Soc. Beng. 43: 88. 1874. p.p. & For. Fl. Brit. Burma 1: 92. 1877, p.p. *Xanthochymus dulcis* Roxb., Fl. Ind. 2: 63. 1832.

Trees; branchlets tetragonous, grooved or keeled; bark olive-coloured, smooth, shiny. Leaves 11 - 25 x 3 - 14 cm, ovate, elliptic or elliptic-oblong, obtuse or rotundate, rarely subcordate at base, obtuse or often acuminate at apex, chartaceous or papyraceous, lateral veins ca 20, irregularly parallel, arcuate, anastomosing at apex into a submarginal nerve; petioles ca 1 - 1.5 cm long. Flowers 5 - 12 in a fascicle, ca 1.5 cm in diam.; bracteoles inserted at swollen base. Sepals 5, rarely 4 or 6, outer ones smaller than inner. Petals 5, rarely 4, ca 1 cm long, ovate, obtuse, flabellately veined, almost closed. Male flowers: stamens in 5 bundles, rarely 4; anthers didymous, ca 5 mm long, linear. Rudimentary pistil absent or present. Female flowers: staminodes few, distributed in 5 fascicles, free or connate at base. Ovary ovoid-subglobose, 5-locular with one ovule in each locule; styles contracted, short, thick; stigmatic rays 5, entire, margin rotundate, coronate. Berries fleshy, bright yellow at maturity, smooth, unilocular, obtusely acuminate at apex, contracted at base. Seeds oblong, 1 - 5; pulp edible, dark-coloured to pleasant taste.

*Fl. & Fr.* March - Nov.

*Distrib.* India: In inland forests at low altitudes. Andaman & Nicobar Islands (Andaman Islands).

Malesia.

*Notes.* Introduced in Indian Botanic Garden, Calcutta; cultivated throughout Malaysia. The fruit contains citric acid and is suitable for jams and preserves. The seeds are used in preparation of medicines applied externally and bark for dyeing mats.

**11. *Garcinia gummi-gutta* (L.) N. Robson** in Brittonia 20: 103. 1968. *Cambogia gummi-gutta* L., Gen. Pl. ed. 5: 522. 1754. *G. cambogia* (Gaertn.) Desr. in Lam., Encycl. 3: 701. 1792; T. Anderson in Fl. Brit. India 1: 261. 1874. *Mangostana cambogia* Gaertn., Fruct. Sem. Pl. 2: 106. 1790.

Trees, up to 20 m tall with round canopy; wood grey, shiny, hard, smooth; bark grey or dark brown, rugose, exudes yellow gum; branchlets horizontal or drooping, glabrous. Leaves 7 - 15 x 2 - 7 cm, oblong, elliptic or lanceolate, cuneate at base, contracted into petioles, acute to obtusely short acuminate at apex, entire, glossy dark green; lateral veins indefinite, 5 - 6 mm apart, slender, prominent, oblique, reticulate; petioles 5 - 12, rarely 20 mm long, stout, channelled. Male flowers: 3 - 5 in short, axillary fascicles, ca 12 mm in diam., white, pale white or pale green; pedicels 7 - 15 mm long, thickened towards tip, often reflexed. Sepals 4, ovate or obovate, unequal, outer pair 5 - 6 mm, inner 7 - 8 mm, coriaceous, margin membranous, fleshy. Petals 4, 8 - 10 mm long, obovate or oblong, concave, margin membranous. Stamens 12 - 20 or more inserted on a prominent

receptacle, forming a globular head; filaments ca 0.5 mm long; anthers ca 0.5 mm long, bilocular, basifixed, apices obtuse, dehiscing vertically. Rudimentary pistil absent or minute; stigmatic lobes 3 - 4, short, yellow. Bisexual flowers: 1 - 3 in terminal and axillary fascicles, larger than male flowers, 1 - 1.5 cm across; pedicels 4 - 6 mm long. Sepals and petals similar to those of male flowers. Stamens 10 - 20; filaments unequal, connate at base in a ring round the ovary or grouped in unequal bundles; anthers bilocular, fertile or often a few sterile. Ovary ca 1 mm long, subglobose or ovoid, 8 - 11-sulcate, grooved; stigmatic rays spreading, free nearly to the base, margin crenate, irregularly or tuberculate. Berries sometimes up to 7 cm in diam., globose, yellow or red, (4 -)6 - 8-grooved, smooth, 6 - 8-seeded, flat and depressed at tip, mamilla thick; pericarp fleshy. Seeds as many as grooves, ca 3 cm long, ovoid, compressed, pale brown, veined, surrounded by a succulent, white or red aril.

#### KEY TO THE VARIETIES

- 1a. Stamens 12 - 20; ovary 8 - 10-locular; stigmatic rays 8 - 10; berries globose, 6 - 8-grooved, grooves ending about the middle 11.2. var. *gummi-gutta*  
 b. Stamens more than 20; ovary 4- or 6 - 8-locular; stigmatic rays 4- or 6 - 8-grooved to the top 2  
 2a. Stamens ca 35; ovary 4-locular; stigmatic rays 4; berries ovoid or conical, 4-grooved 11.1. var. *conicarpa*  
 b. Stamens ca 25 (in male flowers); ovary 6 - 8-locular; stigmatic rays 4 - 8; berries ovoid-oblong, 4 - 8-grooved 11.3. var. *papilla*

**11.1. var. *conicarpa*** (Wight) N.P. Singh, *comb. nov.* *G. conicarpa* Wight, *Icon. Pl. Ind. Orient.* t. 121. 1839 & *Ill. Ind. Bot.* 1: 125. 1840. *G. cambogia* (Gaertn.) Desr. var. *conicarpa* (Wight) T. Anderson in *Fl. Brit. India* 1: 262. 1874. *G. darwiniana* Keshav. *et al.* in *Curr. Sci.* 56: 425. 1987, *syn. nov.*

Leaves broader beyond the middle or linear-oblong or lanceolate-oblong. Stamens inserted on a short, convex torus; filaments short. Rudimentary pistil absent. Berries 4-seeded with angular furrows.

*Fl. & Fr.* March - Jan.

*Distrib.* India: Maharashtra, Karnataka and Tamil Nadu; rare.

Endemic.

*Notes.* Though this variety has often been merged with the species proper by several botanists its distinctive characters make a deserving case to be treated as a good variety, and hence a new combination is made here.

**11.2. var. *gummi-gutta***

Coorgi: *Manthulli*; Kan.: *Upagi* (or *Oopagi*) *mara*, *Seemae hunase*; Mal.: *Pinenga*, *Pinaru*, *Kodapuli*, *Gorakkapuli*, *Kodokapuli*, *Kadumpuli*; Mar.: *Dharambe* or *Dharambo*; Tam.: *Penampuli*, *Kodakkapuli*; Tel.: *Simachinta*; Eng.: *Malabar Gamboge*.

Staminodes subequidistant, connate at base or grouped in fascicles. Ovary 8 - 10-sulcate; stigmatic rays linear, cuneate, tuberculate. Berries pome-shaped, costa prominent, furrows narrow, yellow or red.

*Fl. & Fr.* Jan. - Sept.

*Distrib.* India: Common in evergreen and semievergreen forests and also in Shola forests of Western Ghats up to 1830 m. Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala; often cultivated in botanic gardens.

Endemic.

*Notes.* The 'gummi-gutt' or gamboge is principally used as a pigment in miniature paintings and water colours, besides its medicinal use as a purgative, hydragogue and emetic, particularly in dropsies and worm cases. The gum also makes a good varnish. The fruits are very acidic and eaten raw or pickled. Their rind is used as a condiment for flavouring curries, as a substitute for tamarind and lime. It is also used for polishing gold and silver ornaments and as a substitute for acetic and formic acids for coagulation of rubber latex. The seed oil is used in medicine. Wood suitable for match boxes, splints and posts.

11.3. var. *papilla* (Wight) N.P. Singh, *comb. nov.* *G. papilla* Wight, *Icon. Pl. Ind. Orient.* t. 96. 1839. *G. cambogia* (Gaertn.) Desr. var. *papilla* (Wight) T. Anderson in *Fl. Brit. India* 1: 262. 1874.

Leaves elliptic. Flowers orange red or greenish-yellow outside and red inside. Stamens united into a globose cylindrical androphore. Rudimentary pistil absent. Styles short, thick in female flowers. Berries with a terminal mamilla. Seeds subtriangular with slender testa.

*Fl. & Fr.* Feb. - Jan.

*Distrib.* India: Western Ghats. Tamil Nadu and Kerala.

Endemic.

12. *Garcinia hombroniana* Pierre, *Fl. Forest. Cochinch.* Fasc. 5: 12, t. 79 D-J. 1883; Mahesh. in *Bull. Bot. Surv. India* 6: 121. 1965.

Trees; branchlets stout, quadrangular, yellowish when dry. Leaves 8.5 - 13 x 5 - 7

cm, elliptic to oblong-elliptic, slightly subequal, cuneate at base, subacute or very shortly and abruptly acuminate at apex, almost glossy above, dull beneath, lateral veins ca 32, slender, ascending, inconspicuous; petioles 10 - 13 mm long, channelled above. Male flowers: 3 - 6 in terminal fascicles, ca 2.5 cm in diam. Sepals 4, concave, thinly coriaceous, outer pair 6 - 8 x 3 - 4 mm, orbicular, inner pair 7 - 10 x 5 mm, ovate-oblong. Petals 4, ca 1 cm in diam., ovate-orbicular, concave, base thick, margin membranous. Stamens indefinite, filaments united; anthers inserted on a fleshy, slightly 4-lobed annulus, broadly oblong, bilocular, dehiscing vertically. Rudimentary pistil flat, slightly protruding above staminal mass. Female flowers: Solitary, terminal, similar to male flowers. Staminodes absent. Ovary globose, 8 - 9-locular; stigmas large, peltate, convex, edges recurved when young, with 8 shallow crenations when mature. Berries ca 3 cm in diam., subglobose, smooth, with persistent sepals, pericarp thin, crustaceous. Seeds ca 6, 2.8 cm long, oblong, with soft juicy aril.

*Fl. & Fr.* Feb. - April.

*Distrib.* India: Chiefly on sandy and rocky coastal areas. Andaman & Nicobar Islands.

Thailand, Singapore and Malay Peninsula.

*Notes.* Timber used for house construction and oars. The fruit pulp is sour and edible. Though roots and leaves are reported to be medicinal, they are not in use in India.

13. *Garcinia imbertii* Bourd. in J. Bombay Nat. Hist. Soc. 12: 349. t. 1. 1899; Gamble, Man. Ind. Timb. 57. 1902 & Fl. Pres. Madras 74. 1915.

Tam.: *Manja-Kanji*.

Trees, 9 - 12 m tall; trunk ca 30 cm in diam.; wood yellowish-grey, very hard; bark brown and white, smooth, ca 6 mm thick, cut sweet-scented; sap thin, drying, white, sweet-scented. Leaves usually 4 - 8 x 1.5 - 3 cm, rarely up to 11 x 4 cm, elliptic or lanceolate, cuneate at base, long obtuse-acuminate at apex, entire, dark green, lateral veins 15 - 25, close, ascending, obscure. Male flowers: in terminal fascicles of 3, 6 or 9 at the ends of branchlets; ca 5 mm in diam., succulent, sessile, ebracteate. Sepals 4, suborbicular, concave, outer pair shorter, ca 2.5 mm long, inner pair ca 3 mm long, much imbricated. Petals 4, ca 3 mm, orbicular, concave, much imbricated. Stamens monadelphous in a central mass round the rudimentary pistil; anthers bilocular. Female flowers: solitary or geminate, yellow, succulent, sessile. Ovary bilocular; stigmas broad, convex, entire, sessile. Berries ca 2.5 x 2.5 cm, smooth. Seeds 1 - 2, enclosed in a thick leathery covering.

*Fl. & Fr.* April - Sept.



*Distrib.* India. Common in evergreen forests between 900 and 1100 m. Kerala (localised in South Travancore) and Tamil Nadu (rare in Tirunelveli district).

Endemic.

**14. *Garcinia indica*** (Thouars) Choisy in DC., Prodr. 1: 561. 1824. T. Anderson in Fl. Brit. India 1: 261. 1874. *Brindonia indica* Thouars in Dict. Sci. Nat. 5: 340. 1804. *G. purpurea* Roxb., Fl. Ind. 2: 624. 1832. *Stalagmitis indica* G. Don, Gen. Hist. 1: 621. 1831. *Stalagmitis purpurea* G. Don, Gen. Hist. 1: 621. 1831.

Guj.: *Kokan*; Goa.: *Brindall*; Hindi: *Kakam* or *Kokam*; Kan.: *Murgala* or *Murgal*, *Muringa-hulimara*; Mar.: *Amsol*, *Bhinda*, *Bhirand* or *Bhiran*, *Katambi*, *Kokam*, *Kokambi*, *Ratamba*; Tam.: *Murgali*; Eng.: *Mangosteen*, *Wild mangosteen*, *Red mango*, *The Kokam butter tree*, *The Mangosteen oil tree*, *The Brindonia tallow tree*, *Indian gamboge*, *Tomato plant* (as called in Khandala); Port.: *Brindon*, *Brindeos*.

Graceful, slender trees, usually up to 10 m tall, sometimes up to 15 m, with conical crown, usually buttressed at base; trunk blackish; wood greyish-white, hard; bark light brown, very thin, smooth, rather shiny; branches often drooping, young ones subterete, slender, irregularly striate. Leaves 6.5 - 11 x 1.5 - 5 cm, lanceolate or obovate-oblong, contracted into petiole at base, acute or acuminate at apex, margin membranous, shiny, dark green; lateral veins 7 - 18, slender, prominent; petioles 5 - 12 mm long, slender; young leaves red, beautiful. Male flowers: Small, white; buds as large as a pea, almost globose; pedicels stout, gradually thickened upwards, up to 4 mm long; bracts scale-like, caducous. Sepals 4, decussate, outer pair smaller, 3 - 4.5 mm long, inner pair 4.5 - 5 mm long, ovate-rotundate, base narrow, thick, fleshy, yellowish to pinkish orange. Petals 4, 5 - 6 mm long, thick. Stamens inserted on a hemispheric subquadrate torus; filaments short; anthers oblong, bilocular, truncate. Rudimentary pistil absent or if present as long as stamens. Female flowers: Terminal, shortly peduncled; pedicels short, ca 3 mm long, stout. Sepals and petals similar to male flowers. Staminodes 1 - 3 mm long; filaments short, very thick. Ovary subglobose, 4 - 8-loculed; stigmas convex, coronate, sessile, rays as many as locules, often 2-seriate. Berries almost spherical, not furrowed, 4 - 8-loculed, purple, orange-pink or wine brown, surrounded at base by persistent sepals; pulp red, acidic, fleshy. Seeds 5 - 8, compressed.

*Fl. & Fr.* Nov. - Aug.

*Distrib.* India: In tropical evergreen forests of Western Ghats: Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala (rare); often planted in southern Maharashtra, Nilgiris and Indian Botanic Garden, Howrah.

Endemic.

Introduced in France, Bourbon and Mauritius.

*Notes.* The seeds yield valuable fat known as 'Kokum butter'. It is used as an edible fat, for adulterating ghee, in manufacture of soap and candles. It is also suitable for ointments, suppositories and other pharmaceutical purposes, as a remedy in pthisis-pulmonalis, scrofulous diseases, dysentery, mucous diarrhoea and externally for excoriations, chaps, fissures of lips and as a substitute for spermaceti. The acidic fruit juice is used by blacksmiths for melting iron. The dried outer fruit rind is used as Kokam in Konkan area of Maharashtra as a garnish to give an acid flavour to curries and also for preparing syrups during hot months; sometimes exported to Zanzibar. The ripe fruit is edible, is anthelmintic and cardiotoxic. The wood is well suited for paper pulp.

**15. *Garcinia keenania*** Pierre, Fl. Forest. Cochinch. Fasc. 6: 8, t. 92 G. 1883, '*keenaniana*'.

Shrubs or treelets; branchlets moderately thick, tetragonous. Leaves 7 - 11 x 2.8 - 5 cm, oblong, round or slightly narrowed into a petiole, shortly acuminate at apex, acumen 5 - 10 mm long, coriaceous, glabrous; midrib slightly canaliculate above, lateral veins ca 36 or more, conspicuous above, obscure beneath; petioles 6 - 10 mm long, rather thick. Male flowers not seen. Female flowers: In axillary, umbelliform cymes; ca 7 mm in diam., white, scented somewhat-like those of oranges; pedicels ca 5 mm long. Sepals minute, 4 in subequal pairs, outer pair 1.5 mm in diam., inner pair 3 mm in diam., all orbicular, concave with membranous margins. Petals 4, white, small, 4 mm in diam., longer and thinner than sepals, many-veined, orbicular or slightly oblong, concave. Staminodes absent or sometimes many, minute. Ovary globose, bilocular; stigmas fleshy, convex, margin repand-undulate, rather large, coronate. Fruits not seen.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Assam (Cachar).

Endemic.

*Notes.* Not recollected after its type collection in 1873 *R.L. Keenan s.n.* (Type K!). It seems to be a good species, but can be determined definitely only after collecting and studying male flowers and fruits.

**16. *Garcinia kingii*** Pierre ex Vesque in DC., Monogr. Phan. 8: 407. 1893; Brandis, Indian Trees 50. 1907; Mahesh. in Bull. Bot. Surv. India 6: 124. 1965.

Trees; branchlets terete, young ones quadrato-compressed, grey ochraceous when dry. Leaves 12 - 15 x 4.5 - 7 cm, elliptic or ovate-oblong, obtuse or acute at base, obtusely acuminate at apex, repand, chartaceous, glabrous; lateral veins ca 15, slender, somewhat arcuate, joining in a slender submarginal vein, 1 - 1.5 mm apart. Male flowers: ca 2.5 cm in diam. Sepals 4, ca 7 mm long, subequal, orbiculate, concave, membranous. Petals 4, 13 - 15 x 10 - 11 mm, obovate, obtuse, indistinctly flabellately veined. Stamens indefinite,

below cupuliform rudimentary pistil, more or less involuted at apex; anthers indefinite, oblong, apex recurved, bilocular. Rudimentary pistil columnar at base; stigmas smooth, more or less convex. Berries small.

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands); rare.

Endemic.

*Notes.* No specimens seen.

**17. *Garcinia kurzii* Pierre**, Fl. Forest. Cochin. Fasc. 5: 14, t. 78. 1883; Brandis, Indian Trees 49. 1907.

Shrubs; young branches slightly quadrangular; young bark green. Leaves 16 - 25 x 8 - 10 cm, elliptic, obtuse or acute at base, acuminate at apex, entire or subrepand, coriaceous, shiny; lateral veins indefinite, ca 1 cm apart, slender, more or less arcuate, irregularly anastomosing towards apex into submarginal vein, tertiary veins laxly reticulate; petioles 2 - 2.5 cm long, channelled above. Male flowers: Solitary, rarely paired, 2.5 cm diam., pale white; pedicels 9 - 10 x 2 - 3 cm. Sepals 4, slightly unequal, outer pair 13 x 15.5 mm, inner pair 13 x 10 - 12 mm, orbicular, concave, recurved after anthesis, thick, many-nerved. Petals 4, 16 - 18 x 20 mm, suborbicular, narrowed at base, thick, faintly veined. Stamens indefinite, in 4 bundles, opposite to petals; filaments long; anthers oblong, bilocular. Rudimentary pistil short, apex disciform, 1.5 mm broad, flat or slightly convex, margin wavy, fimbriate. Female flowers: Staminodes absent. Stigma peltate, radiate or lobed. Berries small, up to 3 cm in diam.

*Fl. & Fr.* Jan. - March.

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands).

Endemic.

**18. *Garcinia kydia* Roxb.**, Fl. Ind. 2: 623. 1832; Parkinson, For. Fl. Andamans 90. 1923. *G. cowa* T. Anderson, in Fl. Brit. India 1: 262. 1874, p.p. non Roxb. ex DC. 1824.

*Asm.*: *Kuji-thekera*, *Chopchopa*; (Cachar) *Hau*; -Garó: *Tekra*, *Denga-doti*; Kh.: *Dieng-soh-longksan*; Miri & Abor: *Tarak-asing*.

Diocious trees, 7 - 20 m tall, elegant with a narrow crown; wood white, turning yellowish, heavy, very perishable; bark blackish brown, rough, cracked, cut exudes a yellow latex which hardens into a gum; branchlets glabrous, more or less terete, often drooping, dark coloured when dry. Leaves 8 - 15 x 2 - 4 cm, ovate-oblong rarely obovate-oblong to lanceolate, acute at base, acuminate at apex, thinly coriaceous, glabrous, shiny, lateral veins thin but distinct when dry, slender, rather irregular, ca 12

pairs with few intermediate ones, all arched to form an intramarginal vein; petioles 8 - 12 mm long, slightly dilated at base. Male flowers: In small, axillary or terminal umbels of 3 - 5 or rarely solitary, ca 2 cm in diam.; peduncles 10 - 15 mm long; pedicels ca 6 mm long, thick, clavate, glabrous. Sepals 4, 5 - 6 mm long, equal, ovate, obtuse, fleshy, yellow. Petals 4, pale yellow, 10 - 12 mm long, broadly ovate, blunt, thick, concave. Anthers squarish, bilocular, inserted into a slightly 4-lobed mass of short conjoined filaments, dehiscent by 4 clefts. Rudimentary pistil absent or rarely 2-lobed at apex. Female flowers: Solitary, axillary and terminal, sessile. Sepals and petals similar to male flowers. Stamines 4, small, 3- or 4-fid, alternate with petals, branches gland-tipped, alternate with petals. Ovary globular, sessile, 6 - 8-locular, 6 - 8-lobed; stigmas subsessile, fleshy with 6 - 8 spreading rays. Berries 2.5 - 5 cm in diam., depressed, with a nipple-like protuberance from apex, on which is inserted the persistent stigma, umbonate, dark purple-brown, 6 - 8-seeded. Seeds oblong, ca 2 cm long; aril soft, acidic, juicy.

*Fl. & Fr.* Dec. - Aug.

*Distrib.* India: In tropical forests at lower elevations up to 600 m. Assam, Meghalaya and Andaman & Nicobar Islands; often cultivated for its fruits.

Bangladesh, Myanmar and Malaysia.

*Notes.* It yields an inferior gamboge. Its fruit is considered as specific for dysentery and also for external application in obstinate cases of headaches.

This species is clearly allied to *G. cowa* Roxb. ex DC., under which it is sometimes merged. Some botanists have suggested that introgressive hybridization may take place in areas where both the species occur.

19. *Garcinia lanceaefolia* Roxb., [Hort. Beng. 42. 1814, nom. nud.] Fl. Ind. 2: 623. 1832; T. Anderson in Fl. Brit. India 1: 263. 1874. *G. purpurea* Wallich ex Choisy, Descr. Guttif. Inde 36. 1849, non Roxb. 1832. *Stalagmitis lanceaefolia* G. Don, Gen. Hist. 1: 621. 1831.

Evergreen trees or profusely branching, slender shrubs; branchlets dark brown, decussate; bark rugose, black or dark brown. Leaves 8 - 12 x 1.5 - 2.5 (- 3) cm, narrowly lanceolate, attenuate at base, cuspidate or acuminate at apex, repand, subcoriaceous, dark glossy green, lateral veins 7 - 18, indistinct, anastomosing close to margin. Male flowers: Terminal, solitary or geminate, ca 8 mm in diam., dark yellow, reddish-yellow or red, bracteate. Sepals 4, ca 6 mm long, oblong, fleshy, thick, yellowish-green. Petals 4, red, narrow, slightly oblique, smaller than sepals. Stamens more than 20 in a globose, red mass; anthers oblong, bilocular, almost sessile, introrse, dehiscent by 2 vertical clefts. Rudimentary pistil absent. Female flowers: Terminal or axillary, solitary, larger than male flowers; pedicels as long as flowers, thick, 2-bracteate at base. Sepals 4, ovate, carnos, margin membranous. Petals 4, much narrower, concave. Stamines in 4

bundles of 2 - 10 each, opposite to sepals, connate into a ring at base, irregular; anthers ovate. Ovary globose, contracted at apex, 6 - 20-locular; stigmatic rays 6 - 10, 2-seriate, tuberculate, sessile. Berries orange-yellow, ca 2.5 cm in diam., obovoid, smooth, with persistent sepals and coronate stigma, 6 - 8-seeded.

#### KEY TO THE VARIETIES

- 1a. Leaves narrowly lanceolate; staminodes (in female flowers) 30 - 40, in 4 - 8-androus bundles; flowering twigs ca 1.5 mm thick **19.1 var. lanceaefolia**
- b. Leaves linear-oblong, acute at ends; staminodes (in female flowers) 8 - 13, in 2 - 4-androus bundles; flowering twigs 0.5 - 1.5 mm thick **19.2 var. oxyphylla**

#### 19.1. var. *lanceaefolia*

Asm.: *Rupohi-thekera* or *Kan tekera*, (in Mikir hills) *Prangsu*, *Prango-arong*; Garo: *Thisuru*; Kh.: *Dieng-soh-jadu*; Jain.: *Dieng-sohsint*; Lus.: *Pelte*.

Sepals ca 7 x 6.5 mm. Petals ca 5 x 3 mm. Berries obovoid or turbinate, orange to yellow, edible.

*Fl. & Fr.* Feb. - July.

*Distrib.* India: Common as an undergrowth in evergreen forests, up to 915 m. Assam, Nagaland and Meghalaya.

Bangladesh and Myanmar.

*Notes.* The ripe acidic fruits are eaten and also used in medicine. The leaves are subacidic and are reported to be eaten after cooking. Often cultivated in villages for its fruits.

**19.2. var. *oxyphylla*** (Planch. & Triana) Lanessan, Mem. Garcin. 48. 1872. Mahesh. in Bull. Bot. Surv. India 6: 126. 1965. *G. oxyphylla* Planch. & Triana in Ann. Sci. Nat. ser. 4, 14: 342. 1860.

Asm.: *Rupohi-thekera*.

Ovary 7 - 10-locular; stigmatic rays 7 - 10, regularly 2-seriate. Berries orange-yellow, rarely red, ca 4 cm in diam., ovoid.

*Fl. & Fr.* Nov. - June.

*Distrib.* India: Fairly common in evergreen forests. Assam, Meghalaya, Nagaland and Tripura.

Endemic.

*Notes.* The ripe fruits are eaten, often cultivated in villages for its fruits.

**20. *Garcinia loniceroides*** T. Anderson in Fl. Brit. India 1: 264. 1874. *G. succifolia* Kurz in J. Asiat. Soc. Beng. 41: 293. 1872.

Evergreen shrubs or small trees; branchlets slender, decussate, horizontal, reddish-purple; bark dark grey, leaves confined to young shoots or apices of branchlets; 5 - 10 x 1.5 - 2 (- 2.5) cm, oblong-lanceolate or oblanceolate, narrowed at both ends, entire, membranous, glaucous beneath; lateral veins obscure, slender, irregularly branched and forked. Male flowers: terminal, rarely axillary, ca 4 - 5 mm in diam., tetramerous; pedicels slender. Sepals 4, ca 2 mm long, broadly ovate, concave, somewhat fleshy. Petals 4, similar to sepals in size and shape. Stamens in a central, subtetragonal mass; anthers bilocular, sessile, dehiscent by 2 vertical clefts. Rudimentary pistil absent. Female flowers: 4 - 5 mm in diam., similar to male flowers. Ovary almost globose; stigma tuberculate. Fruit not known.

*Fl.* Nov. - Feb.

*Distrib.* India: Nagaland (Kungba, Naga Hills) and Manipur (Nungba).

Myanmar.

**21. *Garcinia merguensis*** Wight, Icon. Pl. Ind. Orient. 116. 1839 & Ill. Ind. Bot. 1: 124. 1840; T. Anderson Fl. Brit. India 1: 267. 1874.

Trees or shrubs, 13 - 20 m tall; branchlets brachiate, subterete, quadrate-compressed; bark greyish-green. Leaves 5 - 12 x 2.5 - 5 cm, lanceolate, elliptic or ovate, subrepand, thinly coriaceous, midrib prominent, lateral veins minute, thin, ca 2 mm apart, irregular, parallel, arcuate, ending in a stout intramarginal nerve. Male flowers: Indefinite in short, 4 - 6 cm long, axillary cymes, nearly tripartite at base, lateral branches 1-flowered, median 3-flowered, often in false, contracted umbels, ca 1 cm in diam.; pedicels 2 - 10 mm long, tetragonal; bracteoles 2. Sepals 4, decussate, outer bract-like, inner larger, 2.5 mm long, concave, membranous. Petals 4, 5 - 6 mm long, ovate, obtuse, concave, imbricate. Staminal bundles opposite to petals, each bearing a head of anthers, on short filaments; anthers small, didymous, bilocular, shortly obliquely dehiscent. Rudimentary pistil variable, often fungiform, large, styles as long as staminal bundles. Female flowers: Solitary or geminate; pedicels 12 - 25 mm long. Staminal nodes scale-like, margin obtuse-dentate. Ovary shallowly obconic, bilocular, 1-ovuled, ovule semianatropous; styles absent; stigmas large, thick, convex, almost covering the whole ovary.

Berries fleshy, smooth with discoid, 3 - 4 mm broad, sessile, coronate stigma. Seeds solitary, subreniform.

*Fl. & Fr.* Dec. - Jan.

*Distrib.* India: In dense, evergreen forests. Andaman & Nicobar Islands (Andaman Islands).

Bangladesh, Myanmar, Cambodia, S. Vietnam, Thailand, Malacca and Malay Peninsula.

**22. *Garcinia microstigma*** Kurz in J. Bot. 13: 324. 1875 & For. Fl. Brit. Burma 1: 91. 1877; Parkinson, For. Fl. Andaman 90. 1923.

Shrubs, 1 - 2 m tall; branchlets obscurely 4-angled. Leaves 10 - 13 x 3.5 - 6 cm, elliptic to elliptic-oblong, sometimes lanceolate, cuneate at base, obtuse or acuminate at apex, dull on both surfaces when dry, lateral veins faint, interarching. Male flowers: Terminal, solitary, or 2 - 3 in axillary cymes, ca 8 mm in diam., reddish, bracteolate. Sepals 4, ca 5.5 x 6 mm; outer pair ovate, acute, fleshy, keeled, longer than inner, obovate-orbicular, distinctly concave pair. Petals 4, ca 5 mm long, obovate-orbicular, concave, fleshy. Stamens 20 - 35, inserted on a single convex receptacle; filaments short, broad; anthers red, bilocular, broadly ovate, introrse, dehiscence longitudinal. Rudimentary pistil absent. Female flowers: Solitary, on pedicels shorter than those of male flowers. Ovary globose. Berries reddish, globose, smooth, thin, with persistent sepals at base and crowned by the discoid, entire, sessile stigma. Seeds 2 or more.

*Fl. & Fr.* Sept. - Nov.

*Distrib.* India: Frequent in tropical forests. Andaman & Nicobar Islands.

Endemic.

*Notes.* The fruits are edible. The young leaves are cooked and eaten by tribals in Andaman Islands. Rarely cultivated.

**23. *Garcinia morella*** (Gaertn.) Desr. in Lam., *Encycl.* 3: 701, t. 405 f. 2. 1792; T. Anderson in *Fl. Brit. India* 1: 264. 1874. *Mangostana morella* Gaertn., *Fruct. Sem. Pl.* 2: 106, t. 101. 1790. *Garcinia gutta* Wight, *Icon. Pl. Ind. Orient.* 1: t. 44. 1840, excl. syn.

*Asm.*: *Kuji-thekeera*; Beng. & Hindi: *Tamal*; Kan.: *Hardala* or *Aradal*, *Devanahuli*, *Jarize*, *Arsinagurgi*; Mal.: *Chigiri*, *Daramba*, *Karikkampuli*, *Pinnarpuli*; Mar.: *Tamal*, *Revalchinni*; Tam.: *Makki*, *Solaippuli*; Tel.: *Pasupuvarne*, *Revalchinni*; Eng.: *The Mysore Gamboge tree*, *The Indian Gamboge tree*.

Trees, 10 - 17 m tall, with spreading branches and dense crown; branchlets quadrangular, quite glabrous, drying grey; wood yellow, mottled, hard; bark ochraceous, brownish-grey or brown to dark brown, thin, generally smooth, exuding brilliant, dark yellow, sticky, thick latex. Leaves 10 - 16 x 4 - 9 cm, elliptic, ovate, obovate or oblanceolate, acute or cuneate at base, obtuse to shortly obtuse-acuminate at apex, entire or subrepand, chartaceous; lateral veins slender, obliquely parallel, arcuate, anastomosing close to margin, obscure; petioles 8 - 10 (- 15) mm long, stout, thickened and shortly ligulate at base. Male flowers: ca 3 in axillary, leafy fascicles or on old wood, 5 - 10 mm in diam., white or creamy, faintly fragrant; pedicels 4 - 6 mm long. Sepals 4, 4 - 6 mm long, orbicular or elliptic, decussate, outer pair smaller than inner, thin, greenish-white. Petals 4, white to pink, 5 - 8 mm long, rotundate or broadly elliptic, fleshy (drying thin), veined, concave. Stamens numerous (ca 25 - 40) in a central, subglobose mass; filaments short, obconic, free at apex; anthers red, orbicular, flattened, peltate, adnate, plurilocular, red, dehiscence circumscissile or transverse. Rudimentary pistil absent. Female flowers: Axillary, solitary, equal to or larger than male flowers. Sepals persistent. Staminodes ca 10 - 12, connate at base into a ring round the ovary. Ovary subglobose, glabrous, 4-locular; stigmas broad, sessile, 4-lobed, peltate, coronate, dentate, yellow, turning brown-red, persistent. Berries 2 - 3 cm in diam., subglobose or sometimes globose, obtuse, smooth, sessile, yellowish, contains much yellow gamboge, pulp sweet, acidic, crowned by 4 round, confluent papillate stigmas, 4-seeded. Seeds kidney-shaped to ovoid-reniform, laterally compressed, dark brown, muricate.

*Fl. & Fr.* Nov. - July; fruits persist till Dec.

*Distrib.* India: In evergreen, moist and dry deciduous forests from plains up to 1000 m. Western Ghats and North-east India. Karnataka, Tamil Nadu, Kerala, Assam and Meghalaya.

Sri Lanka, Bangladesh, Myanmar, Singapore, Thailand and Malacca.

*Notes.* Many botanists include *G. pictoria* Roxb. under this species but it is treated separately as a good species in this flora.

This species yields a beautiful pigment after attaining 20 years of age. This is the indigenous source of gamboge. The pigment is used in preparing water colours and golden coloured spirit varnishes for metals and for dyeing silken fabrics. A golden yellow ink is also made for writing on black paper. The pigments morellin and guttiferin possess antibacterial properties. The gamboge is used as a hydragogue and drastic cathartic, anthelmintic, in constipation, anasarca and other dropsical affections. The fruit rind is used in tanning. The seed oil or 'butter' is used in cooking and confectionary, as a substitute for ghee, in candle making and in medicine. Wood used for cabinet work and temporary structures.



**24. *Garcinia nervosa*** Miq., Ann. Mus. Bot. Ludg.-Bat. 1: 208. 1864. *G. andersoni* Hook. f., Fl. Brit. India 2: 270. 1874; N.G. Nair in Geobios 4: 221. 1977.

Small trees, 3 - 6 m tall; branchlets slender, ca 2 cm in diam., 4-angled with 2 angles flattened, almost winged when dry; latex white or yellow. Leaves very large, 9 - 15 cm wide, sometimes broader (up to 22 cm), oblong-lanceolate, narrowed to rounded at base, shortly acuminate at apex, margins recurved, dark green, glossy above, pale yellowish below, thickly coriaceous, midrib angular beneath; lateral veins 17 - 20 pairs, prominent, anastomosing into a strong intramarginal vein, interspaces prominently reticulate; petioles 7 - 10 mm thick, stout. Male flowers unknown. Female flowers: many in fascicles, ca 2 cm in diam., yellow, greenish-yellow or white, globose; pedicels very stout, tapering towards base, seated on a subglobose, axillary cushion. Sepals 5, pale yellow, 3 - 5 mm across, rounded or orbicular, ciliate, pubescent outside, imbricate, coriaceous or leathery, concave, outer 2 smaller. Petals 5, 8 - 12 mm across, rounded or orbicular, concave, imbricate. Staminodes 5, alternating with disc lobes, 2 - 3 mm long, with 4 - 6, reddish, minute, sterile anthers. Disc 5-lobed, fleshy, pitted, ciliate 3 - 4 mm across. Ovary ovoid or globose, conical, 5 - 10 x 4 - 6 mm, glabrous; styles very short; stigmas reddish-yellow, 2 - 4 mm across, 5-lobed, divided to the base into linear or oblong, obtuse lobes. Berries pomiform, usually 5-loculed, crowned by stigma.

*Fl. & Fr.* May - Aug.

*Distrib.* India: In dense mixed forests, sandy-loam, clay or rocky loam at almost sea level to 175 m. Andaman & Nicobar Islands.

Singapore and Malaya.

**25. *Garcinia pedunculata*** Roxb. ex Buch.-Ham. (in Ann. Oriental Lit. (I): 244. 1820) in Brewster, Edinburgh J. Sci. 7: 45, t. 1. 1827; T. Anderson in Fl. Brit. India 1: 264. 1874.

*Asm.:* *Bor-the-ker*a; Beng. & Hindi: *Tikul, Tikur*; Kh.: *Soh-lyntraw, Dieng-soh-danei*; Lus.: *Thaipomlein*; Mikir: *Ampri-arong, Miri & Abor, Tabing-asing*.

Trees, ca 20 m tall, deciduous with oval crown; trunk fluted with rather short, spreading branches; wood yellow; bark dark brown or dark grey, almost smooth, thick, spongy, slowly exuding scanty gum. Leaves 10 - 40 x 5 - 15 cm, oblong or obovate-oblong, cuneate at base, acute or obtuse at apex, undulate, subcoriaceous or membranous, midrib stout, prominent beneath, lateral veins 10 - 30, ca 8 - 15 mm apart, regular, obliquely parallel, inarching at tips and anastomosing, prominent beneath; petioles 2 - 4.5 cm long. Male flowers: ca 1 cm in diam., pale green; pedicels erect, stiff, each with a pair of bracts a little above base. Sepals 4, orbicular, concave, fleshy with scarious margins, subequal, outer pair 9 - 10 x 12 mm, inner pair 9 x 6 mm, narrower. Petals 4, 9 - 11 mm long, obovate-oblong, narrowed and as long as or scarcely longer than sepals. Stamens indefinite in a 4-angled, truncate, shortly stipitate mass; anthers bilocular,

tetragonous, introrse. Rudimentary pistil represented by an abortive gland on fleshy receptacle. Female flowers: Solitary, terminal, pedunculate, bracteate, similar to male flowers but larger, ca 2 cm across, yellow to green or pale green; pedicels ca 3 cm long, stout, 4-angled, articulate at base. Staminodes 20 - 30 in 4 fascicles, connate at base. Ovary globose, 8 - 12-locular; stigmas peltate, rays spreading or radiate. Berries saffron-yellow, fleshy, exceedingly acidic, 7 - 11 cm in diam. Seeds 8- 10, large, reniform with fleshy aril.

*Fl. & Fr.* Sept. - July

*Distrib.* India: In evergreen forests up to 915 m. West Bengal, Assam, Arunachal Pradesh, Nagaland, Manipur and Meghalaya; sometimes cultivated.

Bangladesh.

*Notes.* Fruit of this species is one of the largest in the genus. It is pleasant to eat, eaten raw or cooked and used as a fixative or as a mordant for saffron dye. It is used in curries and for acidulating water. Dried slices of fruit used as a substitute for lemon and lime. The timber after seasoning is reported to be useful for planks, beams and for building purposes.

**26. *Garcinia pictoria* Roxb.** [Hort. Beng. 42. 1814, nom. nud.] ex Buch.-Ham. in Mem. Wern. Soc. 5: 46. 1826; Roxb., Fl. Ind. 2: 627. 1832. *G. morella* auct. non Desr. 1792; T. Anderson in Fl. Brit. India 1: 264. 1874, p.p.

Trees, up to 18 m tall; bark ferruginous, intermixed with many yellow specks, exudes yellow gamboge from incisions; branchlets tetragonous, thick, shiny. Leaves 10 - 13 x 3 - 5.5 cm, oblong or elliptic-lanceolate, acute at base, otherwise petiole decurrent, obtusely acuminate at apex, entire; lateral veins ca 20, prominent, rarely with short, interposed alternate veins; petioles ca 5 mm long. Male flowers: sessile. Sepals 4, 3 x 5 mm, orbicular, outer pair shorter than inner, concave, coriaceous. Petals 4, larger and thicker than sepals. Stamens on more or less tetragonous receptacle in the centre of the flower; filaments short; anthers depressed, peltate. Rudimentary pistil absent. Female flowers: yellow, sessile or shortly pedicellate. Sepals and petals similar to male flowers. Staminodes confluent at base in a ring; anthers clavate, sterile. Ovary oblong, ovules attached to the axis a little above its middle; stigmas sessile, 11 - 13-lobed, 4-furrowed, coronate. Berries almost globose, smooth, 4-seeded with persistent sepals. Seeds oblong-reniform.

*Fl. & Fr.* Feb. - Jan.

*Distrib.* India: Common in forests of Western Ghats up to 1100 m. Karnataka, Tamil Nadu and Kerala.

Myanmar.

*Notes.* It yields an excellent yellow pigment. The timber is used locally for various purposes. The seed oil is used locally for burning lamps and as a substitute for ghee.

This species is closely allied to *G. morella* (Gaertn.) Desr., under which it is sometimes sunk.

**27. *Garcinia rubro-echinata*** Kosterm. in Ceylon J. Sci. (Biol. Sci.) 12(2): 128. 1977. *G. echinocarpa* Gamble, Man. Ind. Timb. 53. 1901 & Fl. Pres. Madras 73: 1915, non Thwaites, 1854. *G. echinocarpa* var. *monticola* Mahesh. in Bull. Bot. Surv. India 6: 126. 1965.

Mal.: *Para or pura*; Tam.: *Madul*

Trees, ca 15 - 20 m tall with cylindrical, smooth, dark-brown bole; bark dark red, smooth with numerous, small lenticels, when cut exudes white latex; wood dark red, hard, very heavy; branchlets thick, apically quadrangular, compressed, glabrous. Leaves 8 - 15 x 3 - 8 cm, nearly ovate, obovate, oblong to broadly elliptic, narrowed at base, obtuse or subretuse at apex, thickly coriaceous, margin revolute, midrib flattened above except basal part, lateral veins 30 - 40 pairs, obliquely parallel, prominent; petioles 1 - 2.5 cm long, stout. Male flowers: Axillary or terminal, pale yellow, subtended by rather large bracts. Sepals 4, up to 6 mm long, orbicular, subcordate or obtuse, thick, very fleshy. Petals 4, yellow, almost twice as long as sepals, suborbicular to oblong, suboblique, fleshy. Stamens connate into a short, quadrangular stalk; filaments short; anthers linear-oblong, bilocular, dehiscence vertical, laterally introrse. Rudimentary pistil absent. Female flowers: Terminal, solitary, with bracts at base, slightly larger than male flowers, similar otherwise. Staminodes uniseriate, connate into a ring at base. Ovary 3 - 4-locular, covered with numerous, imbricate, fleshy scales or warts; stigmas peltate, irregularly lobed. Berries 3 - 6 x 2.5 - 4 cm, subglobose or ellipsoid, dark red, covered with spines or broad tubercles, fleshy, short, 1 - 3-seeded; pericarp 3 - 5 mm thick; persistent stigma hemispherical, ca 8 mm long, papillose. Seeds up to 4 cm long, oblong, with scanty aril.

*Fl. & Fr.* Feb. - July.

*Distrib.* India: In moist evergreen forests between 900 and 1830 m. Southern Western Ghats. Tamil Nadu and Kerala.

Endemic.

*Notes.* The seed oil is used for illuminating purposes and in soap and candle making. The leaves and bark are used in cases of dropsical affections and also as a vermifuge.

This species differs from *G. echinocarpa* Thwaites of Sri Lanka in having larger flower, fleshy yellow petals (as against thin pale green), large, dark red fruits with a thick pericarp (as against small, pale green with very thin pericarp).

**28. *Garcinia sopsopia*** (Buch.-Ham.) Mabberley in Taxon 26: 529. 1977. *Oxycarpus sopsopia* Buch.-Ham. in Mem. Wern. Soc. 5: 345. 1826. *G. paniculata* Roxb. ex Wight, Ill. Ind. Bot. 125. 1831; T. Anderson in Fl. Brit. India 1: 266. 1874. *Stalagmitis paniculata* G. Don, Gen. Hist. 1: 621. 1831.

Asm.: *Sochopa-tenga*; Kh.: *Dieng-soh-jadu*, *Dieng-soh-longkor*, *Dieng-soh-longky-daw*; Lus.: *Bombhathei*, *Vawmva*; Garo: *Thirsu*.

Trees, 12 - 20 m tall, dioecious, handsome with an oval lax crown; trunk ca 1.2 m in girth; branchlets many, ascending, decussate; wood moderately hard, greyish-brown, brittle; bark grey red, peeling off in small, thin, flakes, almost smooth, exudes yellow gum. Leaves 13 - 20 (- 24) x 4 - 10(- 14) cm, oblong-lanceolate or obovate, acute at base, acuminate at apex, repand or entire, decussate, shiny, membranous or subcoriaceous, smooth, lateral veins 7 - 10, prominent beneath, ca 2 cm apart, arcuate, anastomosing near margins, tertiary veins very fine, transverse, parallel; petioles 15 - 22 mm long, stout, slightly dilated at base. Male flowers: pure or dull white, sweet-scented, sessile or shortly pedicelled in 12 cm long compound panicles; branches of panicle brachiate angled, pinkish white; 12 - 20 mm in diam., pure or dull white, sweet-scented, almost sessile or pedicels less than 5 mm long. Sepals 4, outer pair thick, ca 2 mm long, inner pair ca 2.5 mm long, decussate, green. Petals 4, pure or dull white, ca 7 mm long, ovate, distinctly concave, imbricate. Stamens indefinite, in a large subglobose, subsessile mass; filaments short; anthers obovate, bilocular, dehiscing by 2 vertical clefts. Rudimentary pistil absent. Female flowers: In short few-flowered, spicate racemes, rarely branched, similar to but larger than male flowers, sessile or with very short pedicels. Stamines absent or rarely 1 - 2 filaments present. Ovary subglobose, 5-locular, pentagonous; stigmas sessile, convex, entire, tubercled, coronate. Berries yellow, ca 2.5 cm, rarely up to 4.5 cm in diam., spherical, succulent, usually 4-locular, crowned by hemispherical, granular stigma. Seeds 3 - 5, reniform; aril pulpy with an agreeable odour but sour, taste similar to that of mangosteen.

*Fl. & Fr.* Nov. - July.

*Distrib.* India: In evergreen forests of Eastern himalayas and lower hills, ascending to 915 m. Sikkim, Assam, Nagaland, Tripura and Meghalaya.

Nepal, Bhutan, Bangladesh and Myanmar.

*Notes.* The aril with good flavour is eaten. It has been recommended as a suitable rootstock for mangosteen. The leaves are also said to be edible, often cultivated (Type is from a tree cultivated in Indian Botanic Garden, Calcutta).

29. *Garcinia speciosa* Wallich, Pl. Asiat. Rar. 3: 37, t. 258. 1832; T. Anderson in Fl. Brit. India 1: 260. 1874.

And.: *Parawa*.

Trees, 12 - 18 m tall; trunk straight, ca 1.5 m in girth; young branchlets pretty, cinnamomeous, slightly tetragonous; wood reddish brown, hard, heavy; bark greyish-black, thin; latex pale yellow or yellow. Leaves 15 - 35 x 5 - 10 cm, oblong or elliptic-oblong, narrowed at both ends, leathery, shiny; lateral veins more or less parallel, straight, all forming an intramarginal nerve; petioles 12 - 25 mm long, thick, angular. Male flowers: Bright yellow, ca 5 cm in diam., very fragrant; peduncles slender, longer than petioles; pedicels stout, over 1 cm long. Sepals 4, ca 1 cm broad, slightly unequal, outer pair ovate, inner reniform, concave, fleshy. Petals 4, ca 2 cm long. Stamens indefinite in 4 short, ca 5 mm long, diverging oval masses, confluent at base; filaments short; anthers oblong, bilocular, dehiscence longitudinal. Rudimentary styles short, thick, columnar; stigmas large, convex, lobed. Female flowers: Solitary, terminal, sweet-scented; pedicels short, thick. Sepals and petals longer than those in male flowers. Ovary subglobular. Berries ca 5 cm in diam., globose, bright red, apiculate, with persistent hardened stigma and thickened sepals; pulp colourless, sweet or very acidic.

Fl. & Fr. Jan. - July.

*Distrib.* India: In tropical evergreen, semievergreen and inland forests, almost at sea level. Andaman & Nicobar Islands (Andaman Islands).

Bangladesh and Myanmar.

*Notes.* Wood suitable for house and bridge posts and several other purposes and is also used for making bows in Andaman Islands. It yields an inferior gamboge.

30. *Garcinia spicata* (Wight & Arn.) Hook. f. in J. Linn. Soc. 14: 486. 1875. Dunn in Gamble, Fl. Pres. Madras 49. 1915, p.p. *Xanthochymus spicatus* Wight & Arn., Prodr. 102. 1834. *G. ovalifolius* (Roxb.) Hook. f., Fl. Brit. India 1: 269. 1874 incl. vars. except *macrantha*, non Oliver, 1868. *G. spicata* (Wight & Arn.) Hook. f. var. *glomerata* Vesque in DC., Monogr. Phan. 8: 311. 1893. *Stalagmitis ovalifolius* G. Don, Gen. Hist. 1: 621. 1831. *Xanthochymus ovalifolius* Roxb., Fl. Ind. 2: 632. 1832.

Kh.: *Dingso Kwang*; Mal.: *Manjanangu*; Mar.: *Haldi, Tavir, Jangali-ramphal*; Tam.: *Kokottai*; Tel.: *Pidatha*.

Elegant trees, 6 - 20 m tall, rarely more than 20 m; trunk straight; branches spreading wide; very young twigs and inflorescences, densely minute pubescent; wood yellowish white, smooth, hard, heavy; bark olive-green, brownish or pale brown, thick, smooth, obscurely hoop-ringed; latex white or yellow, sticky, thick, scanty. Leaves 9 - 22 x 4 - 8

cm, ovate, elliptic-oblong, lanceolate or suborbicular, rotundate or obtuse at base, rotundate, obtuse, often emarginate or rarely acute at apex, repand, thickly coriaceous, shiny, smooth; lateral veins, 15 - 18 pairs, slender, prominent, slightly curved, obliquely parallel, transverse veins laxly reticulate; petioles ca 1 - 1.5 cm long, very thick or robust, often pubescent initially with strongly produced margins, bearing stem clasping ligules at base. Flowers pale green or white, in axillary, leafy fascicles or elongated, 10 - 15 cm long, pseudo-spikes; pedicels 6 - 12 mm long, longer in female flowers; bracts many, minute, pilose, at base of flowers. Sepals 4 - 5, half as long as petals, suborbicular, pubescent outside, margin ciliate, outer 2 coriaceous, inner 2 (or 3) larger, membranous, 2.5 - 3 mm long. Petals 5, white, 6 - 7 (- 8.5) mm long, obovate, concave, membranous, veined. Male flowers: Stamens 8 - 10 in each of 5 long-clawed, spatulate bundles opposite to petals, inserted in bays of green, flossy, convex torus; filaments very short, free; anthers few, didymous. Rudimentary pistil absent. Female flowers: staminodes 5, small with weak anthers. Ovary globose; styles short, ca 1 mm long; stigma peltate, thick, 5-lobed; lobes cuneiform. Berries up to 4 cm in diam., broadly oblong, smooth, yellowish, with bad odour; pulp sweet, acidic, bitter after taste, with black, persistent, 2 - 3 mm in diam. stigma. Seeds up to 2.5 cm long, oblong, laterally flattened, 1 - 3.

*Fl. & Fr.* March - July (- Aug.).

*Distrib.* India: In Western Ghats, Eastern Coast and north-east India at low elevations. Assam, Meghalaya, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala; sometimes cultivated.

Sri Lanka.

*Notes.* Yields strong timber used for general construction purposes. The fruits are edible. The sticky pulp of young fruits affords a chrome-yellow pigment. Bark contains the colouring matter 'Fukuji', used as a mordant dyestuff in Japan. A variable species as to the shape of leaves and length of peduncles and pedicels. Both fascicled flowers on very short branchlets and spicate inflorescences occur on the same tree and consequently var. *glomerata* Vesque cannot be maintained.

31. *Garcinia stipulata* T. Anderson in Fl. Brit. India 1: 267. 1874.

*Lep.: Sanakadan.*

Trees, ca 20 m tall; wood orange-yellow, light, moderately hard; bark brown, smooth; branchlets slender. Leaves 15 - 30 x 4 - 9 cm, elliptic-oblong or lanceolate, obtuse or acute at base, acuminate at apex, thickly coriaceous, dark green above, pale green beneath; lateral veins 10 - 16 pairs, alternate, distant, incurved, nerves obliquely transverse, simple, furcate or laxly reticulate; petioles 1 - 2 cm long, sulcate above; stipules paired, 5 - 6 mm long, early deciduous. Male flowers: 4 - 6 in axillary, shortly pedunculate cymes; pedicels 12 - 18 mm long, stout; bracts 2 - 3 mm long, scale-like,

concave, acute or rounded; bracteoles 2 near the base of pedicels, concave, 2 - 3 mm long. Sepals 4, orbicular, concave, outer pair ca 8 mm enclosing inner pair of ca 6 mm long, pale green or yellow. Petals 4, creamy-yellow or yellow, ca 1.5 cm long, obliquely ovate, acute. Stamens indefinite, monadelphous in an annular mass; filaments short; anthers bilocular. Rudimentary pistil fungiform; stigmas peltate, convex, minutely tubercled. Female flowers: Axillary, solitary or paired, shortly pedicellate. Sepals persistent in fruit. Ovary bilocular; stigmas tuberculate. Berries 4 x 0.8 - 1.5 cm, oblong, smooth, shortly acuminate, bilocular, locules 1-seeded, yellow, pulpy with yellow gum, persistent stigma orbicular with revolute margins. Seeds 22 x 8 mm, oblong, flattened; testa strongly nerved.

*Fl. & Fr.* Aug. - May; fruits sometimes persist up to July.

*Distrib.:* India: Common in the valleys of Teesta river and its affluents and North-eastern region, in moist subtropical forests up to 1525 m. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland and Meghalaya.

Bhutan.

*Notes.* The fruits are eaten by Lepchas in Sikkim.

**32. *Garcinia talbotii*** Raizada ex Santapau in Rec. Bot. Surv. India (ed. 2). 16: 14. 1960. *G. ovalifolius* (Roxb.) Hook. f. var. *macrantha* Hook. f., Fl. Brit. India 1: 269. 1874. *G. spicata* (Wight & Arn.) Hook. f. var. *macrantha* Vesque in DC., Monogr. Phan. 8: 311. 1893. *G. malabarica* Talbot in J. Bombay Nat. Hist. Soc. 11: 234. 1897, non Desr. 1792. *Xanthochymus ovalifolius* Graham, Cat. Pl. Bombay 26. 1839, non Roxb. 1832.

*Kan.:* Haldi, Ont; Mar.: Limboti, Pansara, Tavir.

Trees 6 - 15 m tall, straight, dioecious; branches twiggy, sulcate or angular, dilated at nodes; latex turning brownish, sticky. Leaves 7 - 18 x 4 - 10 cm, elliptic-oblong or ovate, obtuse or retuse, rounded at base, coriaceous, dark green, shiny, lateral veins 16 - 18 or more, distinct, anastomosing; petioles 12 - 18 mm long, rugose, dilated above base. Inflorescences congested, numerous, often on old wood. Flowers creamy-white, white to greenish-yellow on thick peduncles, usually 1.8 - 2.7 cm in diam., pedicels 5 - 12 mm long; bracteoles many, minute at the base of pedicels. Sepals 5, orbicular, concave, ca 3 mm across, green. Petals 5, white, ca 9 - 10 mm across; orbicular, concave, sometimes suborbicular, 5 - 6 mm broad. Male flowers: stamens in 5 phalanges, thick, equalling and opposite to petals, surrounded at base by and springing from a lobed and plaited, thick, fleshy disc; anthers 8 - 12 in each phalange, didymous, reddish; free part of filaments short, stout. Rudimentary pistil absent. Female flowers: staminodes in 5, thin, flattened phalanges surrounding the ovary with a disc, similar to male flowers, anthers 4 - 5 on each phalange, flat, didymous on long free filaments. Ovary globose, 3 - 4-locular; stigmatic lobes 3, thick, spreading. Berries ca 4 - 6 cm in diam., broadly

oblong, yellow, with abundant yellow latex.

*Fl. & Fr.* Nov. - May

*Distrib.* India: In evergreen forests of Western Ghats: Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* The fruits yield an inferior quality of yellow gutta-gum. Dried fruits are used like tamarind in curries.

33. *Garcinia travancorica* Beddome, Fl. Sylv. t. 173. 1872; T. Anderson in Fl. Brit. India 1: 268. 1874.

Mal.: *Malampongu.*

Trees, ca 15 m tall, magnificent; branchlets obtusely 4-angled, shiny; wood yellowish-brown, hard, heavy; bark exudes yellow sticky latex. Leaves 8 - 10 x 1.5 - 2.5 cm, linear-oblong to subspathulate, sometimes broader upwards, rotundate, acute at base, obtuse or blunt at apex, margins revolute, coriaceous, dark green above, pale beneath, midrib stout; lateral veins slender, indefinite, horizontal, close; finely reticulate; petioles 6 - 18 mm long, slender. Male flowers: in trichotomous, short, few-flowered, terminal or subterminal cymes, ca 1 cm in diam, white; pedicels ca 2 - 3 mm long, thickened; sepals 4, orbicular; outer pair much smaller than inner ca 2.5 mm in diam., inner, pair ca 4 mm in diam., concave, decussate. Petals ca 7 mm in diam., rounded, shortly clawed; stamens indefinite, in multifid, polyandrous masses; filaments short; anthers bilocular, linear-oblong, versatile, longitudinally bivalvular; rudimentary pistil columnar, with a circular, peltate stigma. Female flowers: terminal and axillary, slightly larger than male flowers; staminodes ca 5, free, slender, inserted on a hypogynous ring; filaments complanate, linear, in 2 - 3-chotomous branches; anther locules often divaricate, oblong; ovary ca 6 x 4.5 mm, subglobose or pyriform, tetralocular, half-concealed by the large, convex, entire, ca 3 x 7 mm stigma. Berries 3 - 4 cm in diam., oblong to subglobose, contracted into a short, thick style, with a broad, imbricate stigma, ca 8 mm in diam. at top. Seeds 1 - 2, 2.5 - 2.8 x 1.5 - 1.8 cm, brown, smooth, shiny.

*Fl. & Fr.* Sept. - May.

*Distrib.* India: In evergreen montane forests up to 1500 m. Kerala (Travancore) and Tamil Nadu (Tirunelveli).

Endemic.

*Notes.* Wood is brittle, and consequently not used. Yields abundant yellow gam-



boge, uses of which are not yet known. Cultivated in the Lalbagh Botanic Gardens at Bangalore (Karnataka).

**34. *Garcinia wightii*** T. Anderson in Fl. Brit. India 1: 265: 1874.

Mal.: *Attukanika, Pulimaranga or Palimaranga, Kolivala*

Trees, up to 10 m tall; branchlets tetragonous; wood white, moderately hard; bark dark brown, pustular. Leaves 9 - 14 x 2 - 2.5 (- 3.5) cm, linear to linear-lanceolate, acute and decurrent into petiole at base, acuminate at apex, coriaceous, pale green beneath; lateral veins prominent, very slender, obliquely parallel, ca 5 mm apart, arcuate, anastomosing into a submarginal vein; petioles 6 - 8 mm long. Male flowers: Axillary, solitary, or often 2 - 3 together, sometimes numerous, ca 1 cm across, sessile. Sepals 4, ca 4 - 5 mm in diam. orbicular, concave, thinly coriaceous. Petals 4, 4.5 - 5 x 3.5 mm, obovate, distinctly concave. Stamens ca 20, often 12 - 15 united in a tetragonal column enclosing styloidium; filaments free above; anthers peltate, dehiscence oblique. Rudimentary pistil tetragonal. Female flowers: Axillary, solitary, sessile. Ovary almost globose, usually tetralocular; stigmas sessile, large. Berries 11 - 13 x 9 - 11 mm, subglobose, smooth, pale green when young, 4-seeded, with persistent stigma and sepals. Seeds 9.5 x 4.5 mm.

*Fl. & Fr.* Nov. - March.

*Distrib.* India: In evergreen and moist forests, usually near water courses at elevations up to 700 m; sometimes as rheophytes in Southern Western Ghats. Tamil Nadu and Kerala. Endemic.

*Notes.* The gamboge of this species is very soluble, and yields a good pigment.

**35. *Garcinia xanthochymus*** Hook. f., in Fl. Brit. India 1: 269. 1874. *Xanthochymus pictorius* Roxb., Pl. Corom. 2: 51, t. 196. 1805. 1789. *Xanthochymus tinctorius* DC., Prodr. 1: 562. 1824, 'pictorius'. *G. tinctoria* (DC.) W.F. Wight in U.S. Dep. Agric. Bur. Pl. Indus. Bull. 137: 50. 1909, excl. *G. malabarica* Desr.; Dunn in Gamble, Fl. Pres. Madras 74. 1915. *G. pictorius* (Roxb.) D'Arcy in Ann. Missouri Bot. Gard. 6: 998. 1980.

Asm.: *Tepor, Tepol-tenga*; Beng.: *Chalata, Tamal*; Guj.: *Karamala, Ota*; Garo: *Aruak or Arak*; Hindi: *Dampel, Tamal*; Kan.: *Devagarige, Gansargi, Deavkai, Javangi or Janagi, Devangi*; Kh.: *Deing-soh-ryn-san, Dieng-soh-Khyllung*; Kon.: *Dhanambe*; Mal.: *Anavya*; Mar.: *Jharambi, Dharambo, Ota*; Or.: *Cheoro, Sitambu, Chiuri*; Tam.: *Kulavi, Malaippachai, Mukki, Tamalam*; Tel.: *Ivarumidi or Iwara mamadi, Chitakamaraku, Tamalamu*; Eng.: *Mysore Gamboge*.

Trees, 15 - 20 m tall, with a beautiful dense pyramidal crown; branches patent, ends drooping, 6 - 8-angular, often dilated just below nodes; wood yellowish-brown to dark greyish-brown, very hard; bark blackish or dark grey, exfoliating in small round flakes exuding gum; latex milky or pale green, turning yellow on exposure. Leaves very variable in shape and size, 12 - 45 x 4 - 12 cm, linear-oblong or oblong-lanceolate, cuneate at base, acute to acuminate at apex, subrepand, coriaceous, dark green, shiny; lateral veins 15 - 20 pairs, 6 - 12 mm apart, distinct, subparallel, arched, anastomosing at apex, laxly reticulated; petioles 1 - 2.5 cm long, rugose, angular, thick, stout; stipules fleshy, adnate, intrapetiolar, covering terminal bud. Inflorescences axillary or from the axils of fallen leaves, fascicles 4 - 10-flowered. Flowers ca 1.5 - 2 cm in diam., white or cream-coloured; pedicels variable, fleshy, thickened towards apex, 2 - 2.5 cm long, longer in female flowers; bracts minute, suborbicular, red; bracteoles 2, minute, ca 1 mm long. Sepals 5, rarely 4, often the fifth sepal disarranged and scale-like, orbicular, concave, fleshy, unequal; outer 2, 4 - 6 mm long, inner 3, 7 - 8 mm long, membranous, fimbriate, persistent. Petals 5, ca 7 - 9 mm long, greenish-white, thin, shortly clawed, somewhat ciliate, veined. Male flowers: stamens 15 - 20 in 5 broad, up to 13 mm long, bundles of 3 - 5 each, antipetalous, alternating with 5 fleshy glands; anthers on short filaments near forked apices of bundles. Rudimentary pistil absent. Female flowers: staminodes few, in an interrupted ring. Ovary ovoid, acuminate, greenish-white; styles very short; stigmatic rays 5, oblong, spreading, entire, peltate, persistent. Berries ca 6.5 cm in diam., subglobose, pointed, point ca 2 - 3 mm long, pulpy, dark yellow with abundant yellow gum; peduncle ca 3 cm long. Seeds 1 - 4, oblong, 3.5 x 1.8 cm, brown.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: In evergreen, semievergreen, moist deciduous and in the lower hill forests up to 1400 m. Sikkim, Assam, Tripura, Meghalaya, Orissa, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands (Andaman Islands).

Bangladesh, Myanmar, China, Thailand and Malay Peninsula; sometimes cultivated.

*Notes.* The acidic, pleasant fruits are edible, though not very palatable and are used for making sherbets, medicaments, preserves and jams. The gum resin from the stem, bark and fruit make a good water colour (gamboge) used in dyeing. About 4 year old seedlings are useful as rootstock for grafting and inarching mangosteen; sometimes grown in gardens as an ornamental tree for its dense foliage.

The name *Xanthochymus tinctorius* Roxb. published in De Candolle's Prodr. 1: 562. 1824 was a misprint for *X. pictorius* Roxb. (Pl. Corom. 2: 51, t. 196. 1805 non *Garcinia pictoria* Roxb.) and hence the resulting new combinations under *Garcinia* were superfluous, so also *Garcinia pictorius* (Roxb.) D'Arcy (in *Ann. Missouri Bot. Gard.* 6: 998. 1980) which was based on erroneous interpretation.

## DOUBTFUL SPECIES

*Garcinia jelinekii* Kurz in J. Asiat. Soc. Beng. 55: 172. 1876.

This species was described based on a single specimen (Exped. Novara 169, Nicobars *Jelinek* 106?) with leaves like *Garcinia* and a detached fruit of a true *Garcinia* as named in the Calcutta Herbarium (CAL). Indicating this several botanists have expressed that the material is too imperfect to be dealt with. It can be reconsidered after some fresh collections are made.

### 3. *Mammea* L. emend. De Wilde

Small to medium-sized, resiniferous, evergreen, polygamous and dioecious trees; bark usually smooth, yellowish outside, red inside; sap or latex white or yellow in the inner bark. Leaves simple, opposite or subverticillate, usually coriaceous, glabrous, glossy, dark green above, petiolate, exstipulate, pinnately nerved; venation dense and areolate with a conspicuous pellucid gland in the centre of each areole; scales present at the base of leaves. Flowers solitary or fascicled in reduced cymes, axillary or usually on tubercles of bare branches and trunk. Flowers unisexual or bisexual, actinomorphic; bracts many, decussate, surrounding the base of flowers. Calyx connate in bud, splitting into two convex halves at anthesis, more or less persistent in fruit. Petals 4, rarely up to 7, white, decussate, caducous. Stamens numerous, usually free; filaments slender, white, filiform, free; anthers erect, oblong, dehiscing by longitudinal slits. Ovary in male flowers absent or completely reduced, in bisexual flowers sessile, bilocular, ovules 2 in each locule or tetralocular with 1 ovule in each locule (septa sometimes incomplete); styles short, stout, topped by a broad, peltate, 2 - 4-lobed stigma. Fruits drupaceous, pulpy, indehiscent, usually unilocular, sometimes plurilocular; pericarp leathery. Seeds large; surrounded by usually edible, transparent pulp.

Circumtropical - tropical Asia, Africa and America, Malesia, Madagascar & New Caledonia; 47 species, one in tropical America and West Indies, one in tropical Africa, 20 in Madagascar and 27 in Indomalaya and Pacific region, 2 in India.

*Literature.* KOSTERMANS, A.J.G.H. (1961). Monograph on Asiatic and pacific species of *Mammea*. Comm. For. Res. Inst. Indones. Bogor 72: 1 - 63. MAHESHWARI, J.K. (1972). Morpho-taxonomic studies on Indian Guttiferaceae. The genera *Mammea* Linn. s.l. and *Kayea* Wall. In MURTY, Y.S. et al. Adv. Pl. Morph. 137 - 152, ff. 1-52.

*Notes.* *M. suriga* (Buch.-Ham. ex Roxb.) Kosterm. an endemic species of Western Ghats is cultivated in the North and North-east India(?) while *M. americana* L. is cultivated for its edible fruits. *Ochrocarpus* Thouars (Nov. Gen. Madagasc. 15. 1806) considered congeneric here is generally distinguished by the bands of secretory canals of the leaves which cross the secondary nerves and more or less fused filaments, while *Mammea* is distinguished by areoles with a transparent gland in their centre and the free

filaments.

#### KEY TO THE SPECIES

- 1a. Lateral veins closely spaced, 5 - 6 mm apart; pedicels ca 2.5 cm long; petals usually 6, rarely 5; drupes ovoid; flowers solitary or 3 - 10 in lax fascicles or cymes **1. *M. nervosa***
- b. Lateral veins distantly spaced, ca 1 cm apart; pedicels 1.5 - 2 cm long; petals 4; drupes obliquely ovoid; flowers in dense fascicles **2. *M. suriga***

**1. *Mammea nervosa*** (Kurz) Kosterm. in Comm. For. Res. Inst. Indones. Bogor 72: 25, f. 20. 1961. *Ochrocarpus siamensis* T. Anderson in Fl. Brit. India 1: 270. 1874, non *Mammea siamensis* (Miq.) T. Anderson, 1867.

Asm.: *Suklong*.

Trees, up to 15 m tall, evergreen, glabrous with a clean bole of 3 - 5 m long and 1 - 2 m in girth; bark greyish-green, reddish inside, turning brown; latex glands indefinite, conspicuous below; terminal buds 3 - 5 mm long, triangular. Leaves 12 - 24 x (3 -) 4.5 - 5 cm, linear-oblong to oblong-lanceolate or elliptic, acute at base, acute to subacuminate at apex, glabrous, rigidly coriaceous; midrib slightly raised, lateral veins numerous (ca 15 - 20 pairs), 5 - 6 mm apart, anastomosing very close to the margin, conspicuous; petioles (0.5 -) 1 - 1.2 cm long, narrowly concave above; scales minute. Inflorescence of a solitary flower or of 3 - 7 (- 10) flowers in reduced cymes or fascicles. Flowers white, fragrant, ca 1.25 cm across; flower buds globose; bracts ovate-triangular, 1.5 - 2 mm long; pedicels slender, 2.5 - 8 cm long, glabrous. Sepals 2, ca 5 mm long, glabrous. Petals usually 6, rarely 5, ca 7 mm long, obovate-oblong or broadly oblong-lanceolate, obtuse or rounded. Stamens numerous; filaments ca 2 - 3 mm long, filiform, free; anthers oblong, ca 1.5 mm long. Ovary glabrous, globose, ca 1.3 mm long, narrowed into a short, thick, ca 0.5 mm long style; stigma 2-lobed. Fruits ca 3 (- 5) cm long, mucronate, glabrous with persistent, coriaceous sepals at base.

*Fl. & Fr.* March - July.

*Distrib.* India: Grows upto an altitude of ca 1200 m. Mizoram (Lushai hills).

Bangladesh, Myanmar, S. Vietnam, Thailand, Malay Peninsula.

*Notes.* Wood suitable for cabinet work. Flowers yield an essential oil with the aroma of violets. Pollen is used as a cosmetic in Siam.

**2. *Mammea suriga*** (Buch.-Ham. ex Roxb.) Kosterm. in Comm. For. Res. Inst. Indones. Bogor 72: 33, f. 19. 1961. *Calophyllum suriga* Buch.-Ham. ex Roxb., Fl. Ind. 2: 608. 1832. *Mammea longifolia* (Wight) Planch. & Triana in Ann. Sci. Nat. ser. 4, 15: 240.

1861. *Calysaccion longifolium* Wight, Icon. Pl. Ind. Orient. tt. 1999-1839 & Ill. Ind. Bot. 1: 130. 1840. *Ochrocarpus longifolius* (Wight) T. Anderson in Fl. Brit. India 1: 270. 1874.

Asm.: *Suklong*; Beng.: *Nagesar*; Guj.: *Rati-nahkesar*; Hindi: *Nagkesar*; Kan.: *Wundi, Gardundi, Laringi* (male), *Pune or Punay* (female), *Suringi, Suragi*; Konk.: *Rani-undi*; Mal.: *Seraya, Suran-punna*; Mar.: *Punnag, Suringi, Surang, Tambra Nagkesar* (in Bombay); Or.: *Churiana*; Sans.: *Naga-Kesaram-pushpam*; Tam.: *Nagap-pu, Naga-shop-pu, Nagasar-pu, Surabunnai*; Tel.: *Suraponna*.

Evergreen trees, 12 - 18 m tall, glabrous, monoecious; wood hard, red or reddish-grey, smooth; bark rough, exfoliating in irregular pieces; sap milky, latex glands scattered; branchlets obscurely 4-angled; terminal bud ovate-triangular, 3 - 7 mm long. Leaves opposite or ternately verticillate at apices of branchlets, obtuse at base, dark green, shiny, glabrous, midrib stout, prominent, lateral veins few, faint, very slender, connected by a dense reticulation, marginal vein faint, at ca 1 cm from margin; petioles (5-) 7 - 10 mm long, stout, channelled above. Inflorescences axillary, or dense fascicles on nodes of old wood or in axils of fallen leaves; peduncles short, 1-flowered. Flowers white or pinkish, ca 1 cm in diam., sweet-scented, unisexual, often bisexual in cultivation; flower buds globose, white, streaked with red; bracteoles ca 8, 1 - 1.5 mm long, subulate; pedicels slender, thickened upwards. Calyx opening into 2 valves, lobes concave, reflexed during anthesis, reddish, 5 - 7 mm long. Petals white, streaked with red, oblong-obovate, acute, up to 8 mm long, thin, deciduous. Stamens numerous (ca 60 - 100), yellow; filaments 4 - 5 mm long; anthers 2 - 2.5 mm long, linear. Ovary 2 - 2.5 mm long, depressed subglobose, 2 - 4-locular; styles 1.5 - 3 mm long, stout, subulate; stigmas large, umbonate, peltate, obscurely sinuate or 2-lobed. Berries ca 2.5 - 3 x 1 - 1.5 cm, tipped with hard, pointed style, stipitate, 1 - 4-seeded; pulp juicy with the flavour of rose water. Seeds ca 2 x 1 cm.

*Fl. & Fr.* March - July.

*Distrib.* India: In evergreen and deciduous forests up to 600 m. Maharashtra, Karnataka, Tamil Nadu and Kerala; cultivated elsewhere in West Bengal, Assam, Orissa and Uttar Pradesh.

Bangladesh.

*Notes.* Cultivated for its handsome foliage, sweet-scented flowers and planted as an avenue tree and in household gardens. Wood sometimes used for building purposes, planking, for masts and yards of boats and rarely as fuel. Flowers (buds) used for dyeing silk, yield a perfume, which has mild stimulant, carminative and astringent properties and used in dyspepsia and haemorrhoids; flowers used in Hindu worship and for decorating hairs. Fruits are delicious and eaten. Seeds yield a viscid gum.

#### 4. *Mesua* L. emend Kosterm.

Shrubs or middle-sized trees, sometimes larger. Branches often slender, glabrous. Leaves opposite, polymorphic, lanceolate, entire, petiolate, coriaceous, pellucid-dotted, shiny above, often pruinose or glaucous beneath; midrib conspicuous, lateral nerves slender, often obsolete, polygonally reticulate; foliar crystals subsimple, geniculate. Flowers solitary, paired, subfasciculate to fasciculate or in panicles, axillary or terminal, bisexual or polygamous, pretty, sessile or pedicellate, variable in size. Sepals 4, usually outer pair smaller than inner, decussate, imbricate, usually accrescent in fruit. Petals 4, large, alternate with sepals, imbricate. Stamens numerous, hypogynous; filaments filiform, free or connate at base; anthers variously shaped, usually linear-oblong to oblong, basifixed, 2-loculed, connective narrowly marginate, dehiscing at the top or by lateral vertical clefts. Ovary uni- or bilocular, sometimes incompletely bilocular; ovules 2 in each locule, erect, anatropous; style 1, subulate or filiform, slightly flexuous; stigma peltate, irregularly patelliform, obscurely bilobed, incised or 4-fid. Fruits fleshy, drupaceous or capsular nuts, encased by lignified enlarged sepals, 1 - 2-loculed, indehiscent or dehiscent, ultimately dehiscing into 2 - 4-valves. Seeds 1 - 4, exarillate, erect, often mutually pressed in an obtuse angle, exalbuminous; testa slender, fragile, hilum linear, micropyle inconspicuous.

Tropical Asia and Indo-Malesia to Australia (Queensland); ca 40 species; 6 in India, of which 3 are endemic.

*Literature:* MAHESHWARI, J.K. (1964). Taxonomic studies on Indian Guttiferae. II. The genus *Mesua* Linn. Bull. Bot. Surv. India 5: 335 - 343 t. 1 - 4. KOSTERMANS, A.J.G.H. (1969). *Kayea* Wall. & *Mesua* L. in Reinwardtia 7: 425 - 431. STEVENS, P.F. (1986). *Mesua ferrea* became *M. nagassarium* but has to be called *M. ferrea* again (Clusiaceae). Taxon 35: 352 - 354.

*Notes.* Common in tropical forests; often forming consociations. The genus *Kayea* Wallich (Pl. Asiat. Rar.3: 4, t. 210. 1832) considered congeneric here is generally distinguished from *Mesua* by its unilocular ovary with 4 ovules, single style with a 4-fid apex and 1-seeded drupes, while *Mesua* has a bilocular ovary with 4 ovules and single style with a peltate stigma. Kostermans (Reinwardtia 7: 425. 1969) has observed many possible intergradations between the two and merged them.

#### KEY TO THE SPECIES

- |  |                              |
|--|------------------------------|
| 1a. Lateral veins of leaves distinct, arched; flowers less than 4 cm across; fruits indehiscent                                    | 2                            |
| b. Lateral veins of leaves very fine, almost invisible, straight, nearly parallel; flowers more than 4 cm across; fruits dehiscent | 4                            |
| 2a. Leaves ovate to elliptic-lanceolate; flowers small, (ca 7 - 8 mm across), on short branches in 8 - 15 cm long panicles         | <b>I. <i>M. assamica</i></b> |
| b. Leaves oblong to lanceolate; flowers large (more than 1 cm across), in clustered racemes or lax panicles                        | 3                            |

- 3a. Petioles more than 1 cm long; flowers 2 - 2.5 cm across in terminal, ca 15 cm long panicles; ovary not ridged 3. *M. floribunda*
- b. Petioles less than 1 cm long; flowers 1 - 1.5 cm across, in ca 6.5 cm long racemes, crowded at tips of branchlets; ovary distinctly ridged 4. *M. manii*
- 4a. Branchlets pendulous; leaves green beneath, scarcely glaucous or not pruinose, ovate or elliptic-oblong; flowers ca 4.5 cm across 5. *M. pulchella*
- b. Branchlets patent or slightly pendulous; leaves white, glaucous or pruinose beneath, lanceolate, lanceolate-oblong or linear-oblong; flowers more than 4.5 cm across 5
- 5a. Leaves 16 - 30 x 3 - 11 cm; flowers and fruits sessile; flowers comparatively large, more than 10 cm across, surrounded by 2 - 3 large, persistent, adpressed bracts and bracteoles 6. *M. thwaitesii*
- b. Leaves 5 - 18 x 1 - 5 cm; flowers and fruits distinctly pedicelled; flowers comparatively smaller, up to 10 cm across, ebracteate and ebracteolate 2. *M. ferrea*

1. *Mesua assamica* (King & Prain) Kosterm. in *Reinwardtia* 7 : 426. 1969. *Kayea assamica* King & Prain in *Ind. For.* 27: 62. 1901

Asm.: *Sia - nahor*.

Evergreen trees, up to 25 m tall; bole straight, cylindrical, ca 12 m long, 2 - 2.5 m in girth, handsome, slow growing; glabrous; wood light red to reddish-brown, somewhat lustrous, hard and heavy; bark grey or brownish-grey, light, often exfoliating in large square flakes; branchlets greenish-yellow, terete. Leaves opposite, 8 - 16 x 4 - 5 cm, cuneate at base, shortly acuminate at apex, often finely mucronulate, more or less shiny above, dull beneath, firmly coriaceous; lateral nerves 15 - 30, forming an uneven marginal nerve; petioles slender, ca 2 cm long. Inflorescence axillary or terminal, fascicled panicles with short, glabrous, bracteate, slender, decussate branches. Flower buds globular or globose, ca 2 mm in diam.; flowers white, ca 7 - 8 mm across, bracts and bracteoles opposite, small, caducous; pedicels very slender, 5 - 7 mm long, elongated and thickened in fruit. Sepals 4 in 2 pairs, imbricate; outer pair ca 5 mm long, orbicular or suborbicular; inner spatulate, accrescent in fruit. Petals 4, suborbicular, ca 4 mm long, thin, white. Stamens numerous, longer than sepals; filaments free, capillary; anthers globose. Ovary unilocular, ovules 4, erect; style slender; stigmas 4-fid. Fruits ca 2.5 x 4.5 - 6.0 cm, depressed globose, corky outside, almost entirely encased by hard accrescent sepals; latex yellowish-brown. Seeds ca 2.5 - 3.2 cm in diam., usually solitary, reddish-brown, ca 2.5 - 3.2 cm in diam., globose but very depressed, smooth.

*Fl. & Fr.* April - Dec.; sometimes up to Feb.- April.

*Distrib.* India: Common and gregarious in submontane forests of Assam (North Lakhimpur and Dibrugarh).

Endemic.

*Notes.* This species closely resembles *M. floribunda*, which has longer leaves with fewer, conspicuously arcuate lateral nerves and copious racemes with larger flowers and fruits.

Wood is more elastic, harder and stronger than teak and is durable under cover. The timber is used for construction work, internal posts, beams, rafters and for sleepers after treatment. Fruits are used for fish poisoning.

**2. *Mesua ferrea* L.,** Sp. Pl. 515. 1753; T. Anderson in Fl. Brit. India 1: 277. 1874. *Calophyllum nagassarium* Burm. f., Fl. Ind. 121. 1768. *Mesua roxburghii* Wight, Ill. Ind. Bot. 1: 127. 1840. *M. nagana* Gardner in Calcutta J. Nat. Hist. 8: 4. 1847. *M. nagassarium* (Burm. f.) Kosterm. in Ceylon J. Sci. (Biol. ser.) 12: 76. 1976.

And.: *Gangane*; Asm.: *Nahor, Karai*; Garo: *Khimdi* (Garo); Guj.: *Nagchampa*; Hindi: *Nagkesar, Naghas*; Kan.: *Naga sampigi, Nagsampige, Nagachampaka*; Kh.: *Diengngai*; Lus.: *Herse*; Mal.: *Nanga, Peri, Veluthapala*; Mani.: *Utahn*; Mar.: *Nagachampa, Nagchapha, Thora champa*; Naga: *Ngai-ching*; Nep.: *Nari-su, Nagesuri*; Or.: *Nageshvaro, Nageswar*; Punj.: *Nagkesar*; Sans.: *Bhujangakhya, Kanchana, Kesara, Naga, Pushparachana*; Tam.: *Nangal or Nangul, Naka, Mallay-mangal, Irul, Naga-chambagam, Shirunagp-pu, Nagashap-pu, Nangu*; Tel.: *Naga-kesara, Naga-kesaramu, Geja-pushpam, Naga-champakamu*; Eng.: *Indian Rose chestnut, Ceylon Ironwood, Ironwood of Assam, Nagas tree, Mesua*.

Evergreen trees, 20 - 30 m tall; trunk up to 3 m in girth, often buttressed at base; sapwood creamy-white or pinkish brown; heartwood dark red, extremely hard, tough, heavy, bitter and sweet scented; oleo-resin aromatic, clear; bark smooth, ash-coloured, grey, turning dark brown, exfoliating in large, white flakes; branchlets slender, terete. Leaves opposite, decussate, very variable, linear-lanceolate, oblong-lanceolate, lanceolate or elliptic-oblong, obtuse or acute at base, acute, acuminate or cuspidate at apex, rigidly coriaceous, glabrous, shiny above, glaucous and pruinose beneath, generally covered with a wax-like white powder beneath; new leaves crimson red turning pink and ultimately becoming dark green, midrib slender, prominent; lateral nerves very fine almost inconspicuous especially on lower surface, straight, nearly parallel, subhorizontal; petioles slender, 5 - 12 mm long. Flowers white, sweet-scented, axillary and terminal on short, stout, rusty tomentose peduncles, usually solitary, rarely paired, bisexual, showy, 4 - 20 cm in diam.; pedicels 8 - 15 mm long, rather stout, densely rusty tomentose. Sepals 4 in 2 pairs, 12 - 20 mm long, inner pair much longer than outer, orbicular, imbricate, fleshy, concave glabrous to densely velvety puberulous outside, persistent. Petals white with brown or purple veins, 4, 2 - 4.5 cm long, obovate or obcordate, cuneate, margins curled and erose. Stamens numerous, forming a globose, yellow mass, 4 - 5 mm long; filaments very slender, filiform; anthers linear, 2.5 - 3 mm long, golden yellow. Ovary 5 - 7 mm long, ovoid, bilocular, ovules 2 in each locule; styles as long as or longer than



ovary, often curved; stigmas small, peltate. Fruits 2.5 - 3.5 (- 5) x 3 - 4 (-5) cm, ovoid to globose with a conical point, striate, 1-loculed, 1 - 4-seeded, supported by adpressed accrescent, up to 4 cm long sepals, edible; pericarp tough, somewhat woody, at length 2-valved. Seeds variously faceted, 2.5 mm long, pyriform, smooth, with a shiny, dark brown testa.

*Fl.* Jan. - March; *Fr.* May - Oct.

*Distrib.* India: Widespread up to 1500 m in North Eastern and Peninsular India. West Bengal, Assam, Maharashtra, Karniataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands; planted in Uttar Pradesh, Bihar, Sikkim and Orissa.

Nepal, Bangladesh, Myanmar, Sri Lanka, Malaysia, Indonesia, Vietnam, Cambodia, Thailand and Malacca.

*Notes.* Much planted as an ornamental around temples and as avenues, etc. Kostermans (in *Indian J. For.* 8(2); 160. 1985) opines that it is endemic to India and is introduced in other localities. A good ornamental tree with almost all its parts very useful. The timber is very valuable and used for various purposes. The seed oil, dried flowers are very fragrant. Stamens stuffed in pillows for their pleasant scent in Madura (Indonesia). The fruit and seeds are sometimes eaten. The oleo-resin from the bark, roots and immature fruits sometimes used as a substitute for Canada balsam. The parts used in various medicines include root, bark, leaves, a paste and syrup of the flowers and seed oil, etc.

#### KEY TO THE VARIETIES

- 1a. Leaves green, pale or scarcely glaucous beneath, 5 - 8 cm long; flowers ca 4 cm in diam.; sepals almost glabrous 2.1. var. *coromandeliana*
- b. Leaves white; glaucous or pruinose beneath, 6 - 10 (- 20) cm long; flowers 8 - 10 cm in diam.; sepals densely pilose 2.2. var. *ferrea*

2.1. var. *coromandeliana* (Wight) N.P. Singh in *J. Econ. Tax. Bot.* 10: 203. 1987. *Mesua coromandeliana* Wight, *Icon. Pl. Ind. Orient.* t. 117. 1839 & *Ill. Ind. Bot.* 1: 129. 1840. *Mesua ferrea* L. subsp. *pulchella* Vesque var. *coromandeliana* (Wight) Mahesh. in *Bull. Bot. Surv. India* 5: 340. 1963. *M. nagassarium* (Burm. f.) Kosterm. var. *coromandelianum* (Wight) K.K.N. Nair in *Ind. J. For.* 7: 80. 1984. Fig. 32.

Mal.: *Nanga, Veluthapala*; Tam.: *Nangu, Nagha or Nagha-champa, Nagochampakam, Nagal, Mallay-nangal, Nir-nang.*

Evergreen trees, 20 - 30 m tall; trunk erect, straight, buttressed at base. Leaves 5 - 8 x 2.5 cm, narrowly lanceolate, narrowed at base, ending in a long, tapering blunt acumen at apex, glabrous, shiny green above; veins subscrobiculate; petioles ca (0.6

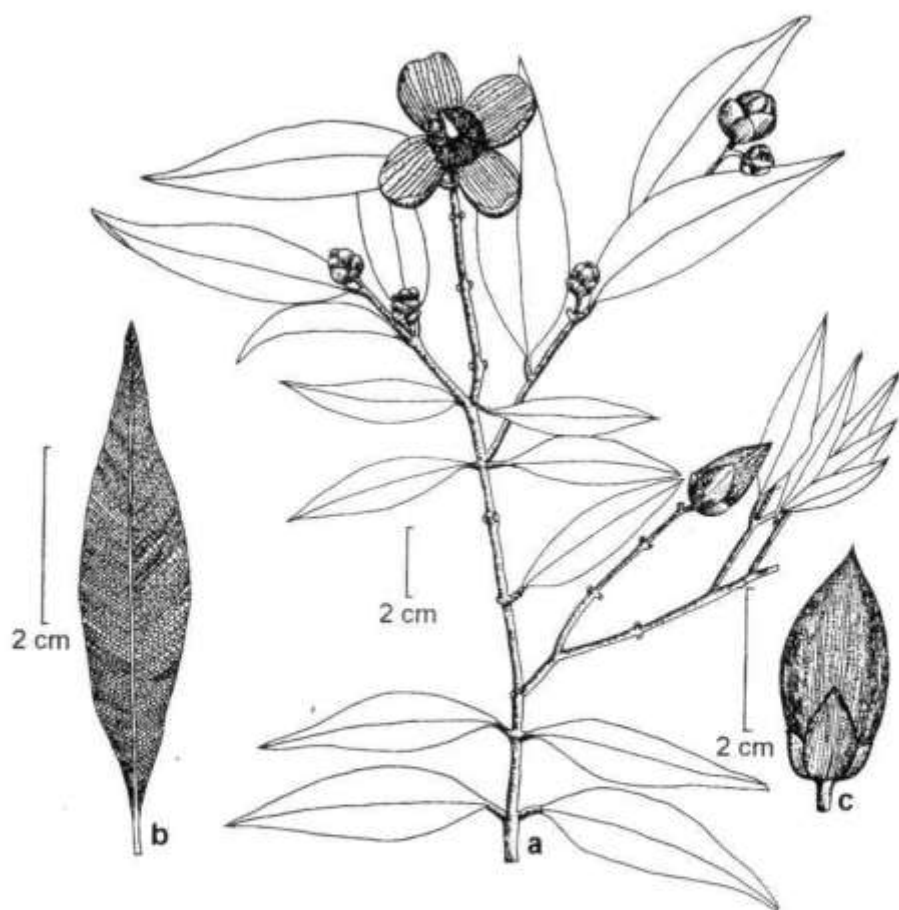


Fig. 32. *Mesua ferrea* L. var. *coromandeliana* (Wight) N.P. Singh : a. flowering and fruiting part of branch; b. leaf; c. fruit.

-) 1 cm long. Flower buds globose; flowers solitary, axillary and terminal, reddish-yellow, fragrant; pedicels shorter than petioles, 2 - 8 mm long. Sepals glabrous or softly pruinose, outer pair 6 - 8 mm long, ovate, inner ca 1 cm long, suborbicular. Petals twice as long as sepals, ca 1.5 - 2 cm long. Ovary 2 - 3.5 mm long; styles 5 - 7 mm long. Fruits 2.5 - 3 cm long, ovoid, shortly acuminate at apex, greenish-yellow, sometimes with a pink tinge. Seeds usually solitary.

*Fl. & Fr.* Dec. - Feb.

*Distrib.:* India: Tamil Nadu and Karnataka.

Endemic.

*Notes.* The timber is very hard, heavy, reddish and valuable for engineering purposes.

2.2. var. *ferrea*.

Fig. 33.

*Mesua nagassarium* (Burm. f.) Kosterm. var. *nagassarium*. *M. ferrea* L. subsp. *ferrea*; Mahesh. in Bull. Bot. Surv. India 5: 337. 1965.

Branchlets patent or slightly pendulous. Leaves 1 - 5 cm broad, lanceolate, narrowly lanceolate or oblong-lanceolate, somewhat acute at base, gradually acuminate or cuspidate at apex; lower epidermis papillate. Flowers solitary or paired, shortly pedicellate. Sepals orbicular, 1 - 2 cm across. Petals white, 2 - 4.5 cm long. Stamens yellow.

*Fl. & Fr.* Feb. - Jan.

*Distrib.* Same as for the species proper.

3. *Mesua floribunda* (Wallich) Kosterm. in Reinwardtia 7: 427. 1969. *Kayea floribunda* Wallich, Pl. Asiat. Rar. 3:5, t.210.1832; T. Anderson in Fl. Brit. India 1:276.1874.

*Asm.:* Bolong, Bah-bari, Darchong-khub, Karol, Kasukarol, Kurull, Kurrum-jowa, Phai-hershei, Serpai.

Evergreen trees, up to 20 m tall; bole straight, ca 10 - 14 m long and 1 - 2 m in girth; wood heavy with distant but large pores; bark greenish grey or brown, reddish inside, exfoliating in round or squarish flakes, exudes yellow-gum; branchlets terete, glabrous. Leaves opposite, 12 - 27 x 3 - 8 cm, narrowly linear or broadly oblong to lanceolate, acute, cuneate or rounded at base, acute or acuminate at apex, thickly coriaceous, glabrous, pellucid-dotted at least when dry; lateral veins arched, meeting near margin, prominent beneath, alternately shorter; petioles 1.5 - 2.5 cm long, slender, terete. Inflorescences ca 15 cm or more long, terminal, many-flowered, lax, panicles, ultimate branchlets

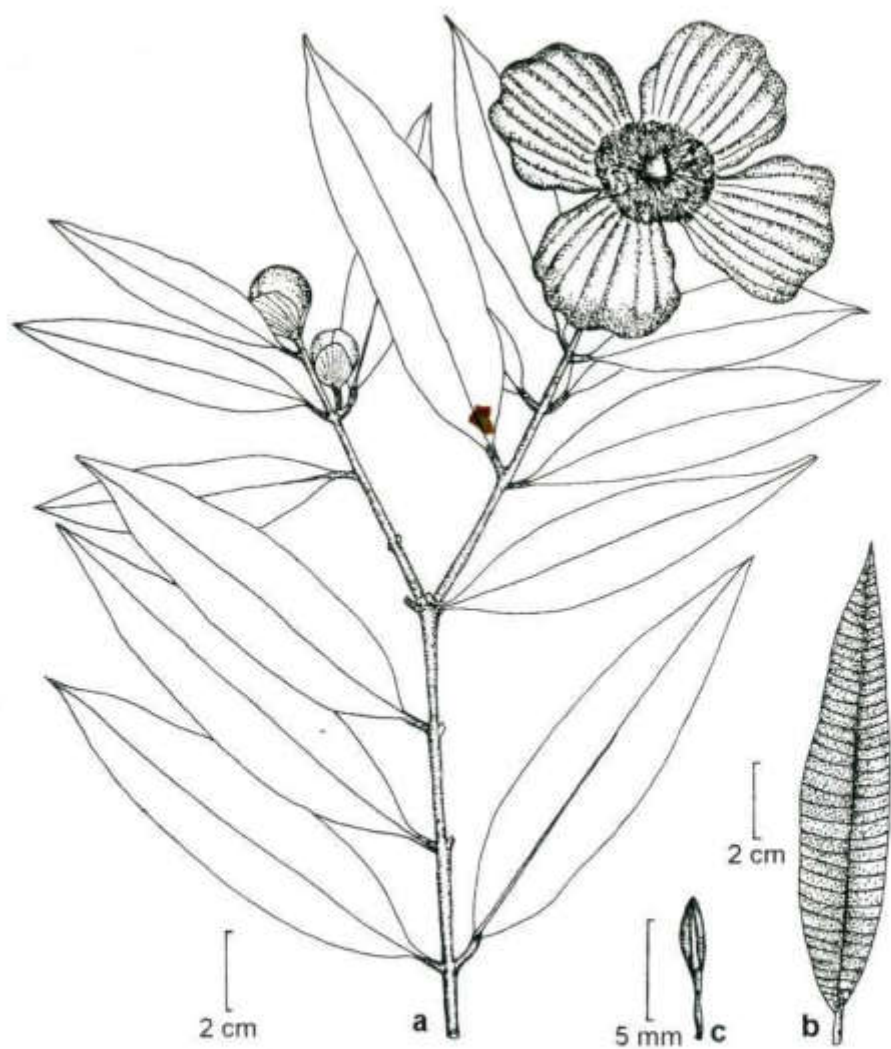


Fig. 33. *Mesua ferrea* L. var. *ferrea* : a. flowering branch; b. leaf; c. seed.

usually end in 3-flowered cymes. Flower buds globose; flowers white with rosy edges, 2 - 2.5 cm in diam., bisexual; bracts or bracteoles 2, opposite at the bases of branches of panicles and pedicels, 6 - 7.5 mm long, glabrous, deciduous; pedicels 6 - 8 mm long. Sepals 4, imbricate, orbicular, broader than long, truncate, green, outer ones 7 x 7 mm, wrinkled and yellow in fruit. Petals 4, ca 7 x 5 mm, oblong-obovate or obovate, membranous, thin but fleshy, slightly longer than sepals. Stamens numerous, 1 - 5 mm long; filaments filiform-capillary, linear; anthers subglobose, golden yellow, bilocular, reniform. Ovary ovoid-conical, unilocular; style slender; stigmas 4-fid. Fruits over 3.5 cm in diam., depressed globose, subglobose to transversely ellipsoid, brown, dry, resiniferous, covered by accrescent, rugose, hardened, yellow sepals, tipped by style. Seeds 1 - 2, reddish-brown, smooth.

*Fl. & Fr.* March - Aug.

*Distrib.* India: In tropical dense hill forests between 100 and 1000 m. Sikkim, Meghalaya (Khasi & Garo hills).

Endemic.

Bhutan and Bangladesh.

*Notes.* The bole is used for dug out canoes and wood for construction work and for making tool handles.

4. *Mesua manii* (King) Kosterm. in Reinwardtia 7: 428. 1969. *Kayea manii* King in Ann. R. Bot. Gard. Calc. 5: 144, t. 174 A. 1876; Parkinson, For. Fl. Andaman Is. 88. 1923. *K. racemosa* auct. non. Planch. & Triana, 1861; T. Anderson in Fl. Brit. India 1: 276. 1874, p.p. *Kayea ferruginea* Pierre, Fl. Forest. Cochinch. Fasc. 7: t. 99. 1885. *Mesua ferruginea* (Pierre) Kosterm. in Reinwardtia 7: 427. 1969.

Evergreen, medium-sized trees; bark pale brown; branchlets slender, glabrous. Leaves opposite, 12 - 18 x 3 - 4 cm, narrowly oblong to lanceolate, tapering at both ends, acuminate at apex, shiny on both surfaces, coriaceous; main lateral veins 15 - 20 pairs ending in an undulated marginal vein; intermediate veins running about half way up, curving, somewhat prominent on lower surface; petioles 7 - 8 mm long. Flowers 12 - 13 mm in diam., borne in several, fasciculate, 3.5 - 6.5 cm long racemes from axils; pedicels 1 - 1.5 cm long, slender. Sepals 4, ovate-orbicular, concave. Petals 4, broadly ovate, concave, slightly smaller than sepals. Stamens numerous, much longer than petals; anthers broadly ovate. Ovary conical, subcompressed, glabrous, tapering into cylindrical style; stigmas 3-fid, lobes linear. Fruits (unripe) compressed with persistent style, enveloped in accrescent sepals.

*Fl. & Fr.* Jan. - Feb.

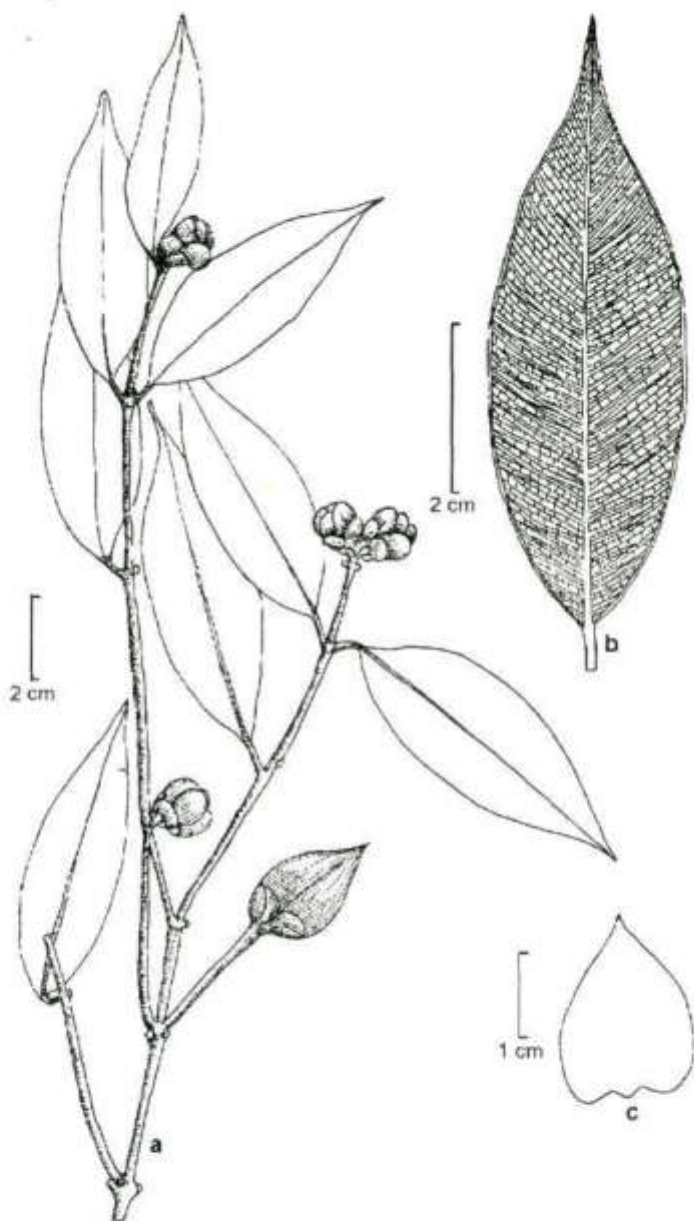


Fig. 34. *Mesua pulchella* Planch. & Triana : a. twig with flowers and fruit; b. leaf; c. seed.

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands). Rare and threatened.

Singapore.

*Notes.* This species was collected only once from Andamans; the description is based mostly on protologue.

**5. *Mesua pulchella*** Planch. & Triana in Ann. Sci. Nat. ser. 4, 15 : 307. 1861. *M. ferrea* L. subsp. *pulchella* Vesque var. *pulchella*. *M. nagassarium* (Burm.f.) Kosterm. var. *pulchella* (Planch. & Triana) Kosterm. in Reinwardtia 7: 427. 1969. **Fig. 34.**

Evergreen trees, up to 25 m tall with enormous buttresses; bark smooth, dark brown or grey, scaly; latex yellow; branchlets slender, terete. Leaves opposite, 7 - 13 x 1.5 - 5.0 cm, ovate or elliptic-oblong, obtuse to conspicuously rounded at base, cuspidate or acuminate at apex, petiolate, glabrous, coriaceous, concolorous, secondary nerves venulose beneath, slender, laxly reticulate; petioles 6 - 15 mm long. Flowers white, 3 - 5 in axillary fascicles, small, sessile, fragrant. Sepals 4(-5), in 2 pairs, outer pair 7 - 9 mm long, suborbicular, inner 10 - 11 mm long, orbicular. Petals 4, ca 2 - 5 cm long, cuneate-obovate. Stamens numerous, yellow; filaments 7 - 9 mm long, slender; anthers ca 1.5 mm long, linear. Ovary ca 2 mm long, ovoid, bilocular; styles as long as ovary; stigmas small, peltate. Fruits ovoid to globose, 2.5 - 3 x 3.4 cm with persistent, accrescent sepals. Seeds smooth.

*Fl.* April; *Fr.* Dec.

*Distrib.* India: In moist evergreen forests of Western Ghats. Tamil Nadu (Tirunelveli) and Kerala (Travancore).

Sri Lanka.

*Notes.* Kostermans (in Dassanayake, Rev. Handb. Fl. Ceylon 1: 110. 1980) considers it to be endemic to Sri Lanka but it is found in Peninsular India as well, though rarely.

Timber is valuable and useful like *M. ferrea*.

**6. *Mesua thwaitesii*** Planch. & Triana in Ann. Sci. Nat. Bot. ser. 4, 15 : 305. 1861; T. Anderson in Fl. Brit. India 1: 278. 1874. *M. ferrea* L. var. *thwaitesii* (Planch. & Triana) Vesque in DC., Monogr. Phan. 8: 634. 1893; Mahesh. in Bull. Bot. Surv. India 5: 339. 1964. **Fig. 35.**

Glabrous trees, up to 20 m tall; bark dark brown, smooth. Leaves opposite, linear-elliptic oblong, contracted and acute to rounded at base, acute or acuminate to cuspidate at apex, thickly coriaceous, pale green above, glaucous, white and faintly

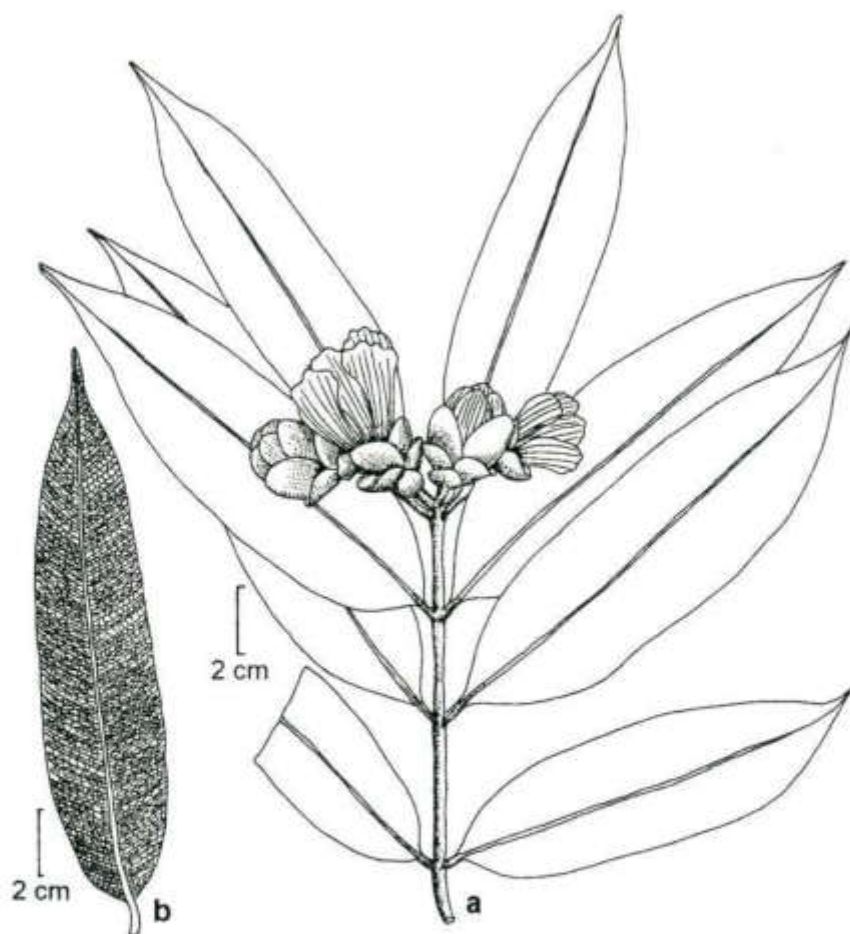


Fig. 35. *Mesua thwaitesii* Planch. & Triana : a. flowering branch; b. leaf.



nerved beneath, papillate on lower surface, petiolate. Flowers rose-coloured, showy, axillary (in axils of apical leaves), solitary, paired or rarely in threes, on a short, pubescent peduncle, ca 11.5 cm in diam. Sepals 4, outer pair smaller than inner pair and petals, slightly pubescent, persistent, accrescent or not. Petals 4, ca 2 cm across, orbicular. Stamens numerous, slender. Ovary 2-loculed; stigma peltate. Fruits 3 - 5 cm long, depressed or obovoid-globose, apiculate or conical, woody, surrounded by enlarged sepals and bracts. Seeds 2.

*Fl. & Fr.* Feb. - Dec.

*Distrib.* India: In semievergreen and evergreen forests of Southern Western Ghats. Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

### 5. *Poeciloneuron* Beddome

Large, evergreen trees; wood hard, heavy; branchlets clothed with minute hairs. Leaves opposite, linear-oblong to lanceolate, acute to attenuate, entire, shiny, smooth, thick, coriaceous, with close-set, numerous, parallel lateral veins, joined at angles by transverse veins or minutely reticulated; petioles channelled above, clothed with minute hairs. Inflorescence of terminal panicles or of solitary flowers, axillary at each node. Flowers yellowish-white or yellowish, rather showy. Sepals 4 - 5, small, imbricate. Petals 5 - 6, contorted. Stamens ca 16 - 22 in 2 whorls, free or slightly connate at base; anthers basifixed, narrowly linear, erect. Ovary bilocular, ovules 2 in each locule, erect; styles 2, subulate, stigmatic at tips or stigmas punctiform. Capsules ovoid, unilocular, 1-seeded, septically dehiscing into 2 coriaceous valves. Seeds erect, hard, exalbuminous; testa loose, membranous, striated; cotyledons fleshy.

Endemic to Southern Western Ghats of India 2 species.

*Notes.* This genus is sometimes assigned to the family Bonnetiaceae based on the presence of fibre tracheids (Kupiers, B. in *Leiden Bot. Ser.* 3: 76 - 101. 1976). But based on opposite leaves and basal placentation it can clearly be placed in the tribe Calophylleae (Kubitzki *et al.* in *Biochem. Syst. Ecol.* 6: 105 - 187. 1978).

#### KEY TO THE SPECIES

- 1a. Flowers in an elongated, terminal panicle; sepals and petals 5 each; anthers lobulated or tuberculate  
**1. *P. indicum***
- b. Flowers solitary, sometimes in fascicles of 2 or 4, axillary; sepals 4; petals 6; anthers entire or smooth  
**2. *P. pauciflorum***

1. *Poeciloneuron indicum* Beddome in J. Linn. Soc. 8: 267, t. 17. 1865 & Fl. Sylv. t. 3. 1869; Dyer in Fl. Brit. India 1: 278. 1874.

Kan.: *Kirballi, Balagi or Balgi* ; Mal.: *Vayala or Vayila* ; Tam.: *Puthankolli, Puthankolli, Vadinangu*.

Large trees, evergreen, gregarious, glabrous, up to 50 m tall; bole clean, straight, 2.5 - 3 m in girth, older trees often buttressed with stilt roots; wood hard, reddish-brown, heavy; bark grey or dark grey to brown, rough; latex yellow; terminal buds enclosed by leaf bases. Leaves 10 - 25 x 4 - 6.5 cm, elliptic, elliptic-oblong or rarely lanceolate, rounded or cuneate at base, obtusely long acuminate at apex, coriaceous, very glossy, dark green; secondary nerves very close, equidistant, curved towards margin; petioles 1 - 4 cm long. Panicles terminal, ca 10 cm long, pyramidally spreading, much branched, minutely puberulous. Flowers ca 2 cm in diam., yellowish-white, creamy or white, fragrant; peduncles and pedicels slightly puberulous; pedicels (0.3 -) 1 - 2 cm long; bracteoles ca 0.5 mm long, triangular. Sepals 5, cleft near to the base, 1.5 - 3 mm long, ovate, imbricate, slightly puberulous outside. Petals 5, 5 - 6 mm long, elliptic to obovate. Stamens ca 20 in 2 whorls; filaments slightly connate at base, ca 0.5 mm long; anthers bright yellow, 2.5 - 3.5 mm long, lobulate or tuberculate, each cell consisting of numerous superposed compartments. Disc below obsolete. Ovary 1 - 2 mm long, bilocular, ovules 2 in each locule; styles 2, slender, 2.5 - 3.5 mm long. Capsules ca 2.5 - 4 cm across, ellipsoid or globose, beaked, ribbed, dull pinkish, 1-seeded, glaucous. Seeds fleshy, ca 2 x 1.5 cm.

*Fl.* March - May; *Fr.* Sept. - Dec.

*Distrib.* India: Common in evergreen forests on the wet slopes in shola forests, often forming clumps, up to 1200 m; usually growing gregariously and luxuriantly, one of the loftiest trees in Southern Western Ghats. Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* Yields good timber especially for railway sleepers, posts, poles, planks, beams, trusses, joints, rafters, for agricultural implements, house construction, bridge building and walking sticks, etc. Root made into a paste in goat milk and taken internally on the first and second day of menstruation acts as an oral contraceptive (Bhatt *et al.* in *Bull. Medico-Ethno-Bot. Res.* 3 (2 - 4): 101. 1982.

2. *Poeciloneuron pauciflorum* Beddome, Fl. Sylv. t. 93. 1871; Dyer in Fl. Brit. India 1: 278. 1874.

Mal.: *Puli-vayila, Pudangalli*; Tam.: *Puthengkolli or Puthangakolli*.

Evergreen trees, up to 18 m tall and 2 m in girth; wood red, hard, heavy; branchlets

clothed with minute hairs; terminal bud enclosed by leaf bases. Leaves opposite, 10 - 13 (- 17) x 3 - 4 cm, narrowly elliptic or lanceolate, attenuate or narrowed at base, bluntly long acuminate at apex, glabrous, slightly recurved along margins; secondary nerves curving towards margin; petioles 10 - 12 mm long. Flowers up to 4 in fascicles, sometimes solitary or paired and terminal or at each node in axils of fallen leaves, white, ca 1 - 1.2 cm across; bracts ca 3 mm long, triangular. Sepals 4, unequal, inner 2 larger, ca 6 mm long, outer 2 ca 2 mm long, puberulous without. Petals 6, imbricate, glabrous. Stamens 16 - 25 in 2 whorls, inserted on a disc below ovary; anthers 4 - 5 mm long, linear, smooth. Ovary ca 2 mm long, bilocular, ovules erect, 2 in each locule; styles 2, ca 3.5 mm long. Capsules ca 2.5 cm long, ca 1.2 cm in diam., obpyriform at first, finally becoming ovoid or globose, with persistent sepals and styler base, dehiscent into 2 coriaceous valves, 1-loculed, 1-seeded. Seeds ca 1 x 0.7 cm, spherical, hard, testa loose, membranous, striated, easily separable from the seed.

*Fl. & Fr.* March.

*Distrib.* India: In evergreen forests between 600 and 1200 m, often on river banks of Southern Western Ghats. Tamil Nadu (Tirunelveli) and Kerala (Travancore).

Endemic.

*Notes.* Timber is valuable and is used for making walking sticks, for building purposes, etc.

#### CULTIVATED SPECIES

1. *Clusia rosea* Jacq., Enum. Syst. Pl. 34. 1760.

Eng.: *Pitch Apple*.

Small trees or shrubs up to 20 m tall; latex yellow. Leaves 9 - 23 x 6 - 15 cm, obovate obtuse at base, rounded, truncate or emarginate at apex; petioles 1 - 2 cm long. Flowers large, 8 - 10 cm in diam., solitary or in 3-flowered, cymose clusters, usually pistillate only. Sepals 4 in dissimilar pairs. Petals white, turning pink or with rosy streaks; 6 - 8, 3 - 4 cm long, obovate, Stamines connate into ring round ovary. Capsules 5 - 8 cm in diam., globose, dehiscent, yellow. Seeds with red aril.

*Notes.* Cultivated in Lalbagh Botanical Garden, Bangalore, Karnataka (Seetharam, Y.N. in *The Lal Bagh J.* 24(3): 3. 1979).

Native of central America.

2. *Garcinia livingstonei* T. Anderson in J. Linn. Soc. 9: 203. 1867.

Trees with robust branches; bark grey, rugose. Leaves often ternate and verticillate, 6 - 12 x 3 - 4.8 cm, obovate or elliptic, acute or cuneate at base, rotundate or shortly apiculate at apex, midrib prominent below, lateral veins 10 - 16, sometimes up to 25, prominent; petioles 6 - 8 mm long, channelled above. Male flowers white, in short, axillary fascicles on raised protruberances, ca 5 mm in diam.; pedicels ca 1.5 cm long, slender. Sepals 4, 2 x 2 mm, orbicular, concave, equal, many-nerved, coriaceous. Petals 4 or 5, similar to sepals but slender, ca 6 mm long. Stamens ca 24, below annular disc. Female flowers similar to male flowers. Ovary ca 3 mm long, bilocular; stigmas convex, hardly lobed, nearly sessile, covering the ovary top. Berries ca 2.5 cm in diam., almost globose, smooth, fleshy; pericarp thin, pulp edible. Seeds oblong, ca 1.5 x 1 cm.

*Fl. & Fr.* Nov. - March.

Cultivated in botanical gardens in West Bengal, Maharashtra, Karnataka and Tamil Nadu.

Native of Tropical Africa.

*Notes.* Fruits are edible while the pericarp and pulp are used in preparing a fermented beverages.

3. *Garcinia mangostana* L., Sp. Pl. 443. 1753; T. Anderson in Fl. Brit. India 1: 260. 1874.

Beng., Hindi, Mal., Mar. & Tam.: *Mangusta, Mangustan*; Eng.: *Mangosteen*.

Evergreen trees with pyramidal or conical crown, 20 - 25 m tall; branchlets many, decussate, stout, cylindric, slightly grooved; wood brick-red, heavy; bark black or dark-brown, yellow, smooth; latex yellow, sticky. Leaves 15 - 25 x 6 - 12 cm, elliptic to elliptic-oblong, acute, obtuse or rotundate at base, acute or shortly acuminate at apex, margins thick, often slightly revolute, thickly coriaceous, at first purpurascens, shiny; lateral veins subhorizontal, numerous, prominent beneath, interarching with a double intermarginal nerve; petioles 2 - 2.5 cm long, stout. Male flowers rare, ca 4 cm in diam., showy, pale green or creamy yellow; pedicels 1.5 - 2 cm long; bracts several, orbicular, concave, scarious. Sepals 4, erect, unequal, coriaceous, orbicular, concave, rotund. Petals 4, larger than sepals, ovate, fleshy, yellowish-red inside, greenish-red outside. Stamens indefinite, inserted on 4 thick, receptacular lobes below rudimentary pistil; filaments short; anthers ovate-oblong, recurved, bilocular, dehiscence longitudinal. Rudimentary pistil discoid, fleshy, red, apex conical, as long as stamens. Bisexual flowers solitary or geminate, pseudoterminal, 4 - 5 cm in diam.; pedicels 1.8 - 2 cm long, stout, woody. Sepals 4, decussate, orbicular, concave, persistent, outer pair shorter than inner, ca 2 cm in diam. Petals 4, purple, 2.5 - 3 cm in diam., orbicular, concave, thick, fleshy. Stamens many, 1- 2-seriate; anthers as in male flowers; filaments 4 - 5 mm long, slender, connate at base. Ovary globular, 4 - 8-locular, smooth; ovules solitary, ascending;

stigmas sessile, punctate, 5 - 8-lobed, lobes cuneiform. Berries up to 7 cm in diam., dark purplish-brown, glossy, smooth, surrounded by enlarged sepals at base and crowned by hard, flat stigma, on short peduncles; pericarp thick, spongy, reddish abounding in yellow latex. Seeds up to 8, oblong, laterally compressed, 1 - 2 cm long, with white, thick, with juicy, pleasant smelling aril.

*Fl. & Fr.* Throughout the year.

In India, this species prefers wet and humid climate and ca 600 - 700 m. Cultivation attempted in West Bengal, Assam, Maharashtra, Goa, Kerala and Tamil Nadu. Successfully established in a small area only, and also very rarely recorded from Arunachal Pradesh and Andamans. Cultivated in Sri Lanka, Myanmar, Thailand, Vietnam, Indonesia (Java), Malay Peninsula, Sunda Islands, Panama; semi-wild in Philippines, Singapore, Tropical Australia & other tropical countries.

*Notes.* Believed to have originated in W. Malesia. Generally considered as a most delicious fruit, highly prized and termed as 'queen of tropical fruits'; used as a dessert and can be made into preserve; available in Calcutta markets imported from Singapore. Rind is astringent, used as a febrifuge, in chronic diarrhoea, cystitis, gonorrhoea, gleet and tropical dysentery; also used in dyeing and tanning. The active principle appears to be a yellow pigment - mangostin. The Pericarp used as a paste for skin infections. Bark, rind and young leaves used as a gargle for a sore mouth. Wood suitable for cabinet work, building purposes, rice pounders and spear handles.

4. *Garcinia zeylanica* Roxb., Pl. Corom. 3: 94. 1820 & Fl. Ind. 2: 621. 1832.

Trees, up to 20 m tall, glabrous; bark dark brown. Leaves 8 - 10 x 4 - 6 cm, oblanceolate, tapering into 1 - 1.5 cm long petiole at base, subacute at apex; lateral veins 5 - 7 pairs, prominent. Male flowers: in axillary and pseudoterminal fascicles; pedicels 1 - 2.5 cm long. Sepals 4, orbicular; outer pair ca 2 mm long, inner ca 3 mm long. Petals 6 - 7 mm long, 4, oblong, fleshy, concave. Stamens ca 30; filaments connate into short, cylindrical, fungiform bundle. Rudimentary pistil often large. Female or pseudobisexual flowers solitary, axillary and pseudoterminal, subsessile, larger than the male flowers. Filaments 6 - 8, short, each bearing a short, abortive anther. Ovary globose, 6 - 8-locular, with longitudinal grooves. Berries up to 8 cm in diam., depressed globose, glossy pale yellow or orange, smooth, rounded, torulose ribs and as many, grooves, both ending below the flat top, mamilla absent; sepals persistent, reflexed; stigmas of 6 - 9 hard papillate rays, 3 - 4 mm in diam. Seeds 3 cm long, oblong, embedded in a very soft, juicy sweet acid arillode.

This endemic species of Sri Lanka was introduced in the botanic garden at Tranquebar near Tanjore, Tamil Nadu and in Indian Botanic Garden, Howrah, West Bengal.

*Notes.* It is closely allied to *G. gummi-gutta* (L.) N. Robson of which it is sometimes

treated as a variety but can be distinguished by its peculiar characters of stamens, ovary and particularly of fruit.

**5. *Mammea americana* L., Sp. Pl. 512. 1753.**

Eng.: *Mamey*, *Mammee*, *Mammea-apple*, *American Mammea tree*, *St. Domingo Apricot*.

Trees, 12 - 20 m tall; wood reddish-brown, hard. Leaves 10 - 25 cm long, broadly oblong-obovate or elliptic-obovate, wedge-shaped, obtuse or rounded at base, entire, coriaceous, dark green, glabrous, glossy above, marked with numerous fine transverse, reticulated veins and pellucid gland-dots; petioles stout, 1 - 1.5 cm long. Inflorescences solitary or fasciculate, on small tubercles in leaf axils. Flowers white, fragrant, ca 2.5 cm in diam., polygamous; pedicels 1 - 1.5 cm long. Sepals 1.2 - 1.7 cm long, fleshy. Petals white, usually 5, rarely 4 or 6, 1.5 - 2 cm long, obovate, concave. Filaments shortly connate, white, 10 - 12 mm long; anthers oblong, laterally dehiscent. Ovary globose; stigmas 2. Fruits large, 15 - 20 x 7.5 - 15 cm, drupaceous, oblate to globose, apiculate, indehiscent, reddish-green or russet with leathery, thick skin. Seeds 1 - 4, resinous, embedded in somewhat sweet, orange aromatic pulp.

Widely cultivated in many tropical countries including India and in tropical South America.

Native of west Indies.

*Notes.* Fruits are eaten raw or stewed, can be cut into slices and served with wine and sugar or preserved in syrup. The pulp is also used in preparation of jams and sauces. Seeds are bitter and resinous, yield a fixed oil suitable for use in cosmetics and pharmaceutical preparations and are toxic to several insect pests including cockroaches, mosquitoes, flies, lice and fleas. Flowers used in preparing a liqueur (*eau de Creole*) in its native country and used for flavouring purposes. Bark extract in water used as tick-wash. Wood is durable, takes good polish and is suitable for cabinet work.

**6. *Rheedia floribunda* Planch. & Triana in Ann. Sci. Nat. ser. 4, 14: 319. 1860.**

Small trees; branches terete; latex yellow. Leaves elliptic, obtuse at base, acute to acuminate at apex; petioles 1.5 - 2 cm long. Pseudobisexual flowers 12 - 16 x 4 - 7 cm; white in axillary fascicles; pedicels 7 - 15 mm long. Sepals 2, orbicular, concave. Petals 4 - 5, obovate. Stamens ca 15 - 20; anthers minute. Ovary somewhat ovate, 3 - 4-locular; stigma 3 - 4-lobed.

*Notes.* Cultivated in Victoria Gardens, Bombay, Maharashtra. Native of Brazil.

**7. *Rheedia madruno* Planch. & Triana in Ann. Sci. Nat. ser. 4, 14: 315. 1860. *R.***

*rostrata* Vesque, Epharמושis 2: 24. 1889 & in DC., Monogr. Phan. 8: 510. 1893.

Small trees. Leaves elliptic or oblong-elliptic, acute or cuneate at base, shortly obtuse or acuminate at apex, secondary veins closely arranged and crossed by distinct bands of secretory canals. Male flowers: Sepals 2. Filaments slender, long; anthers bilocular, dehiscences longitudinal. Rudimentary pistil distinct. Female flowers: Ovary 2-locular; stigmas 2-lobed. Berries 4 - 4.5 x 2 - 2.5 cm, ellipsoid, covered with sharp tubercles; pulp edible, easily separable from the seeds.

*Fl. & Fr.* Oct. - Feb.

This species is reported to be grown in Lalbagh Botanical Garden, Bangalore, Karnataka (Seetharam, Y.N. in *The Lal Bagh J.* 24(3): 2 - 3. 1979).

Native of Colombia.

# THEACEAE

(A.S. Chauhan & T.K. Paul)

Trees or shrubs, rarely scandent. Leaves alternate, rarely subopposite, simple, often serrate or entire, more or less coriaceous, usually exstipulate. Flowers axillary or extra-axillary, rarely lateral or terminal, solitary or in fascicles, regular, bisexual, rarely unisexual, often showy, subtended by 2 - 3 bracteoles at the base of calyx. Sepals 4 - 7, usually 5, free or slightly connate, imbricate, often unequal, persistent. Petals 4 - 9, usually 5, free or connate at base, imbricate or contorted. Stamens numerous, sometimes 5 or 15, adnate to petals, free or connate at base, uniseriate to multiseriate; anthers basifixed or versatile, dehiscence longitudinal, rarely poricidal. Ovary superior, rarely half inferior (in *Anneslea*), sessile, usually 3 - 5 or rarely 1 - 10-loculed, ovules 2 - many in each locule, rarely solitary; styles 1 - 5, free or partly united; stigmas usually small, capitate or entire. Fruit a berry, achene or capsule with persistent sepals at base and style at apex. Seeds small, few or more; endosperm scanty, rarely copious; embryo straight or curved.

Tropical and subtropical regions, mainly in America and Asia, a few in Africa; ca 16 genera and ca 500 species; 9 genera and ca 24 species in India.

*Notes.* The family Ternstroemiaceae (*s.l.*) of Bentham & Hooker have been split into a number of small families viz. Ternstroemiaceae, Actinidiaceae, Stachyuraceae and Theaceae etc. But most taxonomists are of the opinion that the split families Ternstroemiaceae and Theaceae should be kept together under the family Theaceae as two distinct tribes viz. *Camellieae* and *Ternstroemieae* and this is followed in this flora.

## KEY TO THE TRIBES

- |  |                          |
|--|--------------------------|
| 1a. Anthers versatile; fruit a loculicidal or septicidal capsule | 1. <i>Camellieae</i>     |
| b. Anthers basifixed; fruit a berry or achene                    | 2. <i>Ternstroemieae</i> |

## KEY TO THE GENERA IN TRIBES

### Tribe 1. *Camellieae*

- |   |                     |
|---|---------------------|
| 1a. Fruit loculicidally dehiscent   | 2                   |
| b. Fruit indehiscent or rarely partially dehiscent  | 3. <i>Pyrenaria</i> |
| 2a. Seeds winged; trees   | 3                   |
| b. Seeds wingless; shrubs or small trees  | 1. <i>Camellia</i>  |
| 3a. Fruits globose, dehisces up to about half their length; seeds reniform with wing all around except along the ventral edge | 4. <i>Schima</i>    |



- b. Fruits oblong-ellipsoid, dehisces almost throughout their length; seeds ellipsoid with an oblong wing  
2. *Gordonia*

### Tribe 2. Ternstroemiace

- 1a. Flowers in subterminal umbellate corymbs; ovary half inferior 6. *Anneslea*  
 b. Flowers axillary, solitary or in fascicles; ovary superior 2  
 2a. Flowers unisexual; fruits subglobose, ca 5 mm in diam. 8. *Eurya*  
 b. Flowers bisexual, sometimes unisexual; fruits ovoid, globose or subglobose; more than 10 mm in diam. 3  
 3a. Flowers generally unisexual; stamens glabrous; anthers longer than filaments; fruits 1 - 4-seeded 9. *Ternstroemia*  
 b. Flowers bisexual; stamens pubescent; anthers equal or shorter than filaments; fruits few to many-seeded 4  
 4a. Leaves without translucent margins; ovary 2 - 3-loculed; anthers pilose; styles not constricted at base; fruits few-seeded 7. *Cleyera*  
 b. Leaves with translucent margins; ovary 3 - 5-loculed; anthers hispid; styles constricted at base; fruits many-seeded 5. *Adinandra*

### 1. *Camellia* L.

Perennial shrubs or trees. Leaves evergreen, serrate, coriaceous or membranous. Flowers axillary, solitary or fascicled, sessile or shortly stalked, bracteolate. Sepals 5 - 6, unequal, imbricate, graduating from bracts towards petals. Petals 5 or more, shortly connate at base, imbricate. Stamens numerous, unequal, outer stamens partially connate to form a tube or ring, 5 - 12 inner ones free, adnate to the base of petals; anthers versatile. Ovary 3 - 5-loculed, ovules 3 - 4 (- 8) in each locule; styles 3 - 5, free or partially connate. Capsules woody, usually short, loculicidally dehiscent with a persistent central axis. Seeds usually 1 in each locule, subglobose or angular, exalbuminous; embryo straight, thick; radicle short, superior.

In S. and S. W. China extended over S. E. Asia from Nepal to Vietnam, ca 200 species; 5 in India.

*Literature.* SEALY, J.R. (1958). A revision of the Genus *Camellia*, RHS. London. CHANG, H. (1981). A taxonomy of the genus *Camellia*, Sun Yatsen University, China.

### KEY TO THE SPECIES

- 1a. Flowers nodding, bracteolate; sepals persistent 2  
 b. Flowers erect, perulate (bracteoles and sepals not distinguished); sepals deciduous or subsistent 3  
 2a. Branchlets pubescent; leaves membranous; stamens hairy; capsules always 1-seeded 1. *C. caudata*  
 b. Branchlets glabrous; leaves coriaceous; stamens glabrous; capsules 1 - 3-seeded 5. *C. sinensis*

- |   |                         |
|---|-------------------------|
| 3a. Perules deciduous; styles 3-fid at apex           | 2. <i>C. kissi</i>      |
| b. Perules persistent in young fruits; styles 3, free | 4                       |
| 4a. Shrubs, ca 3 m high; stamens 4 - 5 mm long        | 3. <i>C. lutescens</i>  |
| b. Small trees, ca 5 m tall; stamens ca 10 mm long    | 4. <i>C. siangensis</i> |

1. *Camellia caudata* Wallich, [Cat. No. 978. 1829, nom. nud.] Pl. Asiat. Rar. 3: 36. 1832; Dyer in Fl. Brit. India 1: 293. 1874. Fig. 36.

Asm.: *Phulkat*; Kh.: *Dieng-tyrmem-synrang*.

Shrubs or small trees, up to 2.5 m high; branchlets slender, pubescent or puberulous; bark greenish or reddish brown. Leaves 4 - 12 x 1 - 25 cm, elliptic-oblong to narrowly lanceolate or oblong, acute to cuneate at base, acute to caudate-acuminate at apex, serrate, membranous, glabrous above excepting hairy midrib, sparsely adpressed hairy beneath; petioles 2 - 5 mm long, pubescent. Flowers white, axillary, solitary or 2 - 5 in fascicles, ca 3 cm in diam.; pedicels 3 - 4 mm long, pubescent; bracteoles 3 - 5, 1 - 2 mm long, ovate to deltoid, pubescent, persistent. Sepals 5, 3 - 6 x 2 - 5 mm, ovate to somewhat orbicular, densely pubescent outside, glabrous inside. Petals 5, 7 - 15 x 5 - 10 mm, obovate, puberulous towards apex outside, glabrous inside. Stamens 1 - 1.2 cm long, outer stamens connate up to middle, villous; anthers yellow. Ovary 1 - 2 mm long, ovoid, densely villous, 1-locular; styles 9 - 13 mm long, 3-fid, segments 1 - 2 mm long. Capsules 1.5 - 2.5 x 1 - 2 cm, ellipsoid, apiculate, unilocular, 1-seeded. Seeds 1 - 1.2 cm across, globose, glabrous, brownish.

*Fl. & Fr.* Sept. - April.

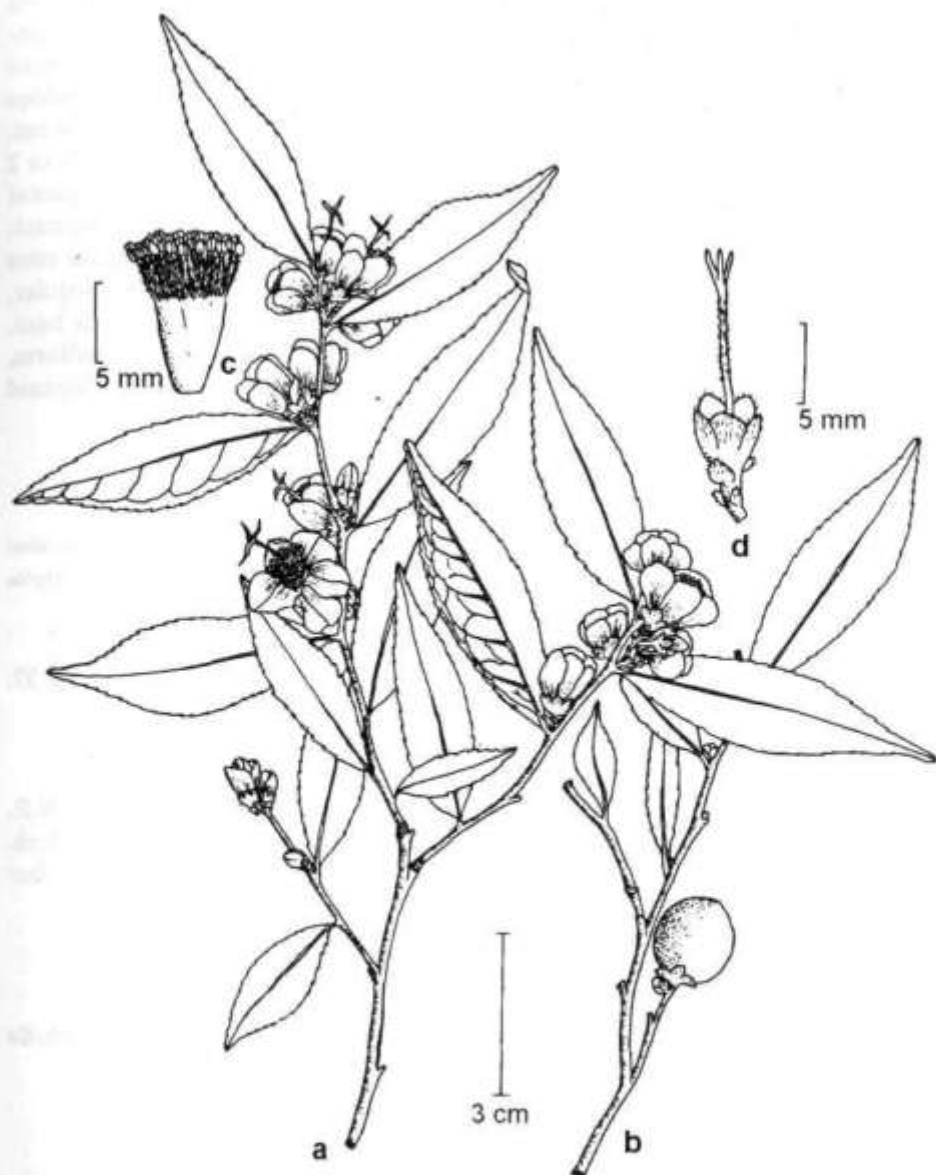
*Distrib.* India: Subtropical forests between 900 and 1600 m. Assam, Arunachal Pradesh, Meghalaya, Nagaland and Mizoram.

Nepal, Bhutan, Bangladesh, Myanmar, China, Taiwan and Indo-china.

*Notes.* *Camellia caudata* belongs to the section *Camelliopsis* (Pierre) Sealy and is distinguished from other species of the section by its slender pedicels and 3 - 6 mm long calyx, not exceeding 5 mm in diameter, 10 - 14 mm long corolla, 9 - 13 mm long styles which are trifid with 1 - 2 mm long segments.

2. *Camellia kissi* Wallich in Asiat. Res. 13: 429. 1820 & Pl. Asiat. Rar. 3: t. 256. 1832. *C. keina* Buch.-Ham. ex D. Don, Prodr. 224. 1825. *C. drupifera* auct. non Lour. 1790; Dyer in Fl. Brit. India 1: 293. 1874. *C. caduca* C.B. Clarke ex Brandis, Indian Trees 61. 1921; Kanjilal *et al.*, Fl. Assam 1: 123. 1934.

Kh.: *Dieng-tyrmem-bhoi*.



**Fig. 36.** *Camellia caudata* Wallich : **a.** flowering branch; **b.** fruiting branch; **c.** androecium; **d.** flower with petals and stamens removed.

Shrubs or small trees, up to 5 m high; young portion of stems and branches pubescent, ultimately glabrous. Leaves 4 - 15 x 1 - 5.5 cm, elliptic-oblong, oblong-lanceolate to oblanceolate, cuneate at base, acute to long acuminate at apex, serrulate to almost entire, often slightly revolute, coriaceous, glabrous above excepting puberulous midrib, hairy or glabrescent beneath; petioles 2 - 5 mm long, hairy or glabrescent. Flowers white, axillary, solitary or 2 together, ca 3 cm in diam., fragrant; pedicels ca 2 mm long. Sepals perulate, 1 - 6 mm long, suborbicular to broadly ovate, silky pubescent outside, glabrous inside, deciduous. Petals 6 or 7, 10 - 15 x 6 - 8 mm, obovate, emarginate, sparsely hairy outside, glabrous inside, caducous. Stamens 5 - 10 mm long, outer ones connate at base, inner ones free, glabrous. Ovary 3 - 5 x 2 mm, ovoid, woolly, 3-locular, usually 1-locular by abortion; styles 3 - 7 mm long, 3-fid at apex, hairy towards base. Capsules 1.5 - 2.5 x 1.5 - 2 cm, ca 2.5 cm in diam., subglobose or globose-pyriform, pubescent, ultimately depressed globose and glabrous. Seeds ca 1 cm in diam., ellipsoid to subglobose, brown.

## KEY TO THE VARIETIES

- 1a. Leaves narrow (0.8 - 1.8 cm)  
 b. Leaves broad (2 - 5.5 cm)

2.1. var. *kissi*2.2. var. *stenophylla*2.1. var. *kissi*

Fig. 37.

*Fl. & Fr.* Jan. - Sept.

*Distrib.* India: In subtropical forest up to 1500 m Eastern Himalayas and N.E. region, and in Bay Islands at lower altitudes. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and Andaman & Nicobar Islands (Andaman Islands).

Nepal, Bhutan, Myanmar, China and Indo-China.

2.2. var. *stenophylla* (Kobuski) Sealy, Rev. Gen. *Camellia* 201. 1958. *C. stenophylla* Kobuski in *Brittonia* 4: 115. 1941.

*Fl.* Nov.*Distrib.* India: In subtropical forests at 1500 m. Meghalaya.

Myanmar and China.

*Notes.* *Camellia kissi* is distinguished by early deciduous nature of its petals. In herbaria very few specimens are seen with petals.

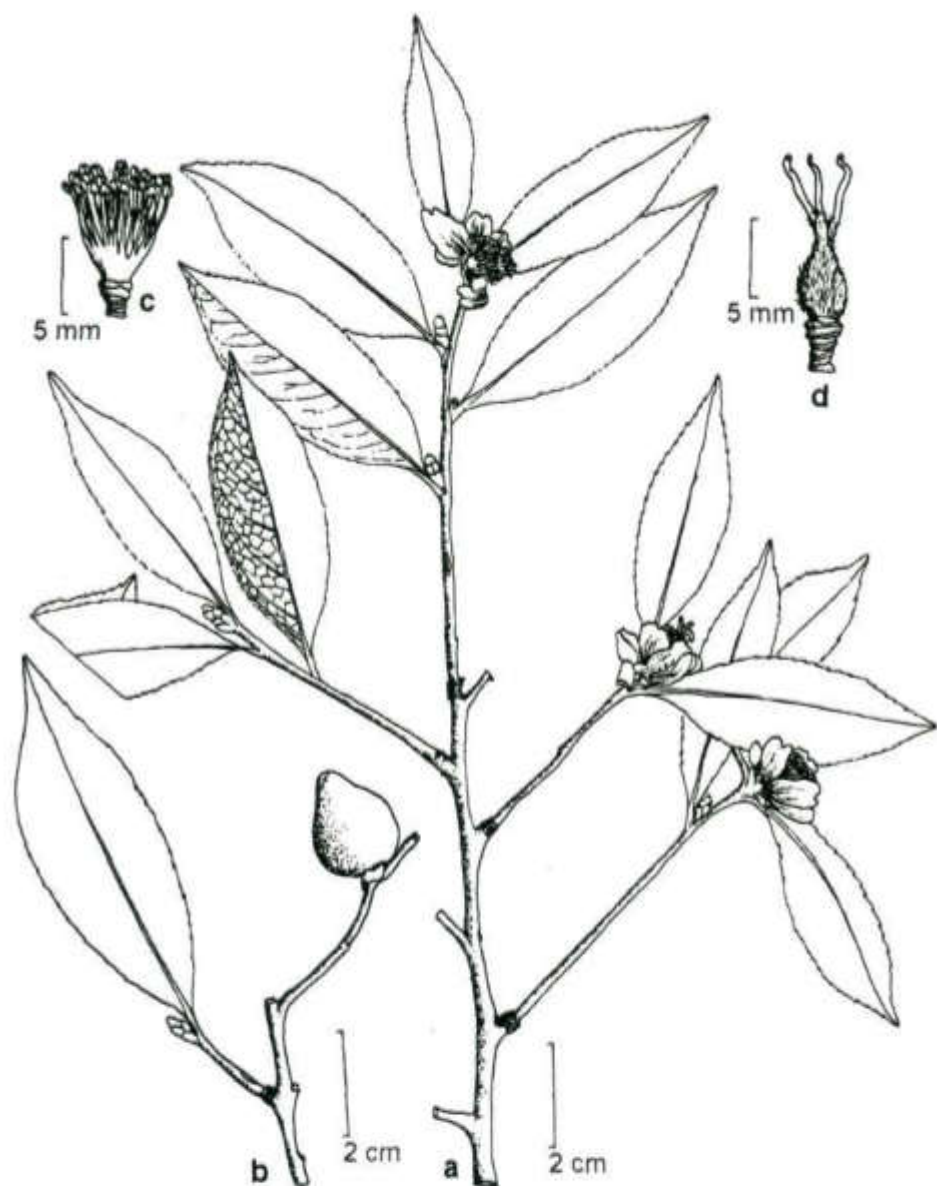


Fig. 37. *Camellia kissi* Wallich var. *kissi* : a. flowering branch; b. fruiting twig; c. androecium; d. pistil.

### 3. *Camellia lutescens* Dyer in Fl. Brit. India 1: 293. 1874.

Shrubs, up to 3 m high; stems and branches glabrous. Leaves 5 - 10 x 2 - 4 cm, elliptic-oblong or oblanceolate, cuneate to rounded at base, caudate-acuminate at apex, closely serrate, membranous, glabrous or sometimes midvein puberulous; petioles 5 - 6 mm long, pubescent. Flowers white, turning yellowish, axillary or terminal, sessile, ca 3 cm in diam., fragrant. Sepals perulate, 2 - 5 x 2 - 5 mm, orbicular to lunate, glabrous outside, pubescent inside, persistent at least in young fruit. Petals 6, outer 4, 8 - 10 x 6 - 8 mm, oblong, inner 2, ca 10 x 6 mm, glabrous. Stamens 4 - 5 mm long, outer filaments connate to form a fleshy irregular cup, glabrous. Ovary ca 2.5 x 2.5 mm, globose, villous; styles 3, very short, free; stigmas capitate. Capsules ca 2 mm in diam., globose, blackish.

*Fl. & Fr.* Nov. - Feb.

*Distrib.* India: Eastern Himalayas, in subtropical forests at 1800 m. Arunachal Pradesh.

Myanmar and Indo-China.

*Notes.* It was first collected by Griffith in 1836 from Mishmi hills of Arunachal Pradesh and it has not been collected since then. Being a wild relative of the Tea Plant (*Camellia sinensis* (L.) O. Kuntze) demands location and conservation of this species for future tea improvement research.

### 4. *Camellia siangensis* T.K. Paul & Nayar in Bull. Bot. Surv. India 27: 92. 1987.

Small trees, up to 5 m tall; young stems and branches glabrous, purplish. Leaves 6.5 - 10 x 2.5 - 4 cm, elliptic to oblong-elliptic, obtuse at base, acuminate at apex, serrulate, glabrous with puberulous midvein above; petioles 5 - 8 mm long, pubescent. Flowers solitary, axillary or terminal; pedicels 1 - 1.5 mm long. Sepals 1 - 6 x 1 - 5 mm, orbicular to lunate, densely hairy towards apex outside, adpressed hairy inside, persistent. Petals 6, oblong, outer 4, 7 - 8 x 5 - 6 mm, inner 2, ca 12 x 6 mm. Stamens ca 10 mm long, outer stamens connate to form fleshy cup. Ovary 2 - 2.5 mm x 2 mm, subglobose, hairy; styles 3, free, 1 - 1.5 mm long; stigmas simple. Fruit unknown.

*Fl.* Nov.

*Distrib.* India: In subtropical forests between 1100 and 1700 m. Arunachal Pradesh.

Endemic.

*Notes.* *Camellia siangensis* is allied to *C. lutescens* but differs by its tree habit, longer stamens and simple stigma.

**5. *Camellia sinensis* (L.) O. Kuntze** in Acta Horti Petrop. 10: 195. 1887. *Thea sinensis* L., Sp. Pl. 515. 1753.

Beng., Hindi & Raj.: *Cha, Chai*; Tam.: *Thayilai*; Tel.: *Theyaku*.

Shrubs or trees, 1 - 6 (- 15); young stems and branches glabrous. Leaves 4 - 18 x 1.5 - 6 cm, elliptic, elliptic-oblong to obovate, cuneate at base, obtuse to shortly cuspidate-acuminate at apex, serrulate to sinuate-serrate, membranous to coriaceous, glabrous above, hairy beneath, ultimately becoming glabrous. Flowers white, axillary, solitary or 2 - 6 in fascicles; pedicels 6 - 10 mm long, ultimately bending downwards; bracteoles 2 - 3, ca 2 mm long, ovate, obtuse, concave, glabrous or velutinous, caducous. Sepals 5 - 6, 3 - 5 x 2 - 3 mm, ovate to orbicular, glabrous or velutinous outside, ciliate, persistent. Petals 7 - 8, 10 - 15 x 6 - 20 mm, ovate, broadly ovate to orbicular, concave. Stamens 8 - 10 mm long, outer ones connate at base, glabrous, adnate to the base of petals; anthers yellow. Ovary 2 - 5 mm long, 1 - 3-loculed, densely hairy; styles 5 - 7 mm long, 3-fid at apex, glabrous or rarely sparsely hairy. Capsules 10 - 15 x 15 - 25 mm, ovoid to subglobose, 3-seeded. Seeds 10 - 15 mm in diam., globose, glabrous, brown or reddish-brown.

#### KEY TO THE VARIETIES

- 1a. Plants up to 15 m tall; leaves elliptic, 7 - 18 x 3 - 6 cm, acuminate at apex, membranous  
5.1. var. *assamica*
- b. Plants up to 6 m tall; leaves oblong, 4 - 10 x 1.5 - 4 cm, abruptly acute at apex, coriaceous  
5.2. var. *sinensis*

**5.1. var. *assamica*** (Masters) Kitamura in Acta Phytotax. Geobot. Kyoto 14: 59. 1950. *Thea assamica* Masters in J. Agric. Hort. Soc. Ind. 3: 63. 1844. *Camellia theifera* Griffith, Not. Pl. Asiat. 4: 558, t. 601, f. 1. 1854 & Icon. Pl. Asiat. t. 601, f. 1, 3. 1854; Dyer in Fl. Brit. India 1: 292. 1874.

*Fl. & Fr.* Jan. - Sept.

*Distrib.* India: Cultivated extensively in upper Assam, also wild in Lakhimpur and Sibsagar districts of Assam.

Nepal, Bhutan, Myanmar, Thailand, China and Indo-China, often cultivated.

**5.2. var. *sinensis*.**

*Thea sinensis* L., Sp. Pl. 515. 1753. *T. bohea* L., Sp. Pl. ed. 2: 734. 1762.

**Fig. 38.**

*Fl. & Fr.* June - Jan.



Fig. 38. *Camellia sinensis* (L.) O. Kuntze var. *sinensis* : a. flowering branch; b. flower with stamens removed.



*Distrib.* India: Cultivated in North eastern India, hills of Uttar Pradesh and Southern India. Cultivated in subtropical and warm temperate zones of South-east Asia. It is known to be wild in Yunnan of China.

*Notes.* *Camellia sinensis*, the tea yielding plant of Commerce is cultivated as a source of beverage. China is the first country to cultivate tea and to appreciate its usefulness. In India tea is cultivated in the hills of North (especially Northeast) and South India, of which Darjeeling (West Bengal) tea is World famous for its flavour.

## 2. *Gordonia* Ellis, nom. cons.

Perennial shrubs or evergreen trees. Leaves crenate or entire, coriaceous or chartaceous. Flowers showy, often subsessile, axillary, solitary or 2 - 3 fascicled at the ends of branches; bracts 2 - 5, caducous. Sepals 5, unequal, graduating from bracts to petals. Petals 5, free or shortly connate at base, inner most larger. Stamens numerous, 5-adelphous or all connate, adnate to the base of petals. Ovary 3 - 5 (-6)-loculed; ovules 5 - 8 in each locule; style 1; stigma 3 - 5-lobed. Capsules ellipsoid-oblong, 3 - 6-angled, woody, loculicidally dehiscent with a persistent central axis. Seeds 4 - 8 in each locule, flat or compressed, ellipsoid, prolonged upwards into oblong wing, exalbuminous; embryo mostly straight, oblique with ovate, flat or slightly crumpled cotyledons; radicle superior.

In tropical and subtropical Asia and North America; ca 40 species, 2 in India.

### KEY TO THE SPECIES

- 1a. Leaves acuminate at apex, obscurely serrate, coriaceous; pedicels ca 2 mm long 1. *G. excelsa*  
 b. Leaves obtuse or obtusely acuminate at apex, crenate, chartaceous; pedicels 2.5 - 5 mm long 2. *G. obtusa*

1. *Gordonia excelsa* Blume, Bijdr. 130. 1825; Dyer in Fl. Brit. India 1: 291. 1874 incl. vars. *G. dipterosperma* Kurz in J. Asiat. Soc. Beng. 45: 119. 1876. *Dipterospermum* sp., Griffith, Not. Pl. Asiat. 4: 564. 1854.

Nep.: *Hinguwa*.

Trees, 8 - 10 m tall; bark of young branches cracking transversely and scaling off. Leaves 5 - 15 x 2 - 5 cm, narrowly elliptic to oblanceolate, acute at base, acute to acuminate at apex, obscurely serrate, glabrous above, appressed simple hairy beneath, coriaceous. Flowers pinkish, fragrant, axillary, solitary, 3 - 5 cm in diam.; pedicels ca 2 mm long, pubescent. Sepals 4 - 10 x 5 - 6 mm, ovate to orbicular, fleshy, pubescent outside, glabrous inside. Petals 1.5 - 2 x 0.5 - 1 cm, orbicular to oblong, hairy outside, glabrous inside. Stamens 4 - 8 mm long, unequal, connate at base. Ovary ca 3 mm long,

oblong, pubescent; style ca 4 mm long; stigma lobed. Capsules 2 - 3 x 1.5 cm, oblong, valves flat on back, more or less tapering upwards, hairy. Seeds 3 - 6 x 2 - 3 mm, ellipsoid, winged; wings 5 - 10 mm long, brownish.

*Fl. & Fr.* Nov. - May.

*Distrib.* India: In subtropical and warm broad leaved forests between 300 and 1370 m. Sikkim and Meghalaya.

Bhutan.

**2. *Gordonia obtusa*** Wallich [Cat. No. 1459. 1829, nom. nud.] ex Wight & Arn., Prodr. 87. 1834; Dyer in Fl. Brit. India 1: 291. 1874. *G. obtusifolia* Wight, Ill. Ind. Bot. 1: 99. 1838. *G. parvifolia* Wight, Ill. Ind. Bot. 1: 99. 1838. **Fig. 39.**

Trees, 10 - 30 m tall. Leaves 5 - 15 x 2 - 5 cm, elliptic to oblong, acute at base, obtuse or obtusely acuminate at apex, crenate, glabrous, chartaceous; petioles 2 - 5 mm long, glabrous or with few hairs. Flowers white, axillary, solitary or 2 - 3 fascicled at ends of branches, ca 3 cm in diam.; pedicels 2 - 5 mm long, pubescent. Sepals 3 - 8 x 6 - 10 mm, orbicular, pubescent outside, glabrous inside. Petals 1.5 - 2 x 0.8 - 1 cm, obovate, pubescent outside, glabrous inside. Stamens 4 - 8 mm long, unequal, connate at base. Ovary 3 - 5 mm long, ovoid, hairy; style ca 2 mm long; stigma lobed. Capsules 2 - 3 x 1.5 cm, oblong with a short acumen, 5-angled, valves deeply sulcate above. Seeds 3 - 7 x 2 mm, ellipsoid, winged; wings 6 - 10 mm long, brownish.

*Fl. & Fr.* Oct. - May.

*Distrib.* India: Western Ghats, in evergreen forests between 500 and 2000 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

#### EXCLUDED SPECIES

***Gordonia anomala*** Sprengel, Syst. Veg. 1: 126. 1824; Dyer in Fl. Brit. 1: 292. 1838. *G. axillaris* (Roxb.) Dietrich, Syn. Pl 4: 863. 1847. *Camellia axillaris* Roxb. ex Ker.-Gawl. in Edw. Bot. Reg. 4: t. 349. 1818 & in Sims Bot. Mag. 46: t. 2047. 1819.

This species was introduced from Pulo Penang by Roxburgh to the Indian Botanic garden, Calcutta. It is no more extant in the garden.

### 3. *Pyrenaria* Blume

Perennial shrubs or trees. Leaves large, serrate, chartaceous or coriaceous. Flowers

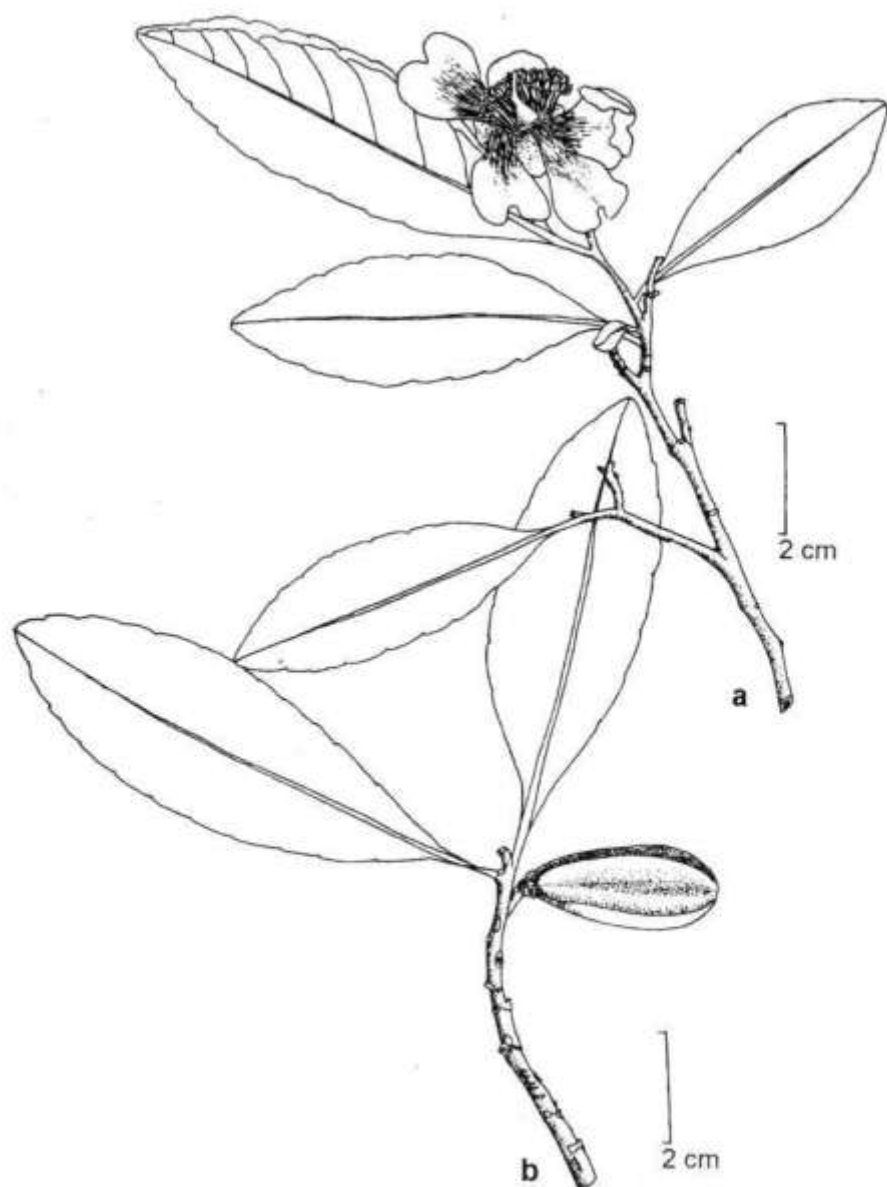


Fig. 39. *Gordonia obtusa* Wallich ex Wight & Arn.: a. flowering twig; b. fruiting twig.

subsessile, axillary, solitary or 2 - 3 in clusters, erect or nodding; bracteoles usually 2. Sepals 5 - 6, usually 5, unequal. Petals 5 - 6, shortly connate at base. Stamens numerous, connate at base and often adnate to the base of petals. Ovary 5 - 6-loculed with 2 - 3 laterally attached ovules in each locule; styles 3 - 5, free, partly or totally united. Fruit a drupe or capsule, indehiscent or rarely partially dehiscent. Seeds hemispheric to oblong, wingless with a prominent hilum on the ventral side, testa woody; cotyledons large, crumpled or conduplicate; radicle inferior, inflexed.

In Asia, ca 30 species; 3 in India.

#### KEY TO THE SPECIES

- |  |                               |
|--|-------------------------------|
| 1a. Leaves glabrous; bracts orbicular, smaller than sepals                     | 2                             |
| b. Leaves pubescent; bracts ovate to oblong, larger than sepals                | 2. <i>P. diospyricarpa</i>    |
| 2a. Fruits woody, with 5 stigmatic heads at apex and persistent sepals at base | 3. <i>P. khasiana</i>         |
| b. Fruits fleshy, without stigmatic heads and persistent sepals                | 1. <i>P. barringtonifolia</i> |

1. *Pyrenaria barringtonifolia* (Griffith) Seem. in Bonplandia 7: 49. 1859; Dyer in Fl. Brit. India 1: 290. 1874. *Eusynaxis barringtoniaefolia* Griffith, Not. Pl. Asiat. 4: 560. 1854 & Icon. Pl. Asiat. 4: t. 603. f. 1-3. 1854.

Fig. 40.

Asm.: *Bon-madhuri, Janghali-tagar, Janghali-cha.*

Shrubs or small trees, 5 - 8 m tall; stems glabrous; bark dark grey. Leaves 8 - 25 x 3 - 10 cm, spatulate, oblanceolate to elliptic, attenuate at base, rounded or truncate to abruptly acuminate at apex, strongly serrate, glabrous, coriaceous, midvein depressed above, raised beneath; petioles 5 - 15 mm long, glabrous. Flowers creamy yellow, axillary, solitary, ca 4 cm in diam., subsessile or with 2 - 3 mm long, glabrous pedicels; bracts 2 - 3, ca 3 mm long, orbicular. Sepals 5 - 6 x 5 - 10 mm long, broadly orbicular, densely pubescent outside, glabrous inside, deciduous. Petals 8 - 15 x 6 - 8 mm, more or less orbicular, densely pubescent outside, glabrous inside. Stamens 2 - 4 mm long, filaments connate at base. Ovary ca 2 mm long, densely pubescent; styles distinct. Fruits 2 - 3 x 1.5 - 3 cm, ovoid, thin walled, fleshy, longitudinally wrinkled, glabrous. Seeds ca 1.5 cm long, ellipsoid, glabrous.

*Fl.* March - May; *Fr.* Oct. - Feb.

*Distrib.* India: In subtropical evergreen forests between 300 and 1200 m. Assam, Arunachal Pradesh and Meghalaya.

Endemic.

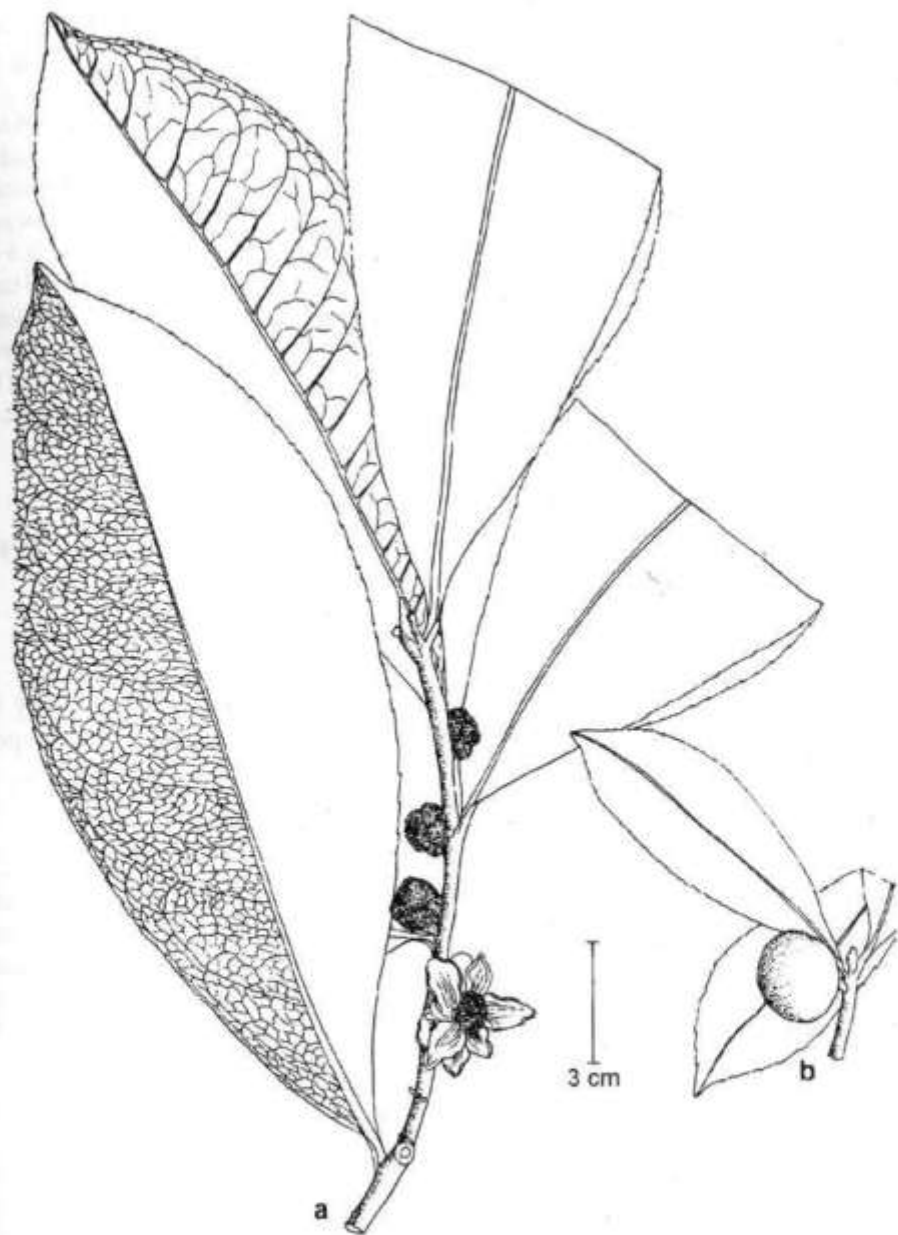


Fig. 40. *Pyrenaria barringtonifolia* (Griffith) Seem. : a. flowering branch; b. fruit with two leaves.

2. *Pyrenaria diospyricarpa* Kurz in J. Asiat. Soc. Beng. 42: 60. 1873; Kanjilal *et al.*, Fl. Assam 1: 119. 1934. Fig. 41.

Trees, 6 - 8 m tall; young stems and branches pubescent. Leaves 5 - 11 x 2.5 - 4 cm, oblong to elliptic-lanceolate, cuneate at base, acute or obtuse at apex, serrulate, pubescent above ultimately glabrescent, pubescent on veins beneath, coriaceous; petioles 0.5 - 1 cm long, pubescent. Flowers axillary, solitary; pedicels 2 - 3 mm long, pubescent; bracts 5, unequal, foliaceous, 5 - 15 x 4 - 6 mm, ovate to oblong. Sepals 5, 4 - 5 x 3 - 4 mm, orbicular to obovate, pubescent outside, glabrous inside. Petals 5, 7 - 12 x 5 - 8 mm, orbicular to obovate, pubescent outside, glabrous inside. Stamens 4 - 5 mm long, filaments connate at base. Ovary 3 - 4 mm long, ovoid, villous; styles 5, free at apex. Fruit 3 - 5 x 1.5 - 3.5 cm, cylindrical or slightly obovoid, crowned with 5 stigmatic heads at tip and sepals and bracts at base. Seeds 1.5 - 2 x 0.6 - 1 cm, ovoid-cylindrical, glabrous.

*Fl.* Nov. - Dec.; *Fr.* Jan. - Feb.

*Distrib.* India: In tropical evergreen forests, Assam (Lakhimpur and Sibsagar districts).

Myanmar.

*Notes.* This species is very rare in India and it has been collected only twice by U. Kanjilal during 1912 and 1931 from Lakhimpur and Sibsagar districts of Assam respectively.

3. *Pyrenaria khasiana* R.N. Paul in Bull. Bot. Soc. Beng. 33: 115. 1979.

Shrubs; stems glabrous; bark brown or brownish grey. Leaves 15 - 21 x 4 - 7 cm, oblanceolate to spatulate, acute or attenuate at base, abruptly short acuminate at apex, serrate, entire towards the base, coriaceous, glabrous, midrib depressed above, raised beneath; petioles 4 - 7 mm long, glabrous. Flowers unknown. Fruits 1.5 - 2 x 1.6 - 2.5 cm, spherical, woody, longitudinally furrowed, crowned with 5 stigmatic heads at tip and persistent sepals at base.

*Fl.*: May.

*Distrib.* India: In subtropical forests between 600 and 900 m. Meghalaya.

Endemic.

*Notes.* This species was described based on Kurz's collection from Khasi hills of Meghalaya and is so far known by type collection only.

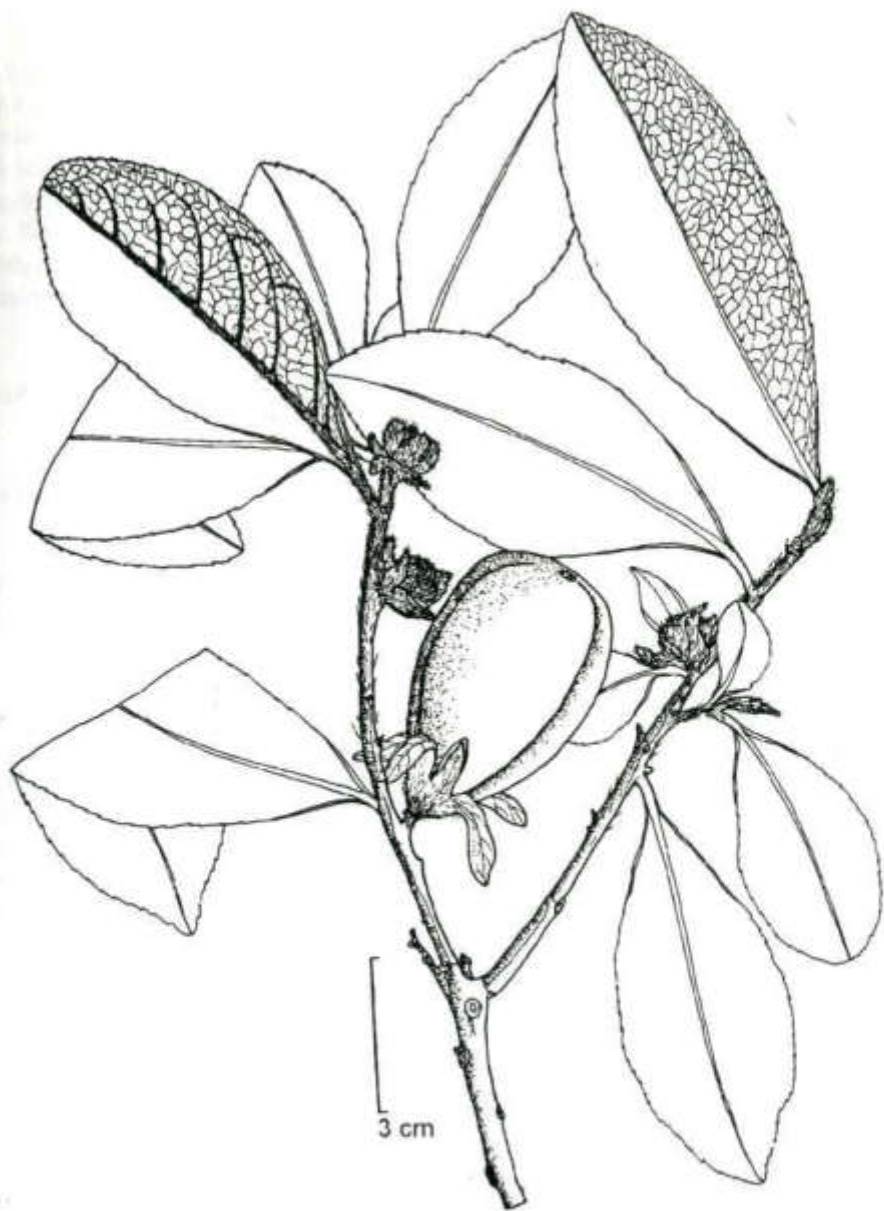


Fig. 41. *Pyrenaria diospyricarpa* Kurz

#### 4. *Schima* Reinw. ex Blume

Evergreen trees. Leaves membranous to coriaceous. Flowers usually on erect peduncles, solitary or in short racemes; bracteoles 2. Sepals 5, subequal. Petals 5, larger than sepals, slightly connate at base, outermost concave and cucullate. Stamens numerous, in 3 - 5 rows, adnate to the base of petals. Ovary usually 5, rarely 4 - 6-loculed; ovules 2 - 6 in each locule, lateral, subpendulous; styles simple or lobed at apex; stigmas broad. Capsules depressed globose, woody, dehisces loculicidally to about half their length, with a persistent central axis. Seeds flat, reniform, dorsally winged, hilum central; endosperm scanty, cotyledons foliaceous, flat or crumpled, acumbent; radical inferior, curved upwards.

A monotypic, polymorphic genus with 9 species and 3 varieties in Tropical Asia; 2 varieties in India.

*Literature.* BLOEMBERGEN S. (1952). A critical study in the complex-polymorphous genus *Schima* (Theaceae). *Reinwardtia* 2: 133 -183.

*Schima wallichii* (DC.) Korthals in Temminck, *Verh. Nat. Gesch. Ned. Bezitt. Bot.* 5: 143. 1842; Dyer in *Fl. Brit. India* 1: 289. 1874. *Gordonia wallichii* DC., *Prodr.* 1: 528. 1824. *G. chilaunea* Buch.-Ham. ex D. Don, *Prodr.* 225. 1825.

Trees, up to 30 m tall; stems and branches glabrous. Leaves 5 - 25 x 2 - 10 cm, oblong to lanceolate, elliptic-oblong or ovate to obovate, cuneate to rounded at base, acute to short acuminate at apex, entire to undulate or crenate-serrate, glabrous above, except for few hairs on midrib, sparsely appressed simple hairy beneath; petioles 0.3 - 3.5 cm long, glabrous. Racemes short, terminal; peduncles up to 5 cm long, minutely white warted. Flowers white, fragrant, 3 - 5 cm in diam.; pedicels 1 - 3 cm long; bracts ca 6 mm long, narrowly oblong, retuse. Sepals 3 - 4 x 3 mm, semicircular to orbicular, glabrous outside, appressed hairy inside, ciliate, persistent. Petals 1 - 1.5 x 0.8 - 1 cm, obovate, pubescent outside at base. Stamens numerous, 5 - 10 mm long. Ovary 2 - 3 x 2 - 4 mm, globose, tomentose, 5 or 6 - 7-loculed; styles 5 - 6 mm long; stigmas flattened, capitate. Capsules 0.5 - 2 x 1 - 2 cm, globose, pubescent when young, ultimately becoming glabrescent. Seeds 7 x 5 mm, glabrous.

#### KEY TO THE VARIETIES

- |  |                          |
|--|--------------------------|
| 1a. Leaves serrate; lateral nerves scarcely forked; pedicels 3 - 3.5 mm across           | 1. var. <i>khasiana</i>  |
| b. Leaves entire to undulate, lateral nerves mostly forked; pedicels up to 2.5 mm across | 2. var. <i>wallichii</i> |

1. var. *khasiana* (Dyer) Bloem. in *Reinwardtia* 2: 164. 1952. *Schima khasiana* Dyer in *Fl. Brit. India* 1: 289. 1784.



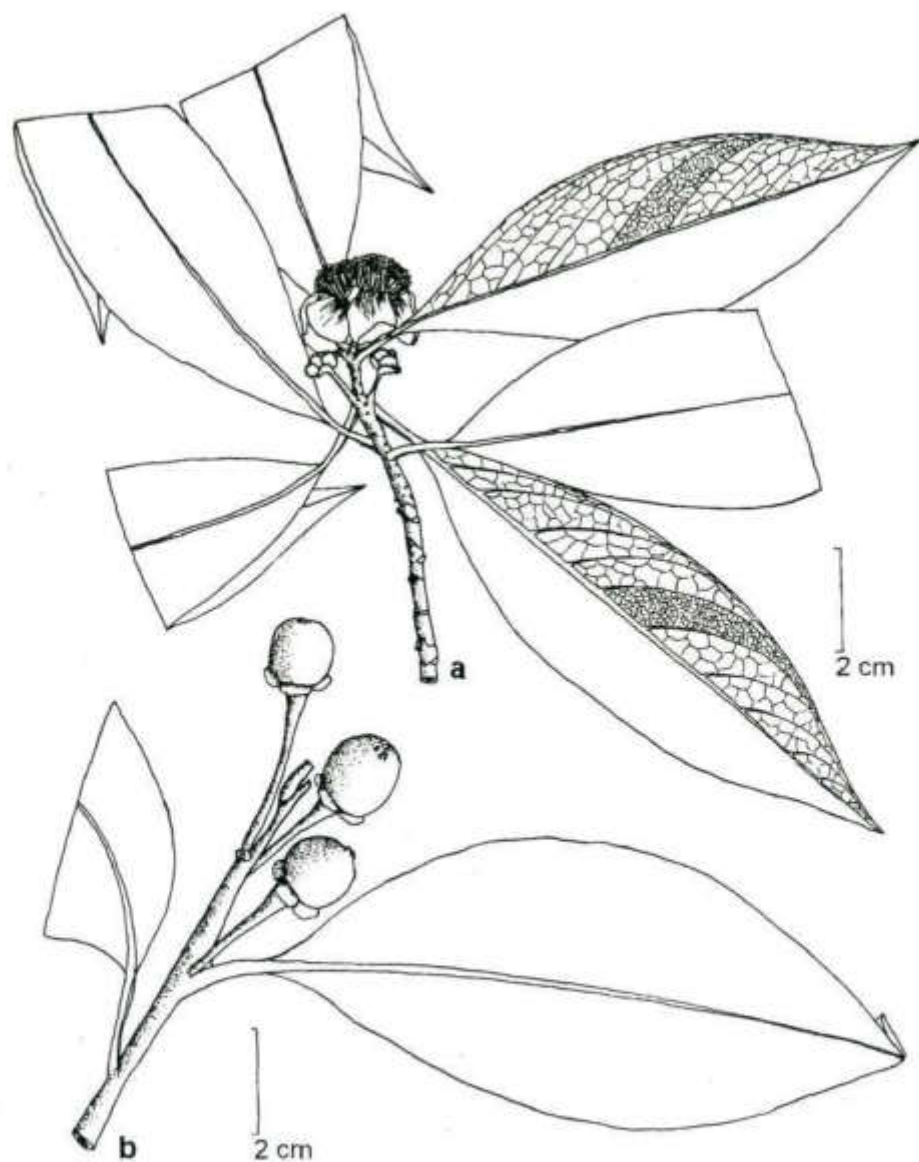


Fig. 42. *Schima wallichii* (DC.) Korthals var. *wallichii* : a. flowering twig; b. fruiting twig.

Kh.: *Dieng-an; Dieng-ngan.*

*Distrib.* India: In subtropical forests between 1200 and 1700 m. Nagaland, Manipur and Meghalaya.

Bhutan and Myanmar.

**2. var. wallichii**

**Fig. 42.**

*Gordonia integrifolia* Roxb., [Hort. Beng. 52. 1814, nom. nud.] Fl. Ind. 2: 572. 1832.  
*Schima mollis* Dyer in Fl. Brit. India 1: 228. 1784.

Asm.: *Noga-bhe*; Kh.: *Dieng-ngan*; Nep.: *Chilaune, Gogra, Aule chilaune.*

*Fl. & Fr.* April - Feb.

*Distrib.* India: Eastern Himalayas and Western Ghats, in evergreen forests between 600 and 1500 m. Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and Tamil Nadu.

Nepal, Bhutan, Bangladesh, Myanmar and China.

*Notes.* Wood used for making plywood.

**5. Adinandra Jack**

Small, evergreen shrubs or trees. Leaves alternate, petiolate or sessile, coriaceous, shallowly serrate. Flowers axillary, solitary or in pairs, bisexual, bracteate, bracteolate. Sepals 5, imbricate, persistent, accrescent. Petals 5, connate at the base, glabrous or sericeous outside. Stamens 15 - 60, 1 - 5 seriate, often 1 - 4-adelphous, adnate to the base of petals; filaments united, rarely free, unequal when more than 1-seriate, pubescent or glabrous; anthers basifixed, long apiculate, extrorse, hispid, rarely glabrous. Ovary 3 - 5 or rarely 2 - 4-loculed; ovules many in each locule; styles 10, elongate, entire or shortly 3 - 5-fid; stigmas entire or lobed. Fruits globose, indehiscent. Seeds many, small, scrobiculate, albumen fleshy.

Tropics and subtropics of Indo-Malesia, except a few outside, ca 80 species; one in India.

**Adinandra griffithii** Dyer in Fl. Brit. India 1: 282. 1874.

**Fig. 43.**

Small, evergreen trees, 10 - 15 m tall; bark dark grey and warty; branchlets and apical buds glabrous. Leaves 8 - 19 x 3.5 - 6.5 cm, elliptic-lanceolate or oblong-elliptic to oblong-lanceolate, cuneate at base, bluntly acute or abruptly acuminate at apex, coria-

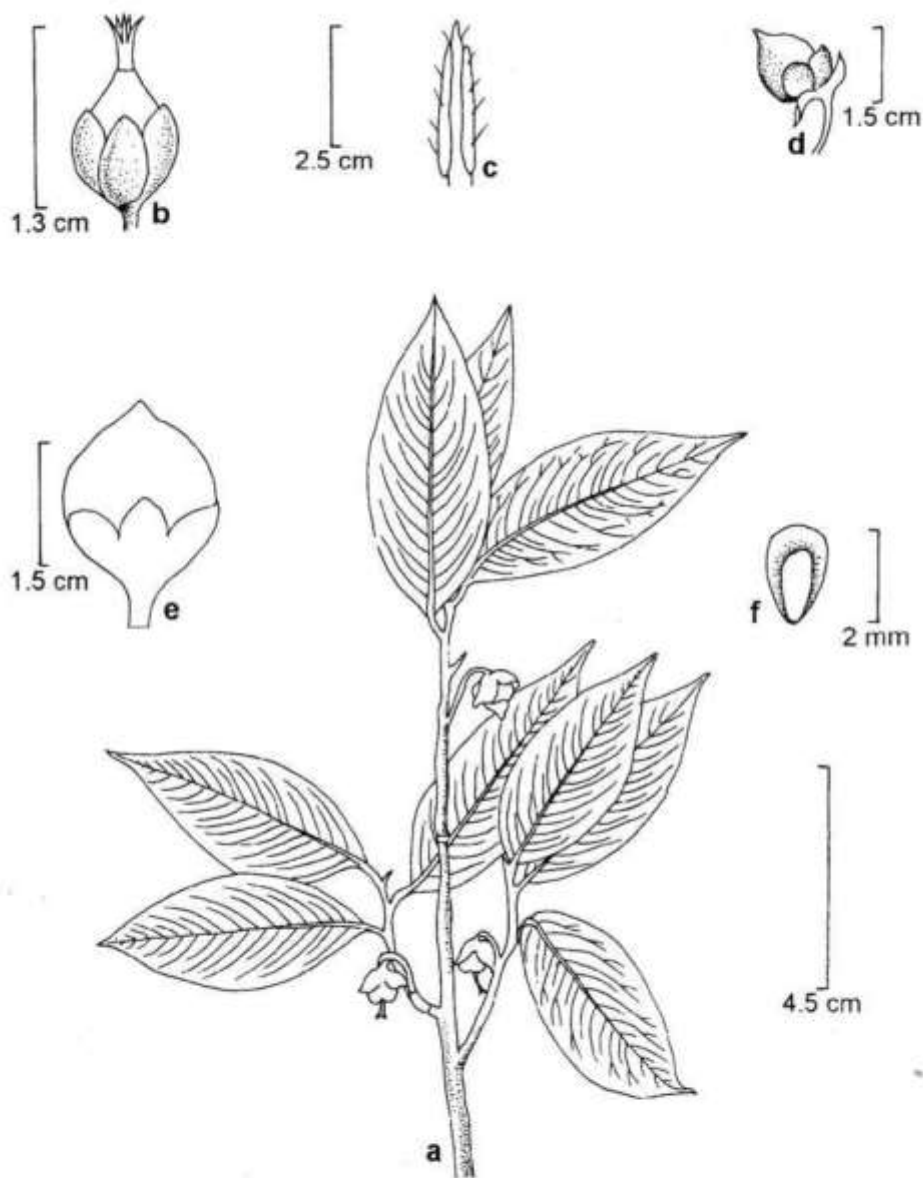


Fig. 43. *Adinandra griffithii* Dyer : a. flowering part of branch; b. pistil; c. stamen; d. young fruit; e. mature fruit; f. seed.

aceous, entire, translucent, recurved, glabrous, pale beneath, lateral veins inconspicuous; petioles ca 1.5 cm long, glabrous, flattened and canaliculate above, subterete below. Flowers white, axillary, solitary or in pairs, erect or sometimes nodding, fragrant; pedicels ca 2 cm long, glabrous; bracteoles 2, alternate, caducous or vestigial. Sepals 5, ca 8 mm long, orbicular-ovate, imbricate, persistent, coriaceous, inner larger, glabrous. Petals 5, ca 9 mm long, connate at base, caducous. Stamens indefinite, 2 - 2.5 cm, unequal, 1-seriate, adnate to the base of petals, sparsely hispid, apiculate. Ovary ca 1.5 cm long, superior, tapering into style, glabrous, 5-locular with axile placentation, ovules many, pendulous in each locule; styles constricted at base, deeply 5-fid, glabrous, divisions cylindrical, hardly longer than the calyx lobes. Berries ca 2 cm across, globose, hard, tipped by thickened base of style, many-seeded. Seeds small, ca 1.5 mm angular, dark brown, reticulate, exalbuminous.

*Fl. & Fr.* April - Dec.

*Distrib.* India: In tropical and subtropical primary evergreen forests between 1200 and 1700 m. Assam, Meghalaya and Nagaland.

Endemic.

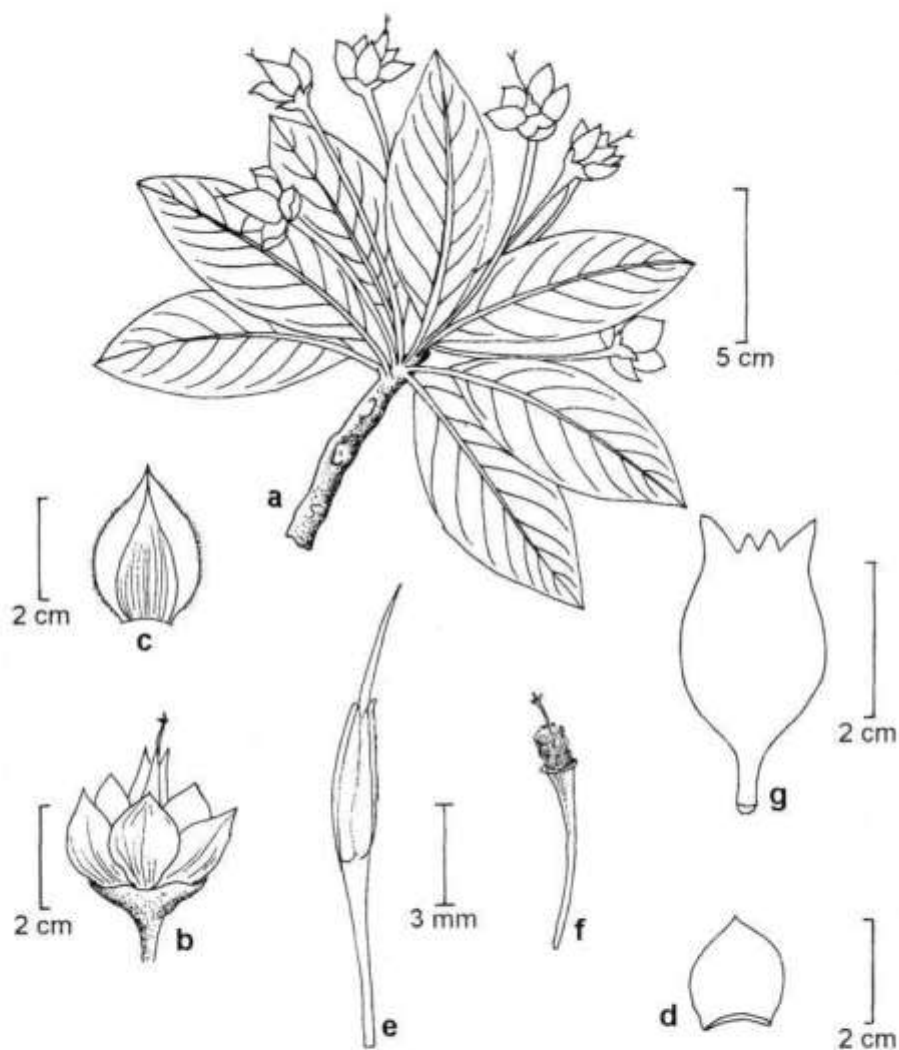
#### 6. *Anneslea* Wallich, nom. cons.

Small, evergreen, glabrous trees. Leaves petaloid, crowded at the apices of branchlets, coriaceous. Flowers white or yellowish, axillary or subterminal umbellate corymbs, sometimes drooping. Sepals 5, connate at base, subtended by 2 bracteoles at base, lobes unequal, imbricate, coriaceous, adherent to ovary at base. Petals 5, connate at base, lobes ovate, perigynous. Stamens many, epipetalous, inserted on a perigynous disc, in 2-series; anthers filiform, long cuspidate. Ovary half inferior, turbinate, 3-locular, ovules many, pendulous; styles long with 3 subulate stigmas. Berries globose, coriaceous, subtended by 2 persistent bracteoles, crowned by persistent sepals, 1 - 3-seeded. Seeds oblong, with horse-shoe shaped cavity, testa osseous, albumen fleshy.

Subtropical to temperate S.E. Asia, ca 9 species; one in India.

1. *Anneslea fragrans* Wallich, Pl. Asiat. Rar. 1: 5. t. 5. 1829; Dyer in Fl. Brit. India 1: 280. 1874. Fig. 44.

Trees, ca 15 m tall; branchlets grey, terete, lenticellate. Leaves crowded at apices of branchlets, exstipulate, 9 - 16 x 2 - 5 cm, lanceolate or oblanceolate, acute at base, obtuse or acute at apex, entire, coriaceous, dark green above, pale beneath; midrib prominent, lateral veins 12 - 15, indistinct, glabrous, small glands present on dorsal surface; petioles 1.5 - 2.5 cm long, slightly winged at base, flat above. Flowers white or yellowish-white in terminal or axillary subumbellate corymbs, erect or nodding, fragrant; pedicels 2 - 5.2 cm long, terete, slender, subclavate, angular at apex; bracteoles 2 at the



**Fig. 44.** *Anneslea fragrans* Wallich : a. flowering part of branch; b. flower; c. sepal; d. petal; e. stamen; f. flower with sepals and petals removed; g. fruit.

base of thalamus, ovate, concave, obtuse, persistent. Sepals 5, connate at base, persistent, yellowish; lobes ca 1.5 x 1.2 cm, ovate, acute or obtuse, coriaceous with membranous margins. Petals 5, connate at base, lobes ca 1 x 1 cm, ovate, cordate, acute, imbricate, opposite to calyx lobes, deciduous. Stamens 30 or more, ca 6 mm long, inserted in 2 series on a perigynous disc at the base of ovary, glabrous; filaments ca 2 mm long, filiform; anthers ca 4 mm long, linear, dehiscing longitudinally. Ovary tricarpeal, syncarpous, half inferior, turbinate, fleshy, ovules many in each locule on axile placentation. Styles ca 1.2 cm long, terete, glabrous; stigmas 3, subulate. Berries ca 2.5 cm in diam., globose, with minute tubercles and marcescent calyx. Seeds 2 - 3, rarely solitary, oblong, obtuse; aril fleshy, deep red.

*Fl. & Fr.* Jan. - May.

*Distrib.* India: In subtropical forests between 1500 and 1900 m. Nagaland and Manipur.

Myanmar and Malesia.

#### 7. *Cleyera* Thunb., nom. cons.

Evergreen trees or shrubs. Leaves alternate, petiolate, entire or serrulate. Flowers bisexual or unisexual, solitary or in fascicles, actinomorphic, bracteate, bracteoles minute or absent. Sepals 5, imbricate. Petals 5, free or connate at base, imbricate, coriaceous, reflexed at anthesis. Stamens many, inserted on the base of petals; anthers pilose. Ovary 2 - 3-loculed, ovules few to many on axile placentation; styles often elongate, shortly 2 - 3-fid. Berries spherical to ovoid-oblong, fleshy. Seeds few with fleshy endosperm.

In C. & S. America and Tropical Asia, ca 24 species; one in India.

*Literature.* KOBUSKI, C.E. (1937). Studies in Theaceae II. *Cleyera*. J. Arn. Arb. 18: 118 - 129.

*Cleyera japonica* Thunb., Nov. Gen. Pl. 68. 1783, p.p. emend. Sieb. & Zucc., Fl. Japan 153, t. 81. 1841. *Temstroemia japonica* Thunb. in Trans. Linn. Soc. London 2: 335. 1794. *Cleyera ochracea* auct. non DC.; Dyer in Fl. Brit. India 1: 283. 1874.

Small, evergreen trees, 6 - 8 m tall; branchlets brown, glabrous, slightly winged at apex. Leaves 3 - 15 x 1.0 - 4.5 cm, oblong-obovate or elliptic-oblong, ovate, cuneate at base, acute or shortly acuminate at apex, entire, coriaceous, midrib raised beneath; lateral veins 13 - 20 pairs, rather obscure; petioles 0.3 - 2 cm long, flattened, glabrous. Flowers whitish, turning yellowish, 1 - 3 in axillary fascicles, 1 - 1.5 cm across; pedicels 1.8 - 2.3 cm long, nodding; bracts ca 3 mm long, elliptic-ovate; bractioles alternate or subopposite at the base of calyx, minute, ovate-orbicular, caducous. Sepals 3 - 5 mm long, broadly ovate to orbicular, shallowly retuse at apex, coriaceous, ciliate, glabrous.

Petals 8 - 12 x 3 - 5 mm, elliptic-oblong, connate at base, coriaceous, glabrous. Stamens many, unequal, arranged in two whorls; filaments 3 - 4 mm long, terete; anthers 1.5 - 2 mm long, ovate-oblong, cuspidate, setose, white. Ovary 2 - 3-loculed, ovules few in each locule; styles 3 - 7 mm long, simple, glabrous; stigmas 2 - 3-lobed, entire. Berries ca 4 mm across, globose, black, tipped with persistent style. Seeds few, brown.

#### KEY TO THE VARIETIES

- 1a. Leaves 3 - 10 x 1 - 3 cm, elliptic, acute to obtuse at apex; petioles 3 - 4 mm long; flowers in fascicles; sepals 3 - 3.5 x 2 - 2.5 mm; petals 8 x 4 mm; styles ca 3 - 4.5 mm long **1.2. var. wallichiana**
- b. Leaves 5 - 15 x 2 - 4.5 cm, elliptic to ovate-oblong, acute or shortly abruptly acuminate; petioles 10 - 12 mm long, flowers solitary or geminate; sepals 4.5 - 5 x 3.5 - 4.5 mm; petals 12 x 5 mm; styles ca 7 mm long **1.1. var. grandiflora**

**1.1. var. grandiflora** (Wallich ex Choisy) Kobuski in J. Arn. Arb. 18: 125. 1937. *C. grandiflora* Wallich [Cat. No. 1461. 1829, nom. nud.] ex Choisy, Mem. Ternstroem. Camell. 21. 1855. *C. ochracea* DC. var. *grandiflora* (Wallich ex Choisy) Dyer in Fl. Brit. India 1: 284. 1874. *C. grandiflora* Hook. f. & Thomson ex Dyer in Fl. Brit. India 1: 284. 1874. **Fig. 45.**

Kh.: *Dieng-tiw-la-mluh.*

*Fl. & Fr.* July - Dec.

*Distrib.* India: In tropical evergreen forests between 1200 and 1900 m. Meghalaya.

China.

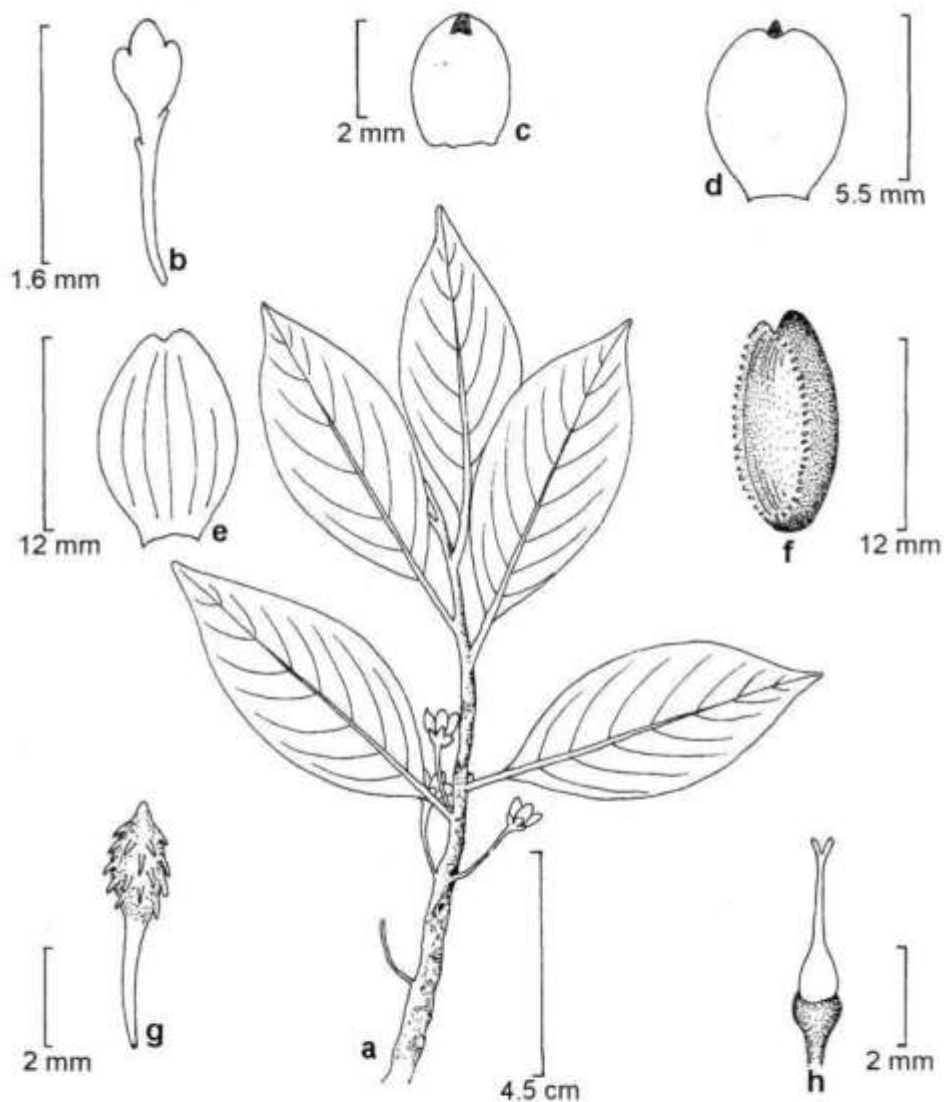
**1.2. var. wallichiana** (DC.) Sealy in Bot. Mag. 163: t. 9606. 1940. *C. ochracea* DC. var. *wallichiana* DC. in Mem. Soc. Phys. Geneve 1: 413. 1832. *Ternstroemia lushia* Buch.-Ham. ex D. Don, Prodr. 225. 1825. *Cleyera lushia* G. Don, Gen. Syst. 1: 566. 1831. *C. ochracea* auct. non DC.; Dyer in Fl. Brit. India 1: 284. 1874, incl. var. *lushia*. *C. japonica* Thunb. var. *japonica* auct. non Thunb.; Banerjee in J. Bombay Nat. Hist. Soc. 51: 776. 1953.

*Asm.*: *Pani-Bokul.*

*Fl.* July - Aug.; *Fr.* Sept. - Oct.

*Distrib.* India: In tropical evergreen forests between 900 and 2400 m. Uttar Pradesh, Assam and Meghalaya.

Nepal, Myanmar and China.



**Fig. 45.** *Cleyera japonica* Thunb. var. *grandiflora* (Wallich ex Choisy) Kobuski : a. flowering part of branch; b. flower bud; c. outer sepal; d. inner sepal; e. petal in front view; f. petal in side view; g. stamen; h. pistil.



8. *Eurya* Thunb.

Evergreen shrubs or trees; stems dark brown, terete or striate. Leaves alternate, simple, sessile or subsessile, undulate, crenate-serrate or serrate, glabrous or sparsely pubescent beneath, exstipulate. Flowers small, unisexual, axillary, solitary or in fascicles, actinomorphic, bracteate and bracteolate. Sepals 5(-6), free or shortly connate, elliptic, ovate to orbicular, glabrous or pubescent outside, imbricate, persistent. Petals 5(-8), white, greenish, pinkish or yellow, connate at base, elliptic oblong, obovate, imbricate. Stamens 5 - 20, unequal, free or connate at base, sometimes adnate to the petals, glabrous; filaments filiform; anthers basifixed, apiculate. Ovary ovoid to subglobose, 2 - 5 carpellary, syncarpous, glabrous or pubescent, usually 3, rarely 2 - 5-loculed, ovules many in each locule, placentation axile; styles as many as carpels, free or connate; stigmas 2 - 5, glabrous or hairy. Berries ovoid, globose or subglobose, brown to bluish, tipped by persistent style, indehiscent. Seeds small, numerous, dark brown, angular, tubercled, reticulate with fleshy endosperm.

In Tropical and subtropical Asia and a few in C. America, ca 88 species; 8 in India.

*Literature.* VESQUE, M.J.(1895). Revisio du genre *Eurya* Thunb. Bull. Soc. Bot. France 42: 151 - 161. KOBUSKI, C.E.(1938). Studies in Theaceae-3. Ann. Missouri Bot. Gard. 25: 299 - 359. KOBUSKI, C.E. (1939). Studies in Theaceae-4. J. Arn. Arb. 20: 361 - 374.

## KEY TO THE SPECIES

- |  |                             |
|--|-----------------------------|
| 1a. Branchlets and apical buds glabrous; leaf apices obtuse to subacute; sepals glabrous outside   | 2                           |
| b. Branchlets and apical buds pilose; leaf apices acuminate; sepals pubescent outside  | 3                           |
| 2a. Leaves undulate and bluntly serrate; anthers longer than filaments; styles ca 0.8 mm long  |                             |
|  | 5. <i>E. japonica</i>       |
| b. Leaves closely sharp serrate; anthers shorter than filaments; styles 1.5 - 2.5 mm long  | 6. <i>E. nitida</i>         |
| 3a. Leaf veins deeply impressed adaxially; male flowers with 5 stamens; female flowers with styles free to base                                | 4                           |
| b. Leaf veins not deeply impressed adaxially; male flowers with 11 - 20 stamens; female flowers with styles free to base or not                | 5                           |
| 4a. Branchlets and apical buds sparsely pilose; anthers basifixed; thalamus not pilose   | 3. <i>E. cavineris</i>      |
| b. Branchlets and apical buds densely pilose; anthers dorsifixed; thalamus densely pilose at the base of rudimentary ovary                     | 2. <i>E. arunachalensis</i> |
| 5a. Leaves elliptic-oblong to elliptic-lanceolate, acuminate; male flowers with ca 17 stamens; female flowers with glabrous or pubescent ovary | 6                           |
| b. Leaves elliptic or oblanceolate, retuse or acuminate; male flowers with ca 20 stamens; female flowers with ovary always glabrous            | 7                           |
| 6a. Pedicels 3-bracteolate; male flowers with chambered anthers; berries glabrous, rarely with few hairs                                       |                             |
|  | 4. <i>E. cerasifolia</i>    |
| b. Pedicels 2-bracteolate; male flowers with unchambered anthers; berries densely pubescent  |                             |
|  | 7. <i>E. trichocarpa</i>    |

- 7a. Shrubs 3 - 4 m high; leaves elliptic-oblong to oblanceolate, obscurely acuminate; styles less than 1 mm long, obscurely trifid 8. *E. sp.*
- b. Shrubs or trees, 5 - 12 m tall; leaves elliptic-oblong or elliptic-lanceolate, acuminate; styles 1.5 - 2 mm long, prominently trifid 1. *E. acuminata*

1. *Eurya acuminata* DC. in Mem. Soc. Phys. Hist. Nat. Geneve 1: 418. 1822; Dyer in Fl. Brit. India 1: 285. 1874, incl. var. *wallichiana*. *Diospyros serrata* Buch.-Ham. ex D. Don, Prodr. 143. 1825. *Eurya membranacea* Gardner in Calcutta J. Nat. Hist. 7: 444. 1847. *E. wallichiana* Steudel in Blume, Mus. Bot. 2: 118. 1856. *E. phyllanthoides* Blume, Mus. Bot. 2: 110. 1856. *E. japonica* Thunb. var. *phyllanthoides* (Blume) Dyer in Fl. Brit. India 1: 284. 1874. *E. wrayi* King in J. Asiat. Soc. Beng. 69: 196. 1890. Fig. 46.

Asm.: *Bon-dousa*, *Bon-sabai*, *Murmura*, *Thengan-jang*; Kh.: *Dieng-lapyrshit*, *Dieng-pyrshitteh*; Nep.: *Sanu Jhingni*, *Jingane*.

Evergreen shrubs or small trees, 5 - 12 m tall; stems dark brown, terete; branchlets and apical buds densely pilose. Leaves 3 - 9 x 1.5 - 3.5 cm, elliptic-oblong to elliptic-lanceolate, acute to cuneate at base, acuminate at apex, upper two-third finely serrate, glabrous above, pubescent beneath; lateral veins 13 - 20 or more, sometimes sparsely hairy; petioles 1 - 3 mm long, hairy. Flowers white or yellowish-white, 1 - 5 in axillary fascicles, ca 4 mm across, fragrant; pedicels 3 - 4 mm long; bracteoles 2, ca 1.2 mm long, elliptic-ovate or ovate, acute, pubescent outside. Sepals 2 - 2.5 x 1.5 - 2 mm, outer two smaller, broadly elliptic, obtuse, pubescent outside. Petals 4.5 - 5 x 2 - 3 mm, obovate, ovate to oblanceolate, glabrous, connate at base. Stamens 15 - 20 or more, unequal; filaments 1 - 3 mm long, terete, glabrous; anthers ca 1 mm long, apiculate, yellow; rarely staminodes present, ca 3.5 mm, which gives appearance of pseudobisexuality in female flowers. Ovary 2 - 3 mm long, subglobose, 3 - 5-loculed, glabrous; styles 1.5 - 2 mm long, united or divided to the base; stigmas 3 - 5, feathery. Berries ca 5 mm across, globose to subglobose, bluish-black or brown, reticulate, many-seeded. Seeds ca 1 mm long, bluntly trigonous, dark brown.

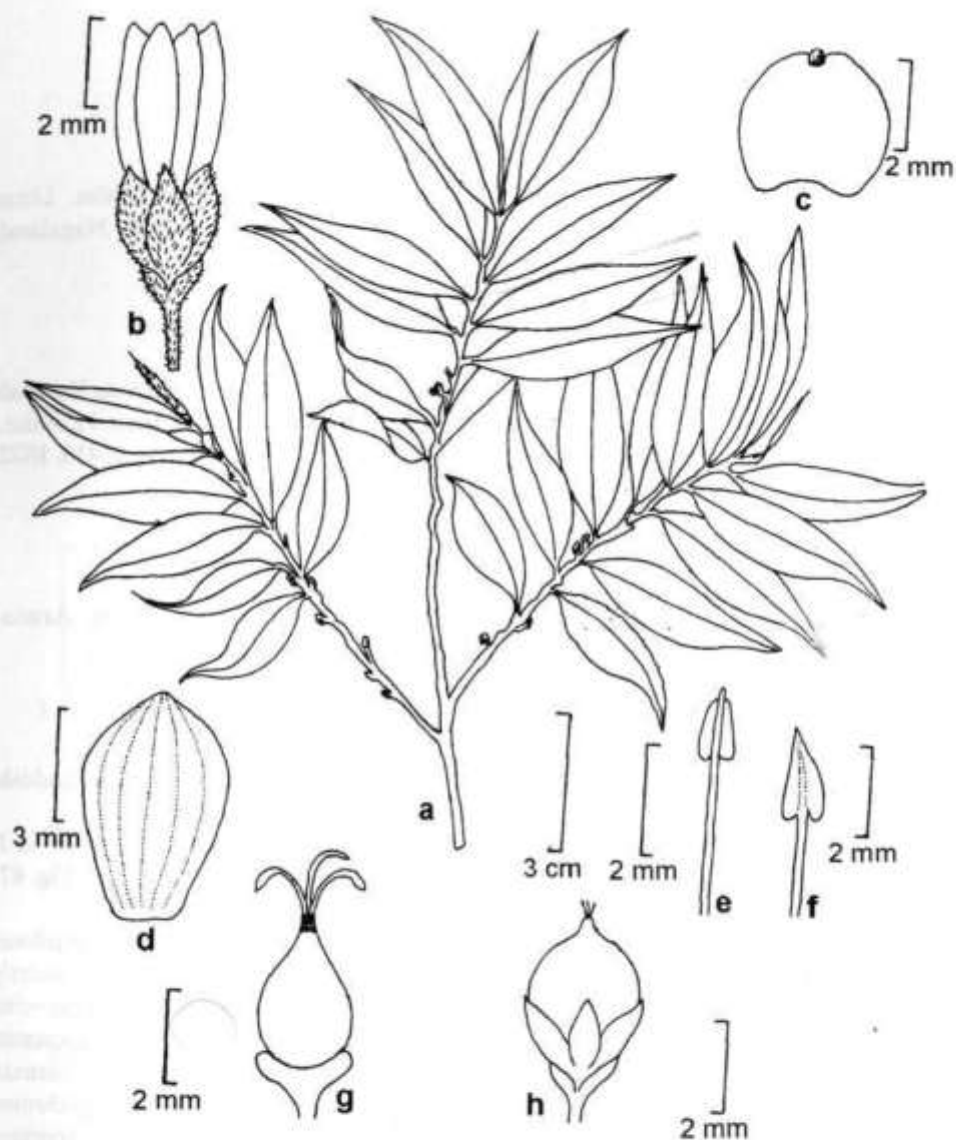
*Fl. & Fr.* July - March.

*Distrib.* India: In tropical to subtropical and warm broad leaved forests between 900 and 2300 m. Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Manipur, Tripura and Meghalaya.

Sri Lanka, Bhutan, Myanmar, China and Malesia.

#### KEY TO THE VARIETIES

- 1a. Midrib sparsely hairy, on abaxial surface; lateral veins and lamina usually glabrous or with few hairs 1.1. var. *acuminata*



**Fig. 46.** *Eurya acuminata* DC. var. *acuminata* : a. flowering part of branch; b. flower; c. sepal; d. petal; e. stamen; f. staminode; g. pistil; h. fruit.

b. Midrib pilose, on abaxial surface; lateral veins and lamina densely hirsute

1.2. var. **euprista**

**1.1. var. acuminata**

*Fl. & Fr.* Sept. - Jan.

*Distrib.* India: In tropical and subtropical forests between 1000 and 1800m. Uttar Pradesh, West Bengal(Darjeeling), Sikkim, Assam, Arunachal Pradesh, Nagaland, Mizoram, Manipur, Tripura and Meghalaya.

Nepal, Bangladesh, Bhutan, China and Indonesia (Java and Sumatra).

1.2. var. **euprista** (Korthals) Dyer in Fl. Brit. India 1: 285. 1874. *E. euprista* Korthals in Temminck, Verh. Nat. Gesch. Ned. Bezitt. Bot. 4: 113. 1841; Griffith, Icon. Pl. Asiat., 4: t. 604, f. 3. 1854. *E. multiflora* DC. in Mem. Soc. Phys. Hist. Nat. Geneve 1: 418. 1822. *E. acuminata* Royle, Ill. Bot. Himal. Mts. 127. t. 25. 1835 non DC. 1822.

*Fl. & Fr.* Aug. - Dec.

*Distrib.* India: In tropical and temperate forests between 1000 and 2500 m. Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur and Mizoram.

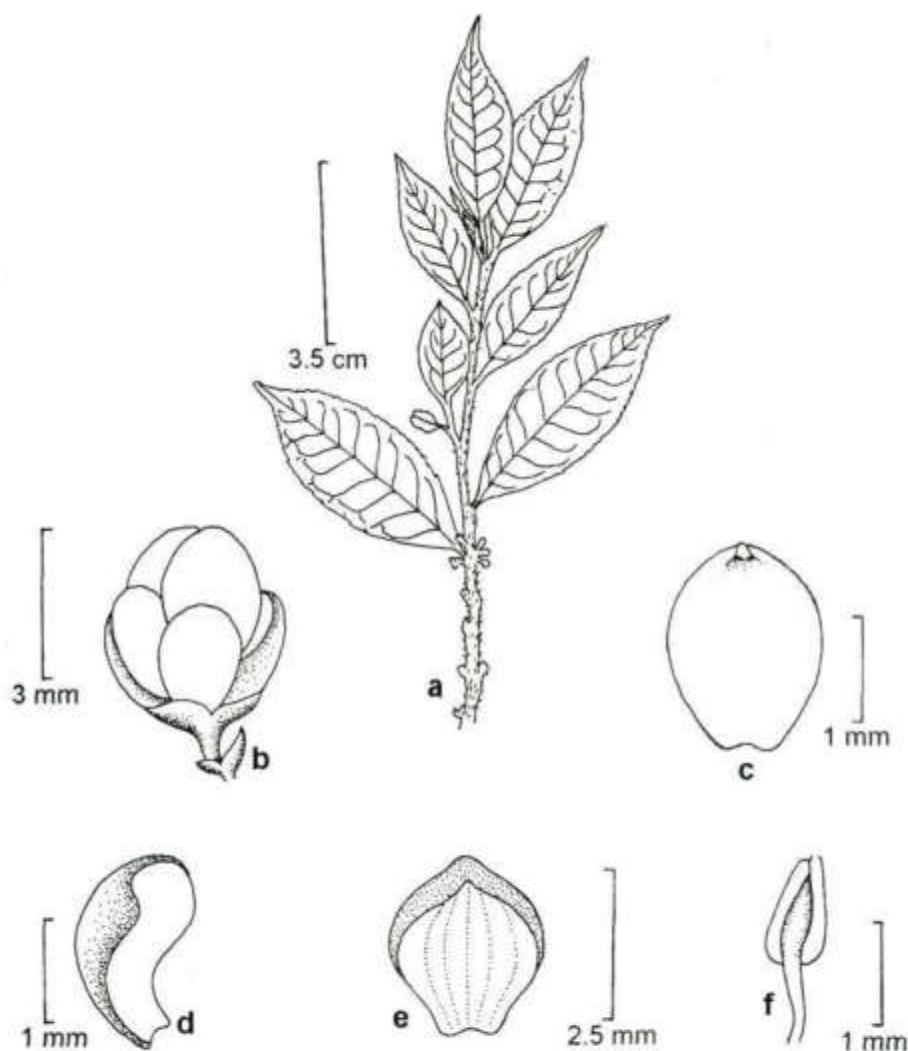
Myanmar and Malaya.

*Notes.* Fruits are eaten by tribals of Lohit and Tirap districts of Arunachal Pradesh.

**2. Eurya arunachalensis** Chauhan in Indian J. For. 13(1): 76. 1990; Giri, *et al.* in J. Bombay Nat. Hist. Soc. 87: 282. 1990. **Fig. 47.**

Shrubs, 4 m high; stems terete, brown, densely simple hairy; apical buds pilose. Leaves 3.5 - 5 x 1 - 2 cm, elliptic or oblanceolate, cuneate at base, acute or shortly acuminate at apex, upper two-thirds margin serrate, midrib densely pilose, lateral veins ca 30, deeply impressed beneath, prominent above, sparsely appressed pubescent. Flower buds globose, 2 or more in fascicles; pedicels ca 1 mm long; bracteoles 2, alternate at the base of thalamus, ca 1 x 0.5 mm. Sepals 2 - 3 x 1.5 - 2 mm, broadly ovate, glabrous. Petals pinkish-white, ca 2.5 x 2 mm, elliptic to oblanceolate, cymbiform in buds, connate at base, glabrous, obscurely veined. Stamens 5, free, ca 2 mm, alternate with petals; filaments ca 1 mm long, glabrous; anthers light yellow, ca 1 mm, dorsifixed, apiculate, introrse. Thalamus densely pilose at the base of rudimentary ovary. Female flowers not seen.

*Fl.* March - Sept.



**Fig. 47.** *Eurya arunachalensis* Chauhan : a. flowering part of branch; b. flower; c. abaxial view of sepal; d. side view of sepal; e. petal; f. stamen.

*Distrib.* India: Arunchal Pradesh (Kameng District).

*Notes.* So far known by type collections only.

3. *Eurya cavinervis* Vesque in Bull. Soc. Bot. France 42: 158. 1895. *E. japonica* Thunb. var. *thunbergii* auct. non Thwaites 1858; Dyer in Fl. Brit. India 1: 284. 1874. *E. handeliana* Kobuski in Ann. Missouri Bot. Gard. 25: 309. 1938.

Nep.: *Jhingni*.

Evergreen shrubs, 1 - 3 m high; branchlets and apical buds sparsely pilose; stems dark grey or brown, striate, often with 2 decurrent ridges from each node at the base of petioles. Leaves 3.5 - 12 x 1.5 - 4.5 cm, elliptic or elliptic-lanceolate to oblanceolate, rounded or cuneate at base, acute to acuminate at apex, upper two-thirds margin serrate, glabrous, veins inconspicuous, deeply impressed above, prominent beneath; petioles 3 - 5 mm, glabrous. Flowers white or creamish, axillary, solitary or geminate. Sepals 2.5 - 3 mm long, broadly ovate, pubescent outside, ciliate. Petals 4 - 4.5 x 2.5 - 4 mm, obovate, glabrous. Stamens 5, ca 2 mm long; filaments terete, glabrous; anthers basifixed. Ovary ca 1.5 mm long, subglobose, glabrous; styles 5 - 9 mm, free. Berries ca 5 mm, globose or broadly ellipsoid, glabrous, brown. Seeds many, small, brown.

*Fl. & Fr.* April - Dec.

*Distrib.* India: In subtropical forests of Eastern Himalaya between 2000 and 3000 m. Sikkim and Assam ?.

Nepal, Bhutan, Myanmar and China.

4. *Eurya cerasifolia* (D. Don) Kobuski in Ann. Missouri Bot. Gard. 25: 326. 1938. *Diospyros cerasifolia* D. Don, Prodr. 144. 1825. *Eurya symplocina* Blume, Mus. Bot. 2: 114. 1856; Dyer in Fl. Brit. India 1: 284. 1874. *E. wallichiana* auct. non Steudel 1856; Planch. ex Dyer in Fl. Brit. India 1: 285. 1874, pro syn. Fig. 48.

Nep.: *Bara Jhingni*.

Shrubs or small trees, 2 - 7 m tall; stems greyish-brown, striate, sparsely setose; branchlets and apical buds adpressed pubescent, ultimately glabrous. Leaves 4 - 12 x 2 - 4.5 cm, broadly elliptic, elliptic-lanceolate or ovate-oblong, acute to cuneate at base, obtusely acuminate at apex, entire or serrate towards apex, chartaceous, dark green with blotches and glabrous above, midrib pubescent beneath, lateral veins 20 or more on each half, sparsely pubescent, distinct on both surfaces; petioles 2 - 6 mm long, pubescent. Flowers white or yellowish-white, 4 - 5 in axillary fascicles; pedicels 2 - 4 mm long; bracteoles 3, alternate, ca 1.5 x 1.2 mm, broadly elliptic, obtuse, silky. Sepals 2 - 3.5 x 2

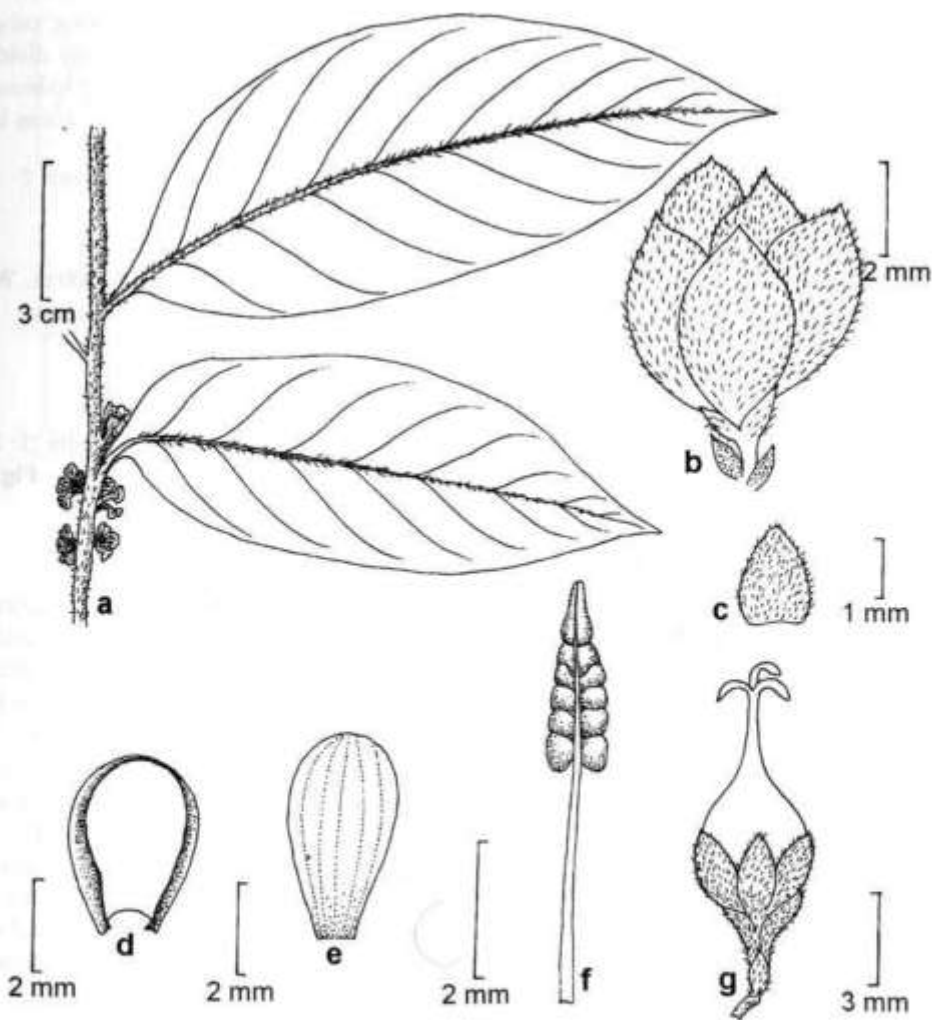


Fig. 48. *Eurya cerasifolia* (D. Don) Kobuski : a. flowering part of branch; b. flower; c. bract; d. sepal; e. petal; f. stamen; g. pistil.

- 2.5 mm, broadly elliptic or elliptic-ovate, obtuse, adpressed pubescent outside. Petals 4.5 - 5 x 2.5 - 3 mm, oblong-elliptic, obtuse, connate at base, glabrous. Stamens 15 - 17, unequal, epipetalous; filaments 1 - 3 mm long, connate at base, glabrous; anthers 1 - 2.5 mm long, apiculate, 4 - 7-chambered, dehiscence lateral. Ovary ca 4 mm long, subglobose to ovoid, glabrous or sparsely pubescent; styles 2 - 3 mm long, deeply divided; stigmas 3-lobed, pubescent. Berries 5 - 7 x 4 - 4.5 mm, ellipsoid or subglobose to broadly ellipsoid, dark brown or blue black, glabrous or with a few hairs. Seeds ca 1 mm long many, angular, minutely tuberculate, brown.

*Fl. & Fr.* Oct. - June.

*Distrib.* India: In subtropical and temperate forests between 1500 and 2200 m. West Bengal, Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Nepal, Bhutan, Myanmar and China.

5. *Eurya japonica* Thunb., Nov. Gen. Pl. 68. 1783; Dyer in Fl. Brit. India 1: 284. 1874, p.p. Fig. 49.

Mal.: *Amuttuvarai*; Sans.: *Vanacahajati*; Tam.: *Huluni*.

Evergreen shrubs or small trees, 4 - 5 m tall; stems brown, striate, glabrous; branchlets and apical buds glabrous. Leaves 2.8 - 6.5 x 1 - 3 cm, elliptic or oblanceolate, acute to cuneate at base, obtuse to subacute at apex, undulate to bluntly serrate, coriaceous, glabrous, pale green to yellowish green; lateral veins 10 - 13 on each half, indistinct; petioles 2 - 3 mm, glabrous. Flowers greenish-white to yellowish, 1 - 3 in fascicles; pedicels ca 3 mm long, glabrous, subtended by 2 alternate bracteoles at the base of calyx; bracteoles 1 - 1.5 mm long, elliptic-ovate. Sepals 2 - 2.5 mm long, broadly ovate or orbicular, glabrous. Petals as long as sepals, orbicular. Stamens 13 - 17, unequal, epipetalous; filaments less than 1 mm long, terete; anthers ca 1 mm long, shortly apiculate. Ovary ca 4 mm long, tricarpeal, syncarpous, glabrous; styles ca 0.8 mm long; stigmas 3-lobed. Berries 4 - 5 mm long, subglobose, brown, warty, tipped with persistent style, many-seeded. Seeds ca 1 mm long, minutely tuberculate, dark brown.

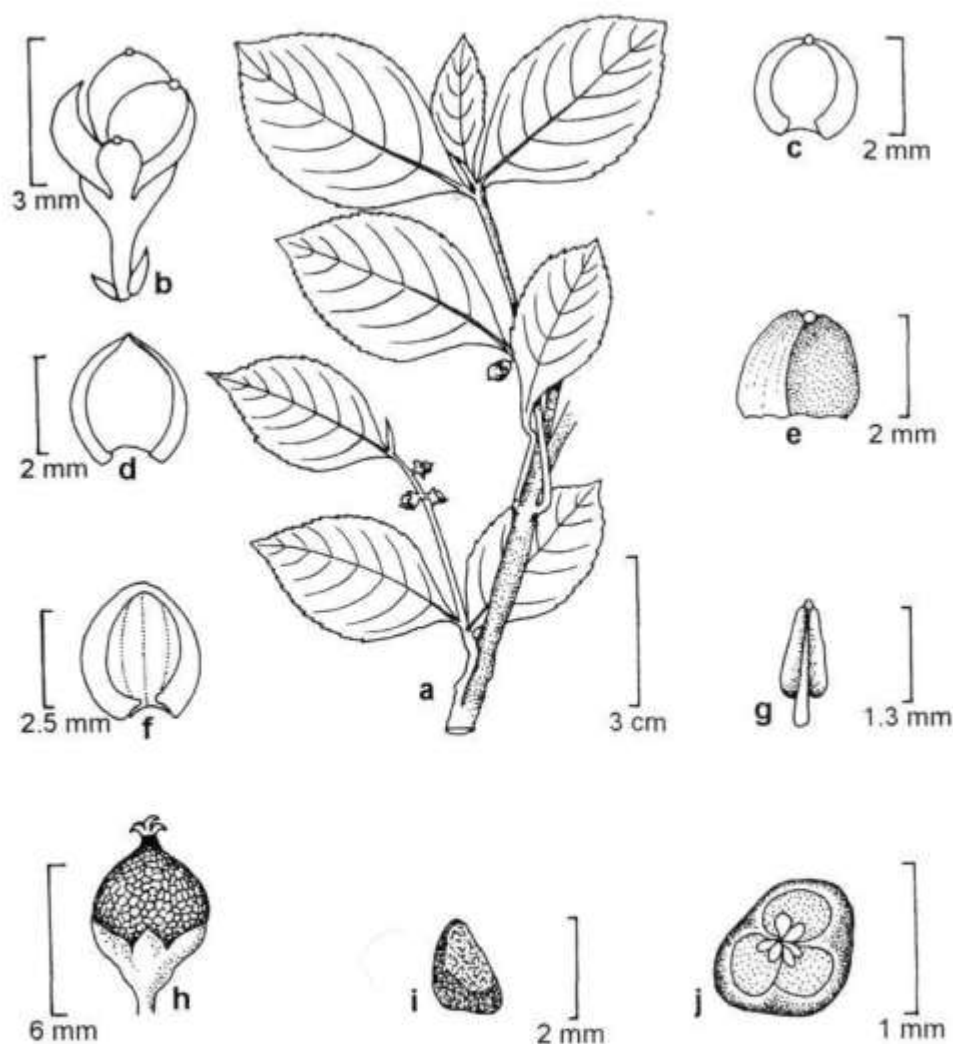
*Fl. & Fr.* June - Dec.

*Distrib.* India: In tropical evergreen forests between 1000 and 2300 m, Karnataka and Tamil Nadu.

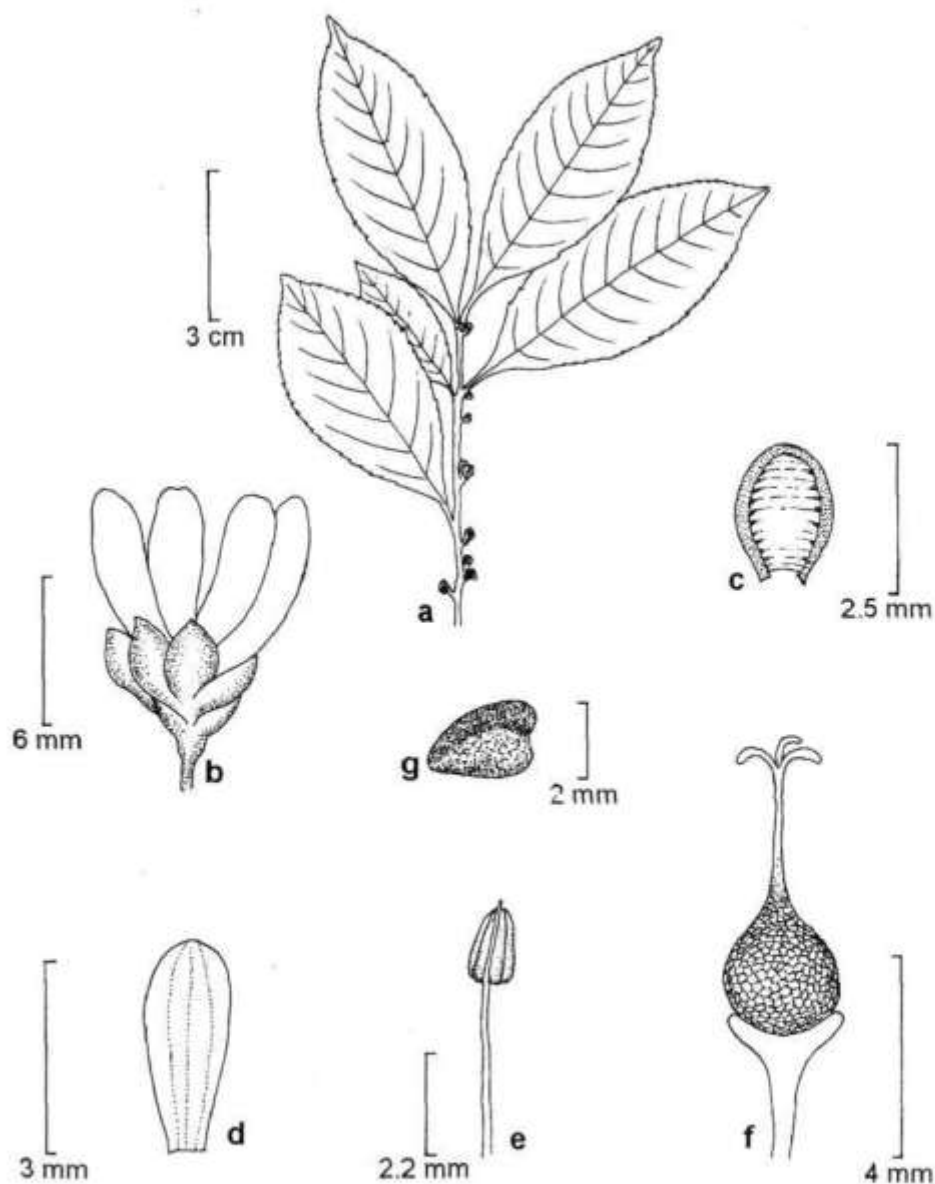
Japan.

6. *Eurya nitida* Korthals in Temminck, Verh. Nat. Gesch. Ned. Bezitt. Bot. 4: 115, t. 17. 1841. *E. japonica* Thunb. var. *thunbergii* Thwaites, Enum. Pl. Zeyl. 41. 1858. *E.*





**Fig. 49.** *Eurya japonica* Thunb. var. *japonica* : a. fruiting part of branch; b. flower; c. outer sepal; d. inner sepal; e. adaxial view of sepal; f. petal; g. stamen; h. fruit; i. seed; j. t.s. of ovary.



**Fig. 50. *Eurya nitida* Kobuski** : a. flowering part of branch; b. flower; c. sepal; d. petal; e. stamen; f. fruit; g. seed.

*japonica* Thunb. var. *nitida* (Korthals) Dyer in Fl. Brit. India 1: 284. 1874. *E. japonica* auct. non Thunb.; Dunn in Gamble, Fl. Pres. Madras 57. 1915. **Fig. 50.**

Asm.: Murmura, Saseni, Panheng-heng, Yabe changne; Kh.: Dieng-shit, Pyrshitlum, Chhamasi; Mal.: Kattukama.

Evergreen, small, spreading trees, 3 - 8 m tall; stems striate, brown; branchlets and apical buds glabrous. Leaves 2 - 7 x 1 - 3 cm, narrowly elliptic to oblanceolate, cuneate to acute at base, obtuse to subacute at apex, upper two-third portion closely sharp serrate, thinly coriaceous, glabrous, lateral veins 11 - 16 on either side of midrib; petioles 1 - 7 mm long, glabrous. Flowers white or greenish-white, 2 or more in axillary fascicles, rarely solitary, ca 2.5 mm across, nodding; pedicels 1 - 2.5 mm long, glabrous; bracteoles 2 at the base of calyx, 0.6 - 1 mm long, oblanceolate. Sepals 1 - 2.5 x 1.0 - 1.5 mm, broadly ovate to orbicular, glabrous, ciliate. Petals 2.5 - 3 x 1.5 - 2 mm, broadly oblong to orbicular, connate at base. Stamens 11 - 15, connate at base, epipetalous; filaments ca 3.5 mm, glabrous; anthers ca 1 mm, apiculate. Ovary ca 3.5 mm, tricarpeal, syncarpous, glabrous; styles 1.5 - 2.5 mm long, divided to about middle; stigmas 3-lobed. Berries ca 5 mm in diam., ovoid to globose, brown, many-seeded. Seeds ca 1 mm across, dark brown, angular, reticulate.

*Fl. & Fr.* March - Dec.

*Distrib.* India: In tropical and subtropical forests between 1000 and 2000 m. Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Karnataka, Tamil Nadu and Kerala.

China and Malesia.

7. *Eurya trichocarpa* Korthals in Temminck, Verh. Nat. Gesch. Ned. Bezitt. Bot. 4: 114. 1841; Dyer in Fl. Brit. India 1: 285. 1874. *E. trichogyna* Blume, Mus. Bot. 2: 114. 1856.

**Fig. 51.**

Small trees with pendulous branches; stems terete brown, adpressed hairy. Leaves 5 - 10.5 x 1 - 3.5 cm, narrowly elliptic, elliptic-oblong or oblong to oblanceolate, cuneate or rounded at base, acute to acuminate at apex, serrate except at base, glabrous above, sparsely hairy beneath, lateral nerves 18 - 22 on either side of midrib; petioles 2 - 3 mm long, hairy. Flowers yellowish, axillary, solitary or 4 - 5 in fascicles; pedicels 2 - 3 mm long, pubescent; bracteoles 2, alternate, ca 1.5 x 1 mm, broadly ovate, hairy. Sepals 2 - 2.6 x 1.8 - 2 mm, ovate or orbicular, acute to obtuse, hairy outside. Petals 3 - 3.5 x 1 - 1.5 cm, elliptic-ovate or oblanceolate, obtuse, glabrous. Stamens 15 - 17, connate at base, epipetalous. Ovary ca 4 mm long, globose or subglobose, densely silky; styles ca 3 mm long, connate at base; stigmas simple. Berries ca 5 mm across, subglobose, brown, pubescent or glabrescent at maturity, reticulate. Seeds many, 1 - 2 mm long, triangular, dark brown.

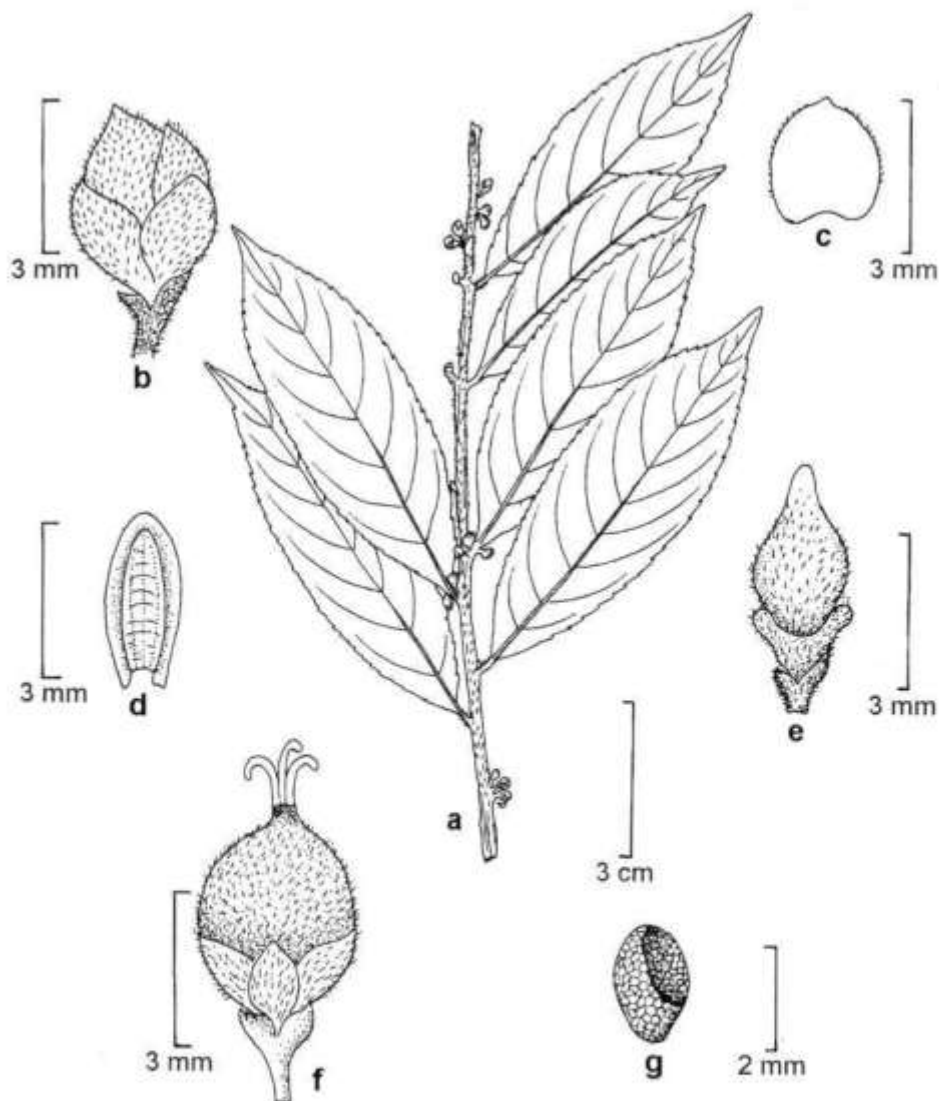


Fig. 51. *Eurya trichocarpa* Korthals : a. flowering part of branch; b. flower; c. sepal; d. petal; e. pistil; f. young fruit; g. seed.

*Fl. & Fr.* July - Jan.

*Distrib.* India: In tropical and subtropical forests between 1000 and 2000 m. Assam, Arunachal Pradesh, Tripura and Meghalaya.

China and S.E. Asia.

*Notes.* According to Grierson & Long (*Fl. Bhutan* 1(2): 56. 1984), the record of *E. trichocarpa* Korthals from Bhutan by Dyer (l.c.) is based on misidentification of *E. cerasifolia* (D. Don) Kobuski.

### 8. *Eurya* sp.

Shrubs, 3 - 4 m high; stem terete, brown; branchlets and apical buds pilose. Leaves 3 - 7.5 x 0.8 - 3 cm, elliptic-lanceolate, elliptic-oblong or oblanceolate, cuneate at base, obscurely acuminate to retuse at apex, serrate except at base, glabrous above, sparsely pubescent beneath; lateral nerves 13 - 20 on either side of midrib, sparsely pubescent beneath; petioles 1 - 3 mm, sparsely pubescent. Flowers white, axillary, 2 or more in fascicles, ca 5 mm across; pedicels 2 - 3 mm long; bracteoles 2, alternate, ca 1 mm long, oblong, pubescent. Sepals 2 - 3 x 1.5 - 3 mm, broadly ovate or suborbicular, glaucous, outer ones smaller than inner, obtuse, glabrous. Petals 4 - 4.5 x 2 - 3 mm, elliptic-oblong, connate at base, obtuse to obscurely retuse, glabrous. Stamens 13 - 17, unequal, epipetalous, monadelphous; filaments 1 - 2 mm long, glabrous; anthers 1 - 2 mm long, smooth, apiculate, dehiscence lateral. Ovary ca 3 mm long, subglobose, glabrous; styles ca 0.6 mm long, trifid; stigmas 3-lobed. Berries ca 5 mm across, ovoid or subglobose, glabrous, tipped with persistent style. Seeds ca 0.8 mm long, many, tuberculate, dark brown.

*Fl. & Fr.* July - Feb.

*Distrib.* India: In evergreen forests of Western Ghats. Karnataka and Tamil Nadu.

#### EXCLUDED SPECIES

*Eurya castanifolia* Vesque in Bull. Soc. Bot. France 42: 158. 1895.

Small glabrous shrubs; stems brown, quite terete. Leaves 12 - 14 x 3 - 6 cm, lanceolate or ovate-lanceolate, long acuminate, distantly serrate; lateral nerves 12 on either side of midrib, oblique, prominent beneath. Flowers in axillary fascicles. Calyx 2 x 2 mm, orbicular, concave, ciliate. Ovary ovoid; style 3-fid, free.

*Distrib.* India: Meghalaya.

*Notes.* Type specimens of this species are presently not traceable. None of the known collections could be matched with the protologue of this species and therefore the species is excluded till fresh collections are made or type is traced.

### 9. *Ternstroemia* Mutis ex L.f., nom. cons.

Evergreen, glabrous trees or shrubs. Leaves pseudo-verticillate at apices of branchlets or subopposite, coriaceous, entire or crenate-serrate. Flowers axillary or extra axillary, solitary or in fascicles, unisexual, sometimes bisexual, nodding, subtended by two bracteoles at base of calyx. Sepals 5, unequal, persistent. Petals 5, connate at the base. Stamens many, epipetalous; anthers glabrous. Ovary 2-3-loculed, ovules 2 in each locule, rarely 1 or 3-6, pendulous; styles simple, subsessile, often absent; stigmas 2-3-lobed or subentire. Berries fleshy or corky, indehiscent. Seeds 1-2 or more, oblong, embryo horse-shoe-shaped, endosperm evanescent.

In C. America, C. and S.E. Asia, ca 166 species; 2 in India.

#### KEY TO THE SPECIES

- 1a. Leaves 4-8 x 1.5-3.5 cm, veins obscure; flowers ca 1.2 cm across; yellow or yellowish-white; anthers apiculate; berries ca 2 cm across 1. *T. gymnanthera*
- b. Leaves 10.5-17.5 x 4-7 cm, veins distinct; flowers ca 3 cm across; anthers truncate; berries ca 3.5 cm across 2. *T. wallichiana*

1. *Ternstroemia gymnanthera* (Wight & Arn.) Beddome, Fl. Sylv. 91, t. 91. 1871; Sprague in J. Bot. 61: 18. 1923. *Cleyera gymnanthera* Wight & Arn., Prodr. 87. 1834. *Ternstroemia japonica* auct. non Thunb. 1794; Dyer in Fl. Brit. India 1: 280. 1874. *T. wightii* Choisy, Mem. Ternstroem. Camell. 19. 1855. *T. japonica* Thunb. var. *wightii* (Choisy) Dyer in Fl. Brit. India 1: 281. 1874. Fig. 52.

Asm.: *Pani-Bokul, Pani-jirkiri*; Kh.: *Dieng-lasaw*; Tam.: *Kiamonu, Kemmuni*.

Evergreen trees or stunted shrubs, 4-15 m tall; bark grey, soft, warty. Leaves often closely approximate at apices of branchlets, 4-8 x 1.5-3.5 cm, obovate, oblanceolate or elliptic-lanceolate, cuneate at base, acute or obtuse at apex, entire to obscurely crenulate, sometimes slightly recurved along margins, coriaceous, glabrous, lateral veins and veinlets obscure; petioles 0.5-1.5 cm long, winged, reddish. Flowers unisexual or bisexual, axillary, solitary or extra axillary, nodding, ca 1.2 cm across, fragrant; pedicels ca 1.5 cm long, flat, 2-ridged, with either 2 small ovate bracteoles or their scars at the base of calyx. Sepals 4-5 x 3-4 mm, broadly ovate to orbicular, slightly retuse at apex, coriaceous, denticulate, glabrous, persistent. Petals 6-8 x 5-6 mm, oblong or obovate-cuneate, leathery, irregularly denticulate. Stamens yellow, many, in unequal, connate at base, epipetalous; filaments ca 1.5 mm long, terete; anthers 3-4 mm, linear,

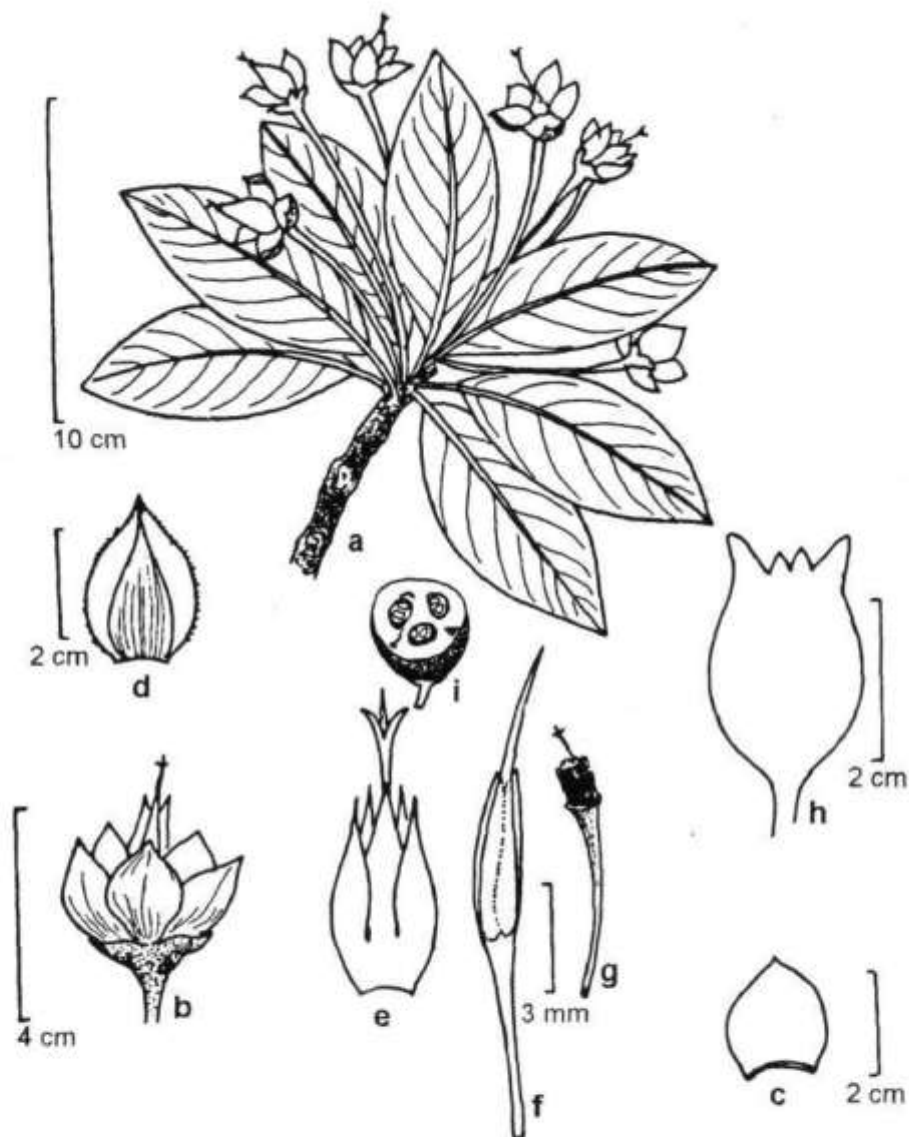


Fig. 52. *Ternstroemia gymnanthera* (Wight & Arn.) Beddome : a. flowering part of branch; b. flowers; c. adaxial view of sepal; d. side view of sepal; e. petal; f. stamen; g. rudimentary pistil; h. fertile pistil; i. fruit.

apiculate, glabrous. Ovary ca 4 - 5 mm long, 2 - 3 mm across, ovoid to globose, glabrous, 2 - 3-loculed, ovules 2 in each locule; styles ca 1 mm long, simple; stigmas capitate, 2 - 3-lobed. Berries ca 2 - 2.5 cm across, ovoid to globose, tipped with persistent style, brown, 3 - 4-seeded. Seeds 6 - 8 mm long, angular, red.

*Fl. & Fr.* Feb. - Nov.

*Distrib.* India: In tropical and subtropical evergreen forests between 1000 and 2200 m. Sikkim, Assam, Meghalaya, Nagaland, Tamil Nadu and Kerala.

Sri Lanka, Nepal, Bhutan, China and S.E. Asia.

**2. Ternstroemia wallichiana** (Griffith) Ridley in Fl. Malay Penin. 1: 198. 1922. *Erythrochiton wallichianum* Griffith, Not. Pl. Asiat. 4: 565, 1854 & Icon. Pl. Asiat 4: t. 585A, f. 7. 1854. *T. penangiana* auct. non Choisy, 1855; Dyer in Fl. Brit. India 1: 281. 1874.

Evergreen, glabrous trees, up to 20 m tall; stems obscurely ribbed, glabrous. Leaves 5 - 17.5 x 4 - 7 cm, oblong, obovate or broadly oblanceolate, cuneate or decurrent at base, acute or shortly acuminate at apex, entire, coriaceous; lateral veins 5 - 7 pairs, distinct; petioles 1 - 2.5 cm long, channelled above, glabrous. Flowers whitish, axillary, solitary, or in fascicles, ca 3 cm across; pedicels 1.5 - 3 cm long; bracteoles 2, ca 1 cm long, ovate, alternate. Sepals ca 1 x 1 cm, orbicular, wrinkled, persistent. Petals ca 1.8 cm long, obovate or broadly orbicular-spathulate, leathery, denticulate. Stamens numerous in several rows; filaments ca 2 mm long, filiform; anthers ca 1 mm long, glabrous, truncate. Ovary conical, 2-loculed, ovule 2 in each locule; stigmas sessile, 2-lobed, dentate. Berries 3.5 cm across, ovoid or globose, fleshy, orange, becoming brown, 4-seeded. Seeds 1.5 x 1 cm, ovoid, oblong, embedded in red pulp, brownish.

*Fl.* Nov. - Feb.; *Fr.* March - April.

*Distrib.* India: In tropical evergreen forests. Andaman & Nicobar Islands (Andaman Islands); rare.

Bangladesh, Myanmar and Malesia.

#### CULTIVATED SPECIES

**1. Camellia japonica** L., Sp. Pl. 2: 698. 1753.

Evergreen shrubs or small trees with lustrous leaves and beautiful flowers of various colours, commonly known as 'Garden Camellia' is cultivated in the gardens of hilly areas of North eastern and South India.



2. *Camellia sasanqua* Thunb, Fl. Jap. 273. t. 30. 1784.

Occasionally cultivated in Assam. Seeds yield an oil, used as lubricant, in soap making, silk industry, etc. (Ambasta (ed.) *The useful plants of India* p. 99. 1986).

## ACTINIDIACEAE

(T.K. Paul)

Trees or shrubs, sometimes trailing or climbing; stems and branches glabrous, strigose or tomentose; pith of branches solid, hallow or chambered. Leaves alternate, simple, pinnately veined, glabrous or with simple hairs or scales, exstipulate. Flowers solitary or few to many in axillary cymes or panicles, bisexual or unisexual. Sepals 5, free or shortly connate at base, imbricate or subcontorted. Petals 5, free or shortly connate, imbricate or subcontorted. Stamens numerous; anthers versatile, dehiscing by longitudinal slits or apical pores. Ovary 5 - many-loculed, 1 or more ovules in each locule; styles equal to number of locules, free or connate at base, usually persistent. Fruit a berry or capsule. Seeds small, numerous.

E. Asia to N. Australia and tropical America; ca 3 genera and 47 species; 2 genera and 10 species in India.

### KEY TO THE GENERA

- 1a. Scrambling shrubs; petals free; anthers opening by longitudinal slits; styles numerous      1. *Actinidia*  
b. Trees or erect shrubs; petals shortly connate at base; anthers opening by apical pores; styles 5      2. *Saurauia*

### 1. *Actinidia* Lindley

Glabrous, strigose or tomentose, climbing or scrambling shrubs; pith of branches often chambered. Leaves entire or serrate, membranous, penninerved. Flowers polygamous or unisexual, solitary or few in axillary, subumbellate cymes or fascicles; bracts minute, 1 or 2 at apices of peduncles. Sepals 5, free or subconnate, imbricate persistent. Petals 5, contorted-imbricate, deciduous. Male flowers with many well developed stamens and rudimentary ovaries with minute styles. Female flowers with well developed ovary. Ovary many-loculed; styles 15 - 30, free, divergent and elongated after flowering, persistent; stamens well developed either empty or with sterile pollen. Berries globose to oblong, glabrous or hairy, spotted with lenticels, usually contain raphides. Seeds numerous, oblong, immersed in pulp.

E. Asia, ca 36 species; 2 in India.

### KEY TO THE SPECIES

- 1a. Stems and branches glabrous or minutely tomentose; leaves ovate, obovate to broadly elliptic      1. *A. callosa*  
b. Stems and branches strigose; leaves ovate to oblong-ovate      2. *A. strigosa*

1. *Actinidia callosa* Lindley, Nat. Syst. ed. 2: 439. 1836. Dyer in Fl. Brit. India 1: 286. 1874.

Scandent shrubs, up to 10 m; stems and branches reddish brown, glabrous or minutely tomentose. Leaves 5 - 15 x 2 - 10 cm, ovate, obovate to broadly elliptic, rarely ovate-lanceolate, obtuse to rounded at base, acute to acuminate at apex, denticulate, subentire to remotely crenate-serrulate, membranous, glabrous above, glabrous or rusty tomentose on veins beneath; petioles 1.5 - cm long, glabrous or tomentose. Flowers solitary or 2 - 5 in cymes or pseudo-umbels; peduncles 1 - 1.5 cm long, glabrous or tomentose; pedicels 5 - 15 mm long, glabrous or tomentose; bracts minute. Sepals 3 - 4 x 2 - 3 mm, ovate to oblong, acute to obtuse at apex, glabrous or tomentose, connate at base. Petals 5 - 7 x 3 - 4 mm, obovate, obtuse or rounded at apex, glabrous. Stamens numerous, 3 - 4 mm long. Ovary 1 - 2 x 1.5 mm, subglobose, hairy; styles numerous, 2 - 3 mm long, clavate; stigmas simple. Berries 1 - 1.5 cm long, 5 - 15 mm in diam., obovoid to ellipsoid, sparsely warted. Seeds ca 1.5 mm long, ovoid, brownish-black.

#### KEY TO THE VARIETIES

- |   |                            |
|---|----------------------------|
| 1a. Leaves tomentose beneath; pedicels and sepals glabrous                | 1.1. var. <i>callosa</i>   |
| b. Leaves tomentose on veins beneath; pedicels and sepals rusty tomentose | 1.2. var. <i>pubescens</i> |

#### 1.1. var. *callosa*

Kh.: *Mei-soh-khan, Mei-jaior*; Nep.: *Tekhiphal*

Leaves 4 - 15 x 3 - 10 cm, obovate to ovate-elliptic, rarely ovate-lanceolates, tomentose, chartaceous. Pedicels and sepals glabrous.

*Fl.* May - June; *Fr.* July - Nov.

*Distrib.* India: In subtropical forests between 900 and 2700 m. Uttar Pradesh, West Bengal (Darjeeling). Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura and Meghalaya.

Nepal, Bhutan, China, Indo-China and Malesia.

1.2. var. *pubescens* Dunn in J. Linn. Soc. Bot. 39: 106. 1911. *A. indochinensis* Merr. in J. Arn. Arb. 19: 53. 1938, *syn. nov.*

Leaves 3 - 8.5 x 1.5 - 4.5 cm, ovate to ovate-elliptic, glabrous above, rusty tomentose on veins beneath, subchartaceous to coriaceous. Pedicels and sepals rusty tomentose.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Assam plains and Eastern Himalayas in tropical and subtropical forests up to 1500 m. Assam and Meghalaya.

China and Malasia.

*Notes.* According to Dunn (l.c.) the leaves of var. *pubescens* are more or less densely villous beneath. But a critical examination of its type (India, Kala Naga hills, Manipur, 3000 ft., 31.5.1882, *Watt* 6919 (CAL)) and all other known specimens from India have hairs only on veins and veinlets, a key character of *Actinidia indochinensis* Merr. [Type: Indo-China, Tonkin, Chapa, *A. Petilot* 5938 (A)] published later. Therefore, the later species is treated here as a synonym of *A. callosa* Lindley var. *pubescens* Dunn.

2. *Actinidia strigosa* Hook. f. & Thomson ex Benth. in *J. Linn. Soc.* 5: 55. 1861; Dyer in *Fl. Brit. India* 1: 286. 1874. Fig. 53.

Nep.: *Tekiphal*

Scandent shrubs, up to 8 m tall; stems and branches reddish brown, strigose with conspicuous lenticels; branchlets densely ferruginous setose. Leaves 10 - 15 x 5 - 8 cm, ovate to oblong-ovate, obtuse to rounded at base, acuminate at apex, finely serrate with hair-like teeth or denticulate, glabrous or slightly puberulous on veins above, sparsely hairy on veins or nearly glabrous beneath, midrib densely covered with brown bristles beneath, petioles 1 - 3.5 cm long, hairy. Flowers 2 - 4 in axillary cymes, sometimes solitary; peduncles up to 1 cm long, pubescent; pedicels 5 - 12 mm long, pubescent; bracts ca 1 mm long, linear. Sepals 4 - 6 x 3 - 5 mm, elliptic to ovate, acute to obtuse at apex, glabrate or sparsely pubescent. Petals 5 - 15 x 6 - 10 mm, obovate, rounded at apex, glabrous. Stamens numerous, 4 - 7 mm long. Ovary 3 - 5 mm long, subglobose; styles numerous, 1.5 - 4 mm long. Berries 2 - 2.5 cm long, 1.5 - 2 cm in diam., ovoid, mucilaginous, edible. Seeds ca 1.5 mm long, oblong, brownish-black.

*Fl.* May - June; *Fr.* Aug. - Sept.

*Distrib.* India: Eastern Himalayas in subtropical broad-leaved forests between 1500 and 3000 m. West Bengal (Darjeeling) and Sikkim.

Nepal and Bhutan.

#### CULTIVATED SPECIES

*Actinidia chinensis* Planch. in Hook., *London J. Bot.* 6: 303. 1847.

This species is commonly known as "Chinese gooseberry" and is cultivated for its fruits which are edible and used for making wines, jams, marmalades etc.

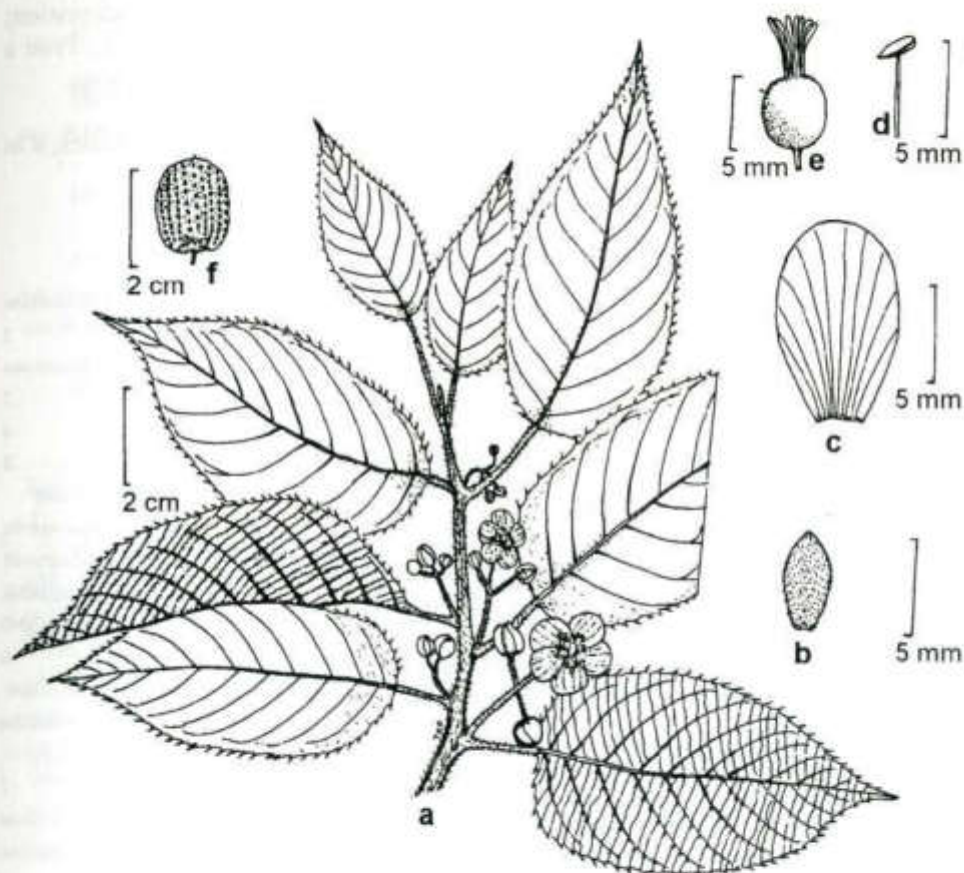


Fig. 53. *Actinidia strigosa* Hook. f. & Thomson ex Benth. : a. flowering branch; b. sepal; c. petal; d. stamen; e. pistil; f. fruit.

## 2. *Saurauia* Willd., orth. et nom. cons.

Shrubs or trees; young stems and branchlets usually brown with tubercular dots and scales. Leaves approximate at ends of branchlets, alternate, simple, mostly serrate with prominent parallel veins diverging from midrib, often with hairs and scales, exstipulate. Flowers axillary, solitary or in cymes or lateral panicles, bisexual, hypogynous, bracteate. Sepals 5, free, imbricate, persistent. Petals 5, free or connate at base, imbricate. Stamens many, adnate to the base of petals; anthers versatile dehiscing through apical pores or short slits. Ovary superior, 3 - 5-locular, ovules numerous in axile placentation; styles 3 - 5, free or variously united, sometimes completely so; stigmas simple. Fruit a berry, globose, rarely dry and subdehiscent. Seeds small, numerous, albuminous.

Tropical and subtropical America, Asia and a few in Australi, ca 300 species; 8 in India.

### KEY TO THE SPECIES

- |  |                          |
|--|--------------------------|
| 1a. Flowers solitary or clustered, more or less sessile  | 1. <i>S. armata</i>      |
| b. Flowers in cymes or panicles, pedicels distinct   | 2                        |
| 2a. Bracts ca 2 x 0.8 cm, oblong; sepals with scales   | 2. <i>S. bracteosa</i>   |
| b. Bracts 1 - 10 x 0.5 - 4 mm, ovate to elliptic-lanceolate, sepals without scales   | 3                        |
| 3a. Panicles 15 - 30 cm long   | 4                        |
| b. Cymes less than 10 cm long  | 5                        |
| 4a. Sepals glabrous or sparsely pubescent; young stems and petioles covered with rusty tomentum and pointed scales               | 6. <i>S. napaulensis</i> |
| b. Sepals densely pubescent outside; young stems and petioles covered with rusty tomentum but without scales                     | 4. <i>S. griffithii</i>  |
| 5a. Mature leaves glabrous beneath   | 8. <i>S. roxburghii</i>  |
| b. Mature leaves densely rusty puberulous beneath  | 6                        |
| 6a. Young stems and petioles covered with dense stiff brownish or black hairs; leaves narrowly lanceolate to elliptic-lanceolate | 5. <i>S. macrotricha</i> |
| b. Young stems and petioles covered with rusty tomentum and scattered adpressed scales; leaves elliptic, obovate or oblanceolate | 7                        |
| 7a. Peduncles and pedicels glabrous; bracts narrowly lanceolate to deltoid, ca 1 mm long   | 3. <i>S. fasciculata</i> |
| b. Peduncles and pedicels covered with scales and hairs; bracts elliptic, 4 - 6 mm long  | 7. <i>S. punduana</i>    |

1. *Saurauia armata* Kurz in J. Asiat. Soc. Beng. 42: 59. 1873. *S. cerea* Griffith ex Dyer in Fl. Brit. India 1: 288. 1874.

Asm.: *Porbotia-heingunia*.

Shrubs or small trees, up to 7 m tall, with scandent branches; young stems and branches with sharp pointed, stiff scales, scales 0.5 - 1 mm long, ultimately glabrescent. Leaves 15 - 40 x 8 - 17 cm, obovate, acute or rounded at base, abruptly short acuminate

at apex, cuneate, remotely serrate or subentire, with stiff hairs, chartaceous, glabrous above, scattered stiff hairy on lateral veins beneath, ultimately becoming glabrescent, lateral veins 18 - 21 on either side of midrib; petioles 0.5 - 2 cm long, stout, densely scaly. Flowers axillary, solitary or in clusters. Sepals ca 10 x 8 mm, elliptic or orbicular, tomentose and with sharp pointed scales outside, tomentose but without scales inside. Petals white with reddish base, ca 12 x 8 mm, orbicular-obovate, glabrous. Stamens numerous, 1 - 2 mm long. Ovary ca 3 mm long, globose densely villous; styles 5, connate, hairy at base. Berries ovoid, densely villous.

*Fl.* April - May.

*Distrib.* India: Eastern Himalayas in subtropical mixed forests between 300 and 900 m. Arunachal Pradesh, Assam and Meghalaya.

Nepal, Bhutan, Myanmar and China.

*Notes.* This species is distinguished from other species of the genus by its solitary or rarely clustered, sessile flowers and sepals with sharp pointed scales on the outer surface.

Wood used for house construction.

2. *Saurauia bracteosa* DC. in Mem. Soc. Phys. Hist. Nat. Geneve 1: 422. 1822. Yogan. *et al.* in Curr. Sci. 51: 198. 1982.

Evergreen trees, up to 8 m tall; young stems scaly. Leaves ca 35 x 15 cm, elliptic-oblong, rounded at base, shortly acuminate at apex, dentate-serrate, scaly above when young, ultimately becoming glabrous, densely tomentose and scaly beneath; petioles ca 5 cm long, stout. Flowers in corymbs; peduncles 5 - 10 cm long; bracts ca 2 x 0.8 cm, oblong, foliaceous, scaly. Sepals much shorter than petals, outer 2 unequal, 4 - 5 x 2 - 3 mm, ovate-lanceolate, scaly; inner 3, ca 7 x 5 mm, ovate, with or without scales. Petals ca 6 x 3 mm, obovate, notched at apex. Stamens numerous, filaments united at base. Ovary ovoid, densely tomentose, 5-loculed, ovules numerous; styles 4 - 5, connate at base, persistent. Berries ca 1 cm long, ca 6 mm across, globose, densely white tomentose. Seeds minute, pyramidal, reticulate.

*Fl. & Fr.* Feb. - April.

*Distrib.* India: In tropical evergreen forests, Andaman & Nicobar Island, (Great Nicobar Island).

Indonesia (Java).

*Notes.* *Saurauia bracteosa* is recently reported (Yoganarasimhan *et al.*, l.c.) from India (Nicobar Islands) and is distinguished by its persistent large foliaceous bracts and apically notched petals.

**3. *Saurauia fasciculata*** Wallich, Pl. Asiat. Rar. 2: 40, t. 148. 1831; Dyer in Fl. Brit. India 1: 287. 1874.

Nep.: *Sare-gogon*.

Shrubs or small trees, up to 6 m tall; young stems and branches densely rusty tomentose and with scattered adpressed scales, scales ca 1 mm long, oblong, acute or obtuse, or truncate and torn, glabrescent. Leaves 10 - 25 x 3 - 8 cm, elliptic-oblong, lanceolate or ovate, acute or rounded at base, acute to attenuate-acuminate, glabrous above, densely rusty tomentose with scattered scales on midrib beneath, lateral veins 15 - 30 on either side of midrib; petioles 0.5 - 5 cm long, rusty tomentose with scattered scales, glabrescent. Flowers fascicled in axillary, 5 - 8 cm long, trichotomous cymes; peduncles glabrous; pedicels 0.5 - 2 cm long, glabrous; bracts ca 1 mm long, linear-deltoid, persistent. Sepals 3 - 5 x 3 mm, orbicular or ovate, rounded or obtuse, glabrous, persistent. Petals white, ultimately pink, 6 - 9 x 5 mm, obovate, rounded. Stamens numerous. Ovary 1 - 2 x 1 - 2 mm, ovoid, glabrous; styles 5, connate above the middle, arms spreading at tips, persistent atleast in young fruits. Berries 7 - 8 x 5 mm, globose. Seeds numerous, minute.

*Fl. & Fr.* May - June.

*Distrib.* India: Eastern Himalayas in warm broad leaved subtropical forests between 500 and 1500 m. West Bengal, (Darjeeling), Sikkim, Assam and Arunachal Pradesh.

Nepal and Bhutan.

**4. *Saurauia griffithii*** Dyer in Fl. Brit. India 1: 286. 1874.

Lep.: *Hlosiphakung*.

Trees; young stems with dense flacose rusty tomentum, ultimately glabrate. Leaves 15 - 36 x 11 - 17 cm, broadly elliptic, oblong or obovate, rounded at base, acute or rounded and abruptly short acuminate at apex, subentire or with distant spinulose serratures, glabrous above, densely reddish-brown tomentose beneath, mature leaves sometimes glabrate, lateral veins 30 - 35 on either side of midrib; petioles 2 - 8 cm long, tomentose like stem. Panicles axillary, much branched; peduncles up to 35 cm long; pedicels up to 2 cm long, tomentose like stem; bracts 10 x 8 mm, ovate or elliptic, deciduous, tomentose. Sepals 5 - 7 x 3 - 4 mm, ovate or elliptic, densely tomentose outside, glabrous inside,



persistent. Petals ca 8 x 4 mm, obovate, glabrous. Stamens numerous. Ovary ca 2 x 1.5 mm, ovoid; styles 5, connate at base, persistent. Berries ca 5 mm long, 5 - 7 mm in diam., globose. Seeds numerous, minute.

*Fl. & Fr.* June - Dec.

*Distrib.* India: Eastern Himalayas in subtropical forests between 600 and 1500 m. Sikkim and Assam.

Bhutan.

*Notes.* Wood used for construction purposes and for making packing cases.

5. *Saurauia macrotricha* Kurz ex Dyer in Fl. Brit. India 1: 287. 1872.

*Kh.: Dieng-soh-jalb, Dieng-soh-lympied*

Shrubs or small trees; young stems and branches hirsute with brown and black, stiff, setose hairs, ultimately glabrescent. Leaves 10 - 27 x 3 - 7 cm, narrowly lanceolate to elliptic-lanceolate, acute to rounded at base, shortly acuminate at apex, setosely serrate or subentire with bristles, scattered stiff hairy on veins above, becoming glabrescent, rusty tomentose beneath, lateral veins 15 - 25 on either side of midrib; petioles 1 - 3.5 cm long, densely hirsute. Flowers red, in axillary cymes; peduncles hirsute; pedicels up to 1 cm long, hirsute; bracts ca 1 mm long, ovate-lanceolate, glabrous. Sepals 3 - 5 x 2 mm, elliptic or broadly ovate, acute or obtuse, glabrous. Petals ovate-rounded, slightly exceeding the sepals, apices reflexed. Stamens numerous. Ovary ca 1 mm long, ovoid, glabrous; styles 5, connate at base. Berries globose.

*Fl.* April - June; *Fr.* June - Aug.

*Distrib.* India: Eastern Himalayas in subtropical forests between 450 and 1500 m. West Bengal (Darjeeling), Assam, Arunachal Pradesh and Meghalaya.

Myanmar and China.

6. *Saurauia napaulensis* DC., Mem. Ternstr. 29. 1822 & in Mem. Soc. phys. Hist. Nat. Geneve 1: 421. 1822; Dyer in Fl. Brit. India 1: 286. 1874. *Temstroemia racemosa* D. Don, Prodr. 225. 1825. *S. paniculata* Wallich in G. Don, Gen. Hist. 1: 567. 1831. *Zanthoxylum serra* Turcz. in Bull. Soc. Nat. Mosc. 31: 440. 1858.

Hindi: *Goganda, Gogina, Pangara*; Lep.: *Kasur, Kasur-Kung*; Nep.: *Gogun*.

Shrubs or medium-sized trees, 5 - 30 m tall; young stems and branches covered with scurfy tomentum and broad based acuminate, 1 - 1.5 cm long, deciduous scales, ulti-

mately becoming glabrous. Leaves 10 - 40 x 5 - 12 cm, elliptic, oblanceolate or oblong-lanceolate, obtuse to rounded at base, acute to acuminate at apex, strongly serrate, glabrous above, rusty tomentose beneath, becoming glabrescent, lateral veins 25 - 50 on either side of midrib; petioles 1 - 5 cm long, covered with rusty tomentum and scales. Flowers pink, ca 1.5 cm in diam., in long, axillary panicles; peduncles up to 30 cm long with rusty tomentum and scales; bracts 3 - 4 mm long, elliptic-lanceolate, acute, deciduous. Sepals 4 - 6 x 3 - 4 mm, glabrous or sparsely pubescent, persistent. Petals 5 - 10 x 3 - 7 mm, ovate-rounded to obovate, rounded at apex. Stamens numerous. Ovary 3 - 4 x 2 - 3 mm, ovoid, glabrous; styles 5, connate at base, 2 - 3 mm long. Berries ca 5 mm long and 5 - 8 mm long, subglobose to ovoid. Seeds numerous, minute, obovoid, reddish-brown.

*Fl. & Fr.* Throughout the year especially during April - Aug.

*Distrib.* India: Throughout Himalayas and N.E India in warm broad leaved subtropical forests between 750 and 2150 m. Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura and Meghalaya.

Nepal, Bhutan, Myanmar, Thailand, Indo-China, China and Malaya.

*Notes.* Fruits are edible and wood used for construction.

7. *Saurauia punduana* Wallich, Pl. Asiat. Rar. 2: 40. 1831, Dyer in Fl. Brit. India 1: 287. 1874. *S. fasciculata* Wallich var. *abbreviata* Choisy, Mem. Ternstr. 27. 1855.

Kh.: *Dieng-Ja-la-ngap, Ja-lang-ngap-sinrang*; Nep.: *Rate Gogun*

Shrubs or small trees, up to 6 m tall; young stems and branches covered with densely rusty tomentose and scattered adpressed scales, scales 0.5 - 1.5 mm long, oblong to deltoid, acute, rarely toothed at apex, glabrescent. Leaves 12 - 25 x 6 - 15 cm, elliptic, obovate or oblanceolate, acute, cuneate or rounded at base, acute or abruptly short acuminate at apex, irregularly serrate, glabrous above, whitish or rusty brown tomentose with scattered scales on midrib beneath, lateral veins 12 - 35 on either side of midrib; petioles 1.5 - 5.5 cm long, tomentose with scattered scales, glabrescent. Flowers pink in ca 8 cm long, axillary cymes, ca 2 cm in diam.; pedicels up to 1 cm long, pedicels and peduncles densely tomentose and scaly; bracts 4 - 6 x 3 mm, elliptic. Sepals ca 10 x 6 mm, elliptic to broadly ovate, glabrous, persistent. Petals pink, ca 10 x 5 mm, ovate to obovate. Stamens numerous. Ovary ca 3 x 1.5 mm, ovoid or globose; styles 5, connate up to middle, free branches spreading, persistent at least in young fruits. Berries ca 8 x 5 mm, globose, juicy. Seeds numerous, minute.

*Fl.* April - June; *Fr.* Sept. - Nov.

*Distrib.* India: In subtropical forests between 600 and 1800 m. West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram and Tripura.

Bhutan, Myanmar and China.

**8. *Saurauia roxburghii*** Wallich, *Pl. Asiat. Rar.* 2: 40. 1831; Dyer in *Fl. Brit. India* 1: 287. 1874.

*Asm.*: *Bon-Posola*, *Paniposala*, *Porbotia-sengunia*, *Hengunia*; *Kh.*: *Dieng-soh-lapied*; *Lep.*: *Safar-Kung*; *Mani.*: *Sing-kharu*; *Naga.*: *Tong-bahu*, *Dia-ching*; *Nep.*: *Gogun*, *Aule Gogun*; *Tipp.*: *Arbeng-Thing*.

Shrubs or small trees, up to 10 m tall; young stems and branches covered with scurfy tomentum and scattered adpressed scales, scales ca 0.5 mm long, linear to subulate, ultimately glabrescent, terete. Leaves 8 - 35 x 2.5 - 13 cm, elliptic, elliptic-oblong, oblanceolate, acute, subacute or rounded at base, acute to shortly acuminate at apex, obtusely serrate, subcoriaceous, young leaves rusty tomentose with scales on midrib beneath, mature leaves glabrous on both surfaces, lateral veins 10 - 20 on either side of midrib; petioles 1 - 6 cm long, rusty tomentose with scattered scales, glabrescent. Flowers axillary, in 6 cm long cymes; peduncles and pedicels rusty tomentose; pedicels 2 - 10 mm long, glabrous; bracts minute, deltoid, acute. Sepals 2 - 3 x 2 - 3 mm, ovate to ovate-rounded, glabrous. Petals white becoming pink, 4 - 5 x 3 - 4 mm, connate at base, ovate, rounded at apex, glabrous. Stamens numerous. Ovary 1 - 2 x 1 mm, ovoid, glabrous; styles 5, 1 - 2 mm long, connate at base, persistent in young fruits. Berries 4 - 5 mm long, ca 5 mm across, subglobose, fleshy, whitish. Seeds numerous minute, brown.

*Fl.* March - May; *Fr.* Sept. - Feb.

*Distrib.* India: Eastern Himalayas and N.E. India in subtropical forests between 300 and 1200 m. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura and Meghalaya.

Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Sri Lanka, Laos and Malaysia.

*Notes.* Leaves used as fodder and wood for house construction. Mucilage from leaves used for preparing hair pomade.

## STACHYURACEAE

(D.C.S. Raju and S. Singh)

Small trees or erect, deciduous shrubs. Leaves alternate, simple, serrulate, membranous, stipulate. Inflorescences axillary, pendulous racemes or spikes. Flowers bisexual or polygamous, tetramerous; bracts 2, connate at base. Sepals 4, imbricate. Petals 4, free, imbricate; stamens 4 + 4, hypogynous; filaments subulate; anthers versatile, bilocular. Ovary tetracarpellary, syncarpous, superior, tetralocular; placentation axile, ovules indefinite; styles simple; stigmas capitate. Berries erect, tetralocular, many-seeded. Seeds small, arillate; endosperm fleshy; embryo straight, cotyledons elliptic; radicle short.

A monotypic family of subtropical and temperate regions of E. Asia (India, Nepal, Bhutan, N. Myanmar, W. & C. China and Japan), ca 7 - 8 species; one in India.

*Literature.* LI, H.L. (1943). The genus *Stachyurus*. Bull. Torrey Bot. Club 70: 615 - 628.

*Notes.* Agardh (1858) separated the genus *Stachyurus* under a monotypic family Stachyuraceae, but Bentham & Hooker (*Gen. Pl.* 1: 184. 1862) treated this under the tribe Sauraucae of the family Ternstroemiaceae of Guttiferales and this was followed by Dyer (in *Fl. Brit. India* 1: 288. 1872). Hutchinson (*Gen. Fl. Pl.* 2: 104 - 105. 1967) stressed its uniqueness and treated it under a different family in the order Hamamelidales.

### *Stachyurus* Sieb. & Zucc.

Small trees or shrubs. Leaves simple, alternate, serrulate, membranous. Flowers small in axillary pendulous racemes or spikes; bracts 2, connate at base. Sepals and petals 4 each, imbricate. Stamens 4 + 4; anthers versatile, dehiscent by slits. Ovary 4-locular, ovules many on axile placentation; styles simple; stigmas capitate. Berries erect, 4-locular, many-seeded. Seeds small, arillate.

A small genus of subtropical and temperate regions of Asia, ca 7 - 8 species; one in India.

*Stachyurus himalaicus* Hook. f. & Thomson ex Benth. in *J. Linn. Soc. Bot.* 5: 55. 1861, in adnota; Dyer in *Fl. Brit. India* 1: 288. 1874.

Shrubs or small trees, much branched from base; branches straggling, gland-dotted, ribbed, reddish-purple. Leaves 6 - 13 x 3.2 - 5.5 cm, lanceolate, ovate-lanceolate to ovate-elliptic, rounded at base, acuminate at apex, finely serrate and thickened, glabrous, membranous to subcoriaceous, strongly reticulate beneath; petioles 8 - 12 mm long, curved at base. Spikes axillary, solitary, 5 - 11 cm long, pendulous; peduncles curved; bracts ovate, leafy; bracteoles 2, opposite, 2 - 3.5 x 2.5 - 3 mm, ovate, cucullate,

glabrous, coriaceous, connate at base, reddish-brown. Flowers appear before leaves, subsessile. Sepals 4, 4.5 - 5.5 x 3 - 4 mm, ovate, thick, cucullate, greenish-yellow, margin thin. Petals 4, greenish-yellow, 6.5 - 7.5 x 4 - 5 mm obovate, cucullate, margin thin. Stamens 8, diplostemonous; filaments outer 5 - 6 mm long and inner 1.5 - 2.5 mm long, thick at base; anthers small, dehiscent by slits. Ovary subglobose; styles 2.5 - 3 mm long; stigmas globose. Berries subsessile, 5 - 6 mm in diam., globose to subglobose with persistent style.

*Fl. & Fr.* March - July ; less frequent.

*Distrib.* India: Open valleys in Eastern Himalayas between 1500 and 12800 m. West Bengal(Darjeeling), Sikkim, Arunachal Pradesh, Nagaland and Manipur.

Nepal, Bhutan, S. Myanmar and China(including Tibet).

## DIPTEROCARPACEAE

(K.P. Janardhanan)

Trees, resinous, usually tall, with crowns becoming sympodial, often emergent, all at first monopodial and a few remaining so, some or most parts hairy, hairs mostly unicellular, acicular and usually fascicled or stellate, peltate or emarginate and single; frequently also with more or less caducous, multicellular, long-stalked (*Vateria*) or capitate (*Dipterocarpus*) hairs. Leaves simple, alternate, entire or rarely sinuate-crenate, usually coriaceous, penninerved, frequently with domatia in the axils of nerves; stipules small, deciduous. Flowers bisexual, regular, pentamerous, usually sweet-scented, in axillary or terminal racemes or panicles; bracts minute or absent, rarely larger and persistent. Calyx lobes free; imbricate or rarely subvalvate, frequently united into a short or long tube, free or adnate to the ovary, becoming enlarged and wing-like in fruit. Corolla contorted, lobes free or often connate at base, twisted in bud. Stamens 5, 10, 15 or numerous, variously connate or free; filaments usually short and often dilated at base; anthers bilocular, latrorse or rarely endporous; connective aristate or with an obtuse appendage. Ovary superior or semi-inferior (*Dipterocarpus*), 2- or 3-locular, ovules 2 in each locule, anatropous or pendulous; styles columnar, entire or trifid, frequently on a stylopodium; stigma small, obscure, 3 - 6-lobed. Fruit an indehiscent nut or a 3-valved capsule with persistent calyx more or less enclosing it, or reflexed, often with some of the lobes accrescent into contorted linear wings. Seeds exalbuminous, cotyledons fleshy, equal or unequal, straight or more or less plaited and crumpled.

Confined to Asian tropics except for a few species in Tropical Africa, mostly in the humid zone, ca 15 genera and 580 species; ca 5 genera and 30 species in India.

*Notes.* Dipterocarps, in general are large evergreen trees with tall branchless stems and do not flower or set seed until they have attained large size and considerable age with the exception of the *Vatica* species which are shrubs or small trees and flower at an early stage. The species belonging to *Dipterocarpus* and *Hopea* are wholly evergreen and are found in the tropical evergreen forests.

*Shorea* species stand on the border line between the evergreen and the deciduous forests, attaining the former state in very moist fertile localities and the latter state in less moist or dry situations. Majority of the dipterocarps belong to the hygrophilous type, while some like *Shorea* spp., *Dipterocarpus costatus* Gaertn.f. belong to the xerophilous type. The dipterocarps occur in India in three zones, viz. Eastern India, Peninsular India and the Andaman and Nicobar Islands. The northern and central part of India is represented by only one species that is *Shorea robusta* Roxb. ex Gaertn.f.

*Literature.* ASHTON, P.S. (1982). Dipterocarpaceae. In: STEENIS, C.G.G.J. VAN, Fl. Males. 1, 9(2): 237 - 552; In: DASSANAYAKE, M.D. & F.R. FOSBERG (1980). Rev. Handb. Fl. Ceylon 1: 364 - 423 and FAO Reg. off. Asia & Pacific; (1985) Dipterocarps of S. Asia, RAPA monogr. 4: 1 - 321.

SMITINAND et al (1979). The Manual of Dipterocarpaceae of mainland S.E. Asia. Thai For. Bull. 12: 1 - 133.

#### KEY TO THE GENERA

- |   |                         |
|---|-------------------------|
| 1a. Leaves plicately folded in bud; stipules amplexicaul, stipular scars encircling twigs; calyx tubular with short lobes   | <b>1. Dipterocarpus</b> |
| b. Leaves, stipules and stipular scars not as above; calyx lobes nearly free  | 2                       |
| 2a. Fruit sepals imbricate with a thickened saccate base, appressed to the nut; anthers with long awns (except in <i>Shorea robusta</i> and <i>S.tumbugaia</i> )  | 3                       |
| b. Fruit sepals valvate, without thickened base; awns of the anther short or none   | 4                       |
| 3a. Leaf nervation dryobalanoid or subdryobalanoid; petals not exceeding 6 mm long; stamens usually 10 or 15; fruiting calyx with 2 aliform and 3 short sepals, each enlarged calyx lobe (wing) with 5 or more fine veins from the base | <b>2. Hopea</b>         |
| b. Leaf venation not as above; petals ca 9 mm long; stamens 15 or more; fruiting calyx with 3 aliform and 2 short sepals, rarely 5, all aliform or short, each enlarged lobe (wing) with 10 or more fine veins from the base            | <b>3. Shorea</b>        |
| 4a. Flowers in terminal panicles; sepals linear, obtuse; calyx scarcely enlarged in fruit, lobes reflexed; stamens nearly 50; anthers linear; stigma obscure  | <b>4. Vateria</b>       |
| b. Flowers in axillary racemes; sepals ovate-lanceolate, acuminate; calyx enlarged in fruit, lobes erect; stamens 15, anthers broadly oblong; stigma prominently conical  | <b>5. Vatica</b>        |

#### 1. *Dipterocarpus* Gaertn.f.

Medium to large-sized, resinous trees with straight boles, buttressed bases and dome-shaped or flat crowns; bark pale or dark grey to orange brown, sometimes pink brown, shallowly flaked in patches, more or less prominently and densely verrucose-lenticellate. Leaves coriaceous, rarely thin, margin usually sinuate towards apex; nerves prominent beneath, straight, curved only towards margin, tertiary nerves scalariform; petioles distinctly geniculate, stout; stipules large, hastate to lorate, obtuse, more or less succulent, caducous. Inflorescences few-flowered, short, stout, zig-zag, somewhat irregularly, sparingly branched racemes. Flowers white or pink, large. Calyx 5-lobed, lobes valvate, two longer ones oblong to spatulate, more or less distinctly 3-nerved and developed into erect, strap-shaped or oblong, larger wings in the fruit, other three lobes remaining short and forming a crown round apex of the nut. Corolla lobes large, white or cream-coloured with a more or less dark crimson or pink stripe down the centre, narrowly oblong. Stamens 15 to many, persisting in a ring around ovary after petals fall off; filaments of variable length, broad, compressed, connate at base, tapering gradually and filiform below the anther; anthers long, linear, taping apically with 4 pollen sacs, inner two somewhat shorter than outer two; appendage of connective short, stout to filiform, glabrous. Ovary enclosed in calyx tube, the apex ovoid to conical, densely puberulent; stylopodium cylindrical to filiform, densely puberulent, narrowing into a

glabrous, filiform style. Fruit large, nut-like, enclosed in calyx tube with two lobes accrescent.

Sri Lanka and India, eastwards to Indo-China, Sumbawa, Borneo and the Philippines, ca 80 species; 10 in India.

*Literature.* As of family.

#### KEY TO THE SPECIES

- |   |                                  |
|---|----------------------------------|
| 1a. Mature fruiting calyx tube angled, ribbed and winged  | 2                                |
| b. Mature fruiting calyx not angled, ribbed or winged   | 5                                |
| 2a. Calyx tube with angles very narrowly winged   | 3                                |
| b. Calyx tube with angles widely winged   | 4                                |
| 3a. Leaves glabrous on both surfaces; lateral nerves straight; flowers, 5 - 6.3 cm across; two enlarged fruiting calyx lobes oblong-spathulate, 3-nerved from three-quarters of their length or throughout, an additional pair making 5-nerved towards base, glabrous, three short lobes elliptic       | <b>5. <i>D. grandiflorus</i></b> |
| b. Leaves densely tomentose with fine stellate hairs on both surfaces when young, becoming glabrous or nearly so above when old; lateral nerves ascending; flowers ca 1.8 cm across; two enlarged fruiting calyx lobes linear-oblong, 3-nerved, sparsely stellate-hairy, three short lobes suborbicular | <b>3. <i>D. costatus</i></b>     |
| 4a. Young shoots clothed with buff-coloured indumentum of short, tangled hairs; lateral nerves of leaves 12 - 16 pairs; calyx tube stellate-hairy and pilose; corolla lobes oblong, stellate-pubescent, more densely outside; fruits thin, stellate-hairy, somewhat glaucous                            | <b>1. <i>D. alatus</i></b>       |
| b. Young shoots densely fulvous tomentose; lateral nerves 15 - 20 pairs; calyx tube glabrous; corolla lobes linear-spathulate, velutinous outside; fruits glabrous, glossy  | <b>2. <i>D. bourdillonii</i></b> |
| 5a. Branchlets pubescent, tomentose or pilose   | 6                                |
| b. Branchlets glabrous (sometimes shortly buff puberulent in <i>D. retusus</i> )  | 8                                |
| 6a. Stamens many; fruit belly broadly turbinate or ovoid; leaves glabrous, lateral veins looped along the margins; bark light grey, smooth, exfoliating in irregular, round flakes  | <b>6. <i>D. indicus</i></b>      |
| b. Stamens up to 30; fruit belly globose, subglobose or ovoid   | 7                                |
| 7a. Bark greyish-brown, scaly and lenticellate, exfoliating in round flakes; leaves ciliate along the margins, lateral nerves ascending; calyx sparsely stellate-hairy  | <b>4. <i>D. gracilis</i></b>     |
| b. Bark pale bluish-grey outside, not lenticellate, closely vertically fissured; leaves thinly ciliate along the margins, lateral nerves straight and parallel; calyx velvety outside   | <b>8. <i>D. mannii</i></b>       |
| 8a. Fruits pointed towards both the ends, densely greyish dull brown silky outside; corolla lobes reaching 6.3 cm long, falcate; leaves sparsely pilose when young, glabrous above except along midrib when mature, stellate-pubescent beneath nerves   | <b>9. <i>D. retusus</i></b>      |
| b. Fruits globose, ovoid or ellipsoid, blunt at apex, smooth and glabrous, glaucous; corolla lobes up to 3 cm long, linear or linear-oblong; leaves glabrous on both surfaces   | 9                                |
| 9a. Fruits globose to subtrubinate, without striations, linear wings of the fruit abruptly constricted and revolute at base, strongly 3-nerved, nearly the whole length with an additional pair of longitudinal nerves more or less developed; bark dark grey, peeling off in flakes                    | <b>7. <i>D. kerrii</i></b>       |



- b. Fruits globular or ovoid or ellipsoid, smooth with marked striations; linear wings of fruit not as above but with one prominent median nerve and 2 basal smaller nerves; bark greyish brown, vertically fissured and irregularly flaking or cracking, rarely smooth, exfoliating in strips **10. *D. turbinatus***

**1. *Dipterocarpus alatus*** Roxb., [Hort. Beng. 42. 1814 nom. nud.] ex G. Don, Gen. Hist. 1: 813. 1831; Roxb., Fl. Ind. 2: 614. 1832; Dyer in Fl. Brit. India 1: 298. 1874, p.p. *D. costatus* Buch.-Ham. in Mem. Wern. Soc. 6: 300. 1827, non Gaertn. f. 1805. *D. incanus* Roxb., [Hort. Beng. 42. 1814, nom. nud.] Fl. Ind. 2: 614. 1832; Dyer in Fl. Brit. India 1: 298. 1874.

And.: *Gurjun*; Beng.: *Dholi garjan*, *Dhulya garjan*, *Harra garjan*, *Sil garjan*, *Mashk-haliya garjan*; Hindi: *Gurjan*.

Lofty evergreen trees, ca 60 m tall; bole straight, clear ca 6.5 m in girth; bark thin, smooth, light grey, pale yellow inside. Leaves 10 - 20 x 5.6 - 11.2 cm, ovate or elliptic-ovate, cuneate or broadly rounded at base, acute or short acuminate at apex, repand, shiny and nearly glabrous above except on veins, pubescent beneath; petioles 2.5 - 3.8 cm long, flattened above, softly pubescent; stipules 5 - 8.5 cm long, stellate-tomentose to pilose. Racemes axillary, simple or branched, 3 - 7-flowered, the lowest flower with a short pedicel, 3 - 3.5 cm long. Calyx tube 1 - 1.5 cm long, obconic with 5 wings starting from between the lobes and running down to the base; three shorter lobes ca 4 mm long, rounded or reflexed, two longer lobes ca 1.5 cm long, linear-oblong. Corolla lobes ca 3 cm long, white or yellowish-white. Stamens 30 - 32; filaments ca 4 mm long, flattened; anthers 4 - 5 mm long, connective produced into a 3 - 4 mm long bristle. Ovary densely tomentose; styles ca 1 cm long, stout, ribbed and pilose at base and glabrous towards tip. Fruits 1.7 - 2.5 cm long, globose, usually 5-winged to the base; wings glaucous, sparsely stellate-hairy; larger wings ca 10 - 12.5 x 2.5 cm, linear-ovate or spatulate, obtuse, 3-nerved, smaller wings 5 - 12 mm long, orbicular or ovate.

*Fl.* Jan. - March; *Fr.* May - June.

*Distrib.* India: In evergreen and semievergreen forests in low lying areas along the foot hills and valleys on fertile alluvial soils. Andaman & Nicobar Islands (Andaman Islands).

Bangladesh, Myanmar, Thailand and Indo-China.

*Notes.* Most elegantly proportioned evergreen tree, perhaps the tallest of the Indian *Dipterocarpus* species, the bole is smooth, light grey, cylindrical, sometimes well over 30 m in height. This species is easily recognised by its hoary foliage and more or less globose fruits with 5 straight or slightly undulate accrescent ridges on the calyx tube.

Wood used for construction work, floorings, panelling, for making packing cases, tea chests etc. The oleo-resin is used for making plasters and torches; as a substitute for

copaiba and also applied externally to treat gonorrhoea. Hot decoction of bark is used in the treatment of rheumatic complaints.

**2. *Dipterocarpus bourdillonii*** Brandis in Hook., Icon. Pl. 5(1): t. 2403. 1895; in J. Linn. Soc. 31: 34. 1895 & Indian Trees 66. 1906. **Fig. 54.**

Mal.: *Kar angili, Kalpine, Charatta-anjili*; Tam.: *Karanjili*.

Evergreen trees, ca 50 m tall; trunk straight, ca 1.7 m in girth; bark light coloured; wood reddish-brown, hard. Leaves 20 - 30 x 12 - 17 cm, ovate or elliptic, shortly acuminate, long hairy especially on the nerves beneath, sometimes intermixed with a few short, stellate hairs; petioles 4 - 5 cm long. Flowers white, ca 5 cm long and ca 3.8 cm across, 3 - 5 in racemes. Calyx tubular, obconical, broadly 5-winged; lobes linear; tube of fruiting calyx ca 3.8 cm long. Stamens 30; anthers hastate, locules subequal, connective nearly as long as anthers, produced above. Fruit ca 3.5 cm long, globose or obovoid; wings purplish-brown, two longer ones 10 - 12 x 1.9 cm.

*Fl.* Jan. - March; *Fr.* April - June.

*Distrib.* India: usually occur along the sides of streams in tropical evergreen forests of Western Ghats up to 600 m. Kerala.

Endemic.

*Notes.* A magnificent evergreen tree species endemic to Western ghats. This species is closely allied to *D. insignis* Thwaites of Sri Lanka but can be easily distinguished it by its elliptic, shortly acuminate leaves having long hairs especially on nerves beneath and longer petioles.

Wood used in the manufacture of plywood, for house building purposes and in match industry.

**3. *Dipterocarpus costatus*** Gaertn.f., Suppl. Carp. 3: 50, t. 187. 1805. *D. scaber* Buch.-Ham. in Mem. Wern. Soc. 6: 300. 1827; Dyer in Fl. Brit. India 1: 297. 1874. *D. alatus* auct. non Roxb. ex G. Don 1831; Dyer in Fl. Brit. India 1: 298, 1874, p.p.

And.: *Garjan*; Beng.: *Telia garjan, Sada garjan, Keshogarjan*.

Trees, ca 20 - 30 m tall; trunk ca 3 - 4 m in girth; bark rough, scaly, dark grey, rather thick; branchlets, leaf buds, midrib above, petioles, inflorescences, calyx and outer surface of corolla covered densely with yellowish brown indumentum of long, tawny hairs mixed with stellate hairs. Leaves of flowering shoots 5.6 - 12 x 4.3 - 8.7 cm, ovate, ovate-oblong or more or less broadly elliptic, cuneate or slightly cordate at base, acute or shortly abruptly acuminate at apex, obtuse, entire or repand, pilose on both surfaces;



Fig. 54. *Dipterocarpus bourdilloni* Brandis : a. flowering twig; b. fruit.

lateral nerves 10 - 15 pairs; petioles 1.5 - 4 cm long, flattened or slightly chanelled above, softly pubescent; stipules ca 5 cm long, shaggy yellow tomentose. Spikes axillary or terminal, 3 - 9-flowered, branched or unbranched, up to 7 cm long. Calyx campanulate, 5 ribs starting from between lobes and running down to the base, 2 - 3 mm long, rounded, two longer ones ca 1.2 cm long, linear-oblong, tube and lobes densely stellate-pilose. Corolla lobes 1.7 - 2.5 cm long, oblong, tomentose outside. Stamens 18 - 20, shorter than style at anthesis; filaments flattened at base; anthers 4 - 5 mm long, linear-lorate, connective produced into a 3 - 4 mm long bristle. Ovary ovoid, tapering into columnar style, ovary and basal half of style densely pubescent. Fruit belly ca 1.8 cm across, subglobose, longitudinally 5-ribbed, stellate-tomentose or slightly pilose; two longer calyx lobes 6.5 - 10 x 1.5 - 2.5 cm, linear-oblong, obtuse, 3-nerved to the middle or sometimes beyond the middle, three shorter lobes revolute, prominent.

*Fl.* Feb. - April; *Fr.* June.

*Distrib.* India: Occurs in mixed evergreen forests at 600 - 1000 m on steep hill slopes exposed to strong winds, but nowhere common. Andaman & Nicobar Islands (Andaman Islands) and Tripura.

Myanmar, Thailand, Indo-China and Malaysia.

*Notes.* The round crown with smaller, more or less lighter and hairy foliage and the small (the smallest for the genus), globose fruits with 5 straight ridges on the calyx tube makes this species distinct.

Wood used in plywood industry, for general construction purposes and for making railway sleepers; also classified as an excellent fuel wood. Oleo-resin obtained from the wood is reported to be used in the treatment of ulcers.

**4. *Dipterocarpus gracilis*** Blume, Bijdr. 224. 1825. *D. pilosus* Roxb., [Hort. Beng. 93. 1814, nom. nud.] Fl. Ind. 2: 615. 1832; Dyer in Fl. Brit. India 1: 296. 1874. *D. skinneri* King in J. Asiat. Soc. Beng. 62: 92. 1893. *D. turbinatus* Buch.-Ham in Mem. Wern. Soc. 6: 300. 1832, non Gaertn. f. 1805. *D. turbinatus* Gaertn. f. var. *andamanica* King in J. Asiat. Soc. Beng. 62: 92. 1893. *D. andamanicus* (King) Tewary & Sarkar in Ind. J. For. 10: 63. 1987.

*And.:* Gurjan, Chota Pata Gurjan; *Eng.:* Short leaf Gurjan.

Trees, ca 40 m tall; bole cylindrical, ca 5 m in girth; branchlets, leaf buds, exterior of stipules, undersurface of leaves, midrib above and petioles densely rufous tomentose. Leaves 8 - 29 x 4 - 15 cm, ovate, elliptic-oblong or elliptic-lanceolate, obtuse to rounded at base, shortly acuminate at apex, slightly repand or distantly crenate, with fascicled cilia, at first pubescent, becoming glabrous on dorsal surface, lateral veins 12 - 24 pairs; petioles 2.5 - 4 cm long. Racemes ca 9 cm long, terminal or axillary, geniculate.

Flower-buds ca 2.5 x 0.8 cm. Calyx tube ca 1.5 cm long, ovoid, obovoid to funnel-shaped, slightly angular, glabrous. Corolla lobes 2.5 - 4 cm long, stellate-tomentose outside. Stamens ca 30, longer than style; filaments short; anthers linear, connective produced into a bristle. Ovary ovoid-conical, tapering into a slender stylopodium; styles slender, filiform, tomentose on the basal half. Fruit almost globose or broadly ovoid-conical, smooth without ribs or striations, two longer lobes of fruiting calyx ca 16.5 x 2.3 cm, narrowly spatulate, obtuse, strongly reticulated, three shorter lobes ca 2.2 x 1 cm, ovate to orbicular, constricted at base.

*Fl.* Nov. - Jan.; *Fr.* Feb. - May.

*Distrib.* India: One of the principal constituents of the upper storey in tropical evergreen and semievergreen forests, usually on well drained alluvial soils in valleys and hill tops. Assam and Andaman & Nicobar Islands.

Bangladesh, Myanmar, Thailand and Malesia.

*Notes.* The white resin obtained from the bark is characteristic of the species. Ashton (in *Fl. Males.* 1, 9(2): 302. 1982) mentions that this species was confused in the past with *D. baudii* Korthals, a species of Cochin-China, Cambodia, Myanmar, Thailand and Malesia. However, the longer tomentum on vegetative buds, exterior of the stipules, twigs, petioles and inflorescence, and in general, larger size of all parts, almost glabrous, elliptic to elliptic-ovate leaves with acute tip and the oblong fruit wings abruptly constricted at the base in the latter species distinguishes it from *D. gracilis* Blume. Smitinand *et al* (in *Thai For. Bull.* 12: 36. 1980) state that the "this species is closely allied to the Malesian species, *D. chartaceus* Sym. with which it is often reported to grow but can be distinguished easily from the latter by its narrow wings, nearly cuneate towards the base and the tawny pilose-tomentose twigs".

Wood used for general construction purposes, especially for interior works and also as sleeper wood after treatment. Oleo-resin is used in the treatment of of urino-genital diseases.

**5. *Dipterocarpus grandiflorus*** (Blanco) Blanco, *Fl. Filip.* ed. 2, 314. 1845; Griffith, *Not. Pl. Asiat.* 4: 515. 1854. *Mocanera grandiflora* Blanco, *Fl. Filip.* ed. 1: 451. 1837. *Dipterocarpus griffithii* Miq., *Ann. Mus. Lugd.-bat.* 1: 213. 1864; Dyer in *Fl. Brit. India* 1: 299. 1874.

And.: *Gurjan*; Eng.: *Long leaf Gurjan*.

Trees, ca 50 m tall; trunk 5 m in girth, hardly buttressed; bark light grey, peeling off in strips; branchlets, leaf bud, outer surface of stipules, parts of petals exposed in bud and top portion of ovary densely, pale buff pubescent, parts otherwise glabrous. Leaves 12.5 - 24 x 7.5 - 15 cm, elliptic-ovate to broadly ovate, rounded or sometimes subcordate

at the insertion of petioles, shortly acuminate at apex; lateral nerves 12 - 20 pairs; petioles ca 8 cm long, slender, shallowly grooved, canescent becoming glabrous at maturity; stipules ca 17.5 x 3.7 cm, oblong-lanceolate, subacute. Racemes axillary, 2 - 4-flowered, usually simple, sometimes branched, occasionally reduced to a single flower; rachis 7 - 15 cm long, peduncle 2.5 - 3.8 cm long in solitary flowers, glabrous or clothed with yellowish-brown scales. Calyx tube 1.5 - 2.2 cm long, more or less 5-winged, glabrous, 3 longer lobes 4 - 7 cm long, linear-spathulate, obtuse, faintly reticulate, wavy, more or less reflexed, 2 smaller lobes 2.5 - 3.8 cm long, oblong to deltoid. Petals 3.7 - 5 cm long, mealy outside. Stamens 27 - 30, longer than style at anthesis; filaments ca 4 mm long, compressed, connective produced into 5 mm long bristle. Ovary tapering into a short, stout, columnar style, densely tomentose; style ca 1.1 cm long, glabrous in upper half, puberulent in lower half. Fruits ca 6 x 2.5 cm when mature, oblong or ellipsoid, usually with 5 wings; two accrescent calyx lobes (wings) 15 - 22 x 4.5 cm, obtuse, reticulate with 3 parallel nerves, glabrous; three shorter lobes ca 2 x 1.5 cm.

*Fl.* Jan. - Feb.; *Fr.* April - June.

*Distrib.* India: Fairly common in upper hill slopes on rich loamy soils close to sea. Andaman & Nicobar Islands (Andaman Islands).

Myanmar and Malesia (Malaysia, Indonesia and Philippines).

*Notes.* In Andaman Islands this species grows in association with *D. kerrii* King and *D. gracilis* Blume as a conspicuous component of the mixed evergreen forest. During November - December the tree sheds its leaves and after a short leafless period, new flushes appear from December to early February. The indumentum on the shoots and the buds, size and shape of the leaves and fruits and length of the enlarged fruiting calyx (wings) have been observed to vary in this species.

Wood widely used as a plywood timber and for temporary construction work, also used as scantlings and plankings and for packing cases. The oleo-resin obtained from the wood is used in varnish industry.

6. *Dipterocarpus indicus* Beddome, Fl. Sylv. t. 94. 1871; Rama Rao in For. Pl. Travancore 34. 1914; Gamble, Fl. Pres. Madras 81. 1915. *D. turbinatus* auct. non Gaertn. f. 1805; Dyer in Fl. Brit. Ind. 1: 295. 1874, p.p. Fig. 55.

Kan.: Yennemara, Banasampa, Dhuma, Challenne, Kallenne; Mal.: Kalpayin, Vavan-gu, Velayani; Tam.: Ennei.

Evergreen trees, ca 40 m tall; bole straight, ca 20 m long, cylindrical, ca 4.5 m in girth; wood light red to greyish-brown, moderately heavy, fine-textured; young shoots short adpressed tomentose. Leaves 12 - 25 x 6.2 - 17.5 cm, ovate, truncate-cordate at base, acute at apex, entire; lateral nerves 10 - 15 pairs. Flowers white, fragrant, ca 7.5

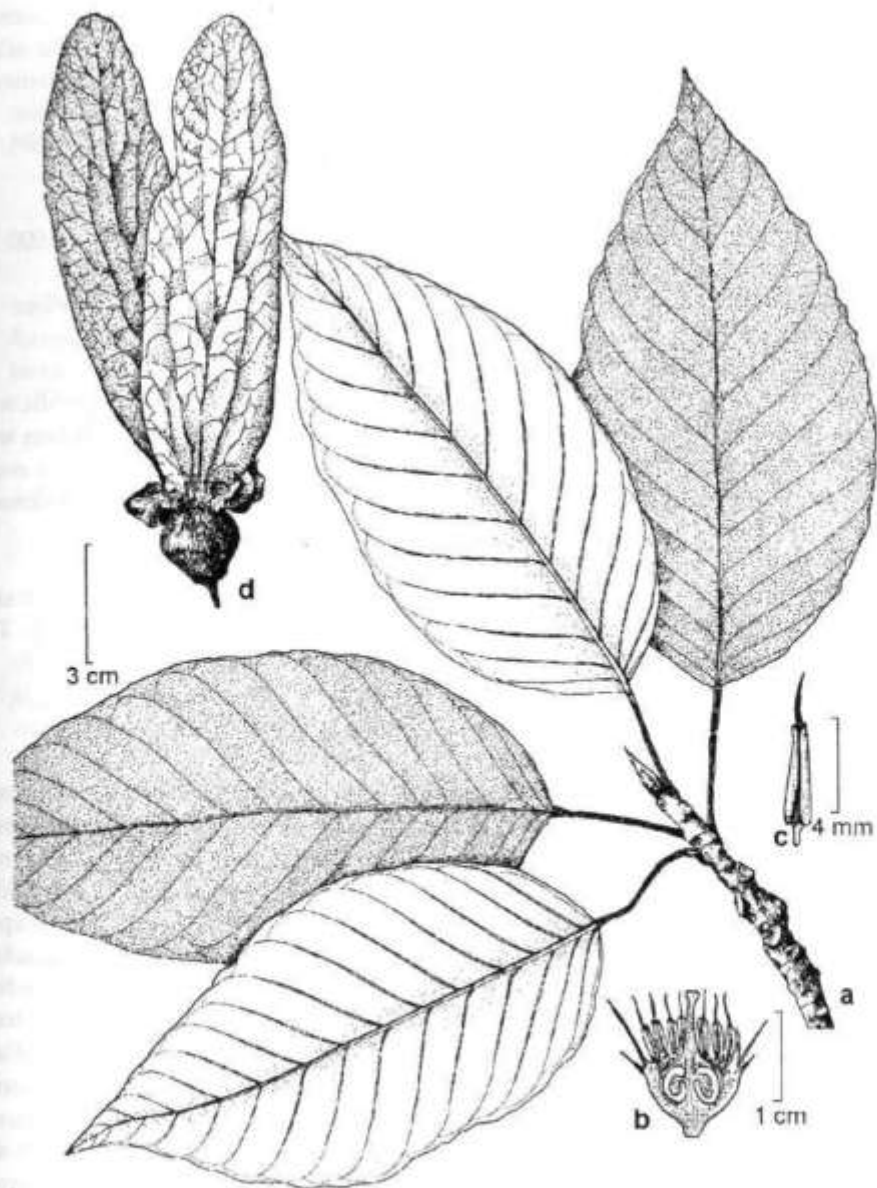


Fig. 55. *Dipterocarpus indicus* Beddome : a. twig with leaves; b. l.s. flower; c. stamen; d. fruit.

cm across, in axillary, 3 - 8-flowered racemes. Tube of fruiting calyx smooth, obconic, two enlarged lobes (wings) 7.5 - 14 x 3.5 cm, strongly 3 - 5-nerved, reticulate, three other lobes deltoid or orbicular, ca 1 cm across. Petals tinged with pink. Staminal filaments yellowish. Fruits brownish, 1.7 - 2.6 cm across, glabrous.

*Fl.* Dec. - March; *Fr.* April - July.

*Distrib.* India: In tropical evergreen and semievergreen forests, up to 1000 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* It closely resembles *D. turbinatus* Gaertn. f. and is considered conspecific with it by some botanists. *D. indicus* Beddome, differs from it in having smaller leaves with fewer pairs of lateral nerves, smaller flowers in usually branched racemes, a more globular fruit with shorter, more strongly 3-nerved wings and more or less densely stellate-scaly petioles, main nerves beneath and inflorescences.

Wood extensively used for house construction especially for interior works; for ship building, for making railway carriages, masts of boats and also in plywood industry. The oleo-resin is applied for treating rheumatic complaints.

#### 7. *Dipterocarpus kerrii* King in J. Asiat. Soc. Beng. 62: 93. 1893.

Trees, ca 40 m tall; bole ca 4 m in girth; branchlets slender smooth, slightly flattened at tips, glabrous, dark coloured, turning black on drying. Parts of petals exposed in bud, inside of stipules, and apex of ovary densely silky pubescent, parts otherwise glabrous. Leaves 7.5 - 15 x 3.7 - 7.5 cm, elliptic to elliptic-ovate or ovate-lanceolate, obtuse, rounded or cuneate at base, acute or very shortly and bluntly acuminate or cuspidate at apex, undulate or distantly crenate towards apex, glabrous on both surfaces, turn blackish brown or chocolate brown on drying, lateral nerves 9 - 16 pairs, obliquely ascending, prominent beneath; petioles 2.5 - 3.8 cm long, rather slender; stipules 3.8 - 6.3 cm long, glabrous outside, silky pubescent inside, turn black on drying. Flowers 2 - 5 in axillary, simple or branched spikes, the lowest flower often distinctly pedicelled and all appearing pedicellate due to contraction at the base of calyx. Calyx tube 1.2 cm long, glabrous or glaucous, three smaller lobes scarcely 2 mm long, rounded, two larger lobes ca 5 mm long, linear-oblong. Petals ca 2.5 cm long, linear-oblong, obtuse, finely stellate-tomentose outside, hoary inside. Stamens ca 33; filaments 5 mm long, flattened at base. Ovary small, ovoid, densely tomentose; styles 8 mm long, glabrous in upper two-fifth portion. Fruits 2.5 - 3.3 cm in diam. in the middle, blunt at apex, glabrous, much contracted beneath calyx lobes, shortly stipitate; two longer lobes of fruiting calyx 7.5 - 14 x 2.2 - 3.1 cm, linear-oblong or oblong-lanceolate, obtuse, glabrous, three shorter lobes ca 1 x 1 cm, suborbicular, subrevolute.



*Fl.* Jan. - Feb.; *Fr.* April - July.

*Distrib.* India: In tropical evergreen forests, usually on hill slopes and ridges in which out crops of igneous rocks of the serpentine type are predominating. Andaman & Nicobar Islands (S. Andaman Islands).

Myanmar, Indo-China and Malesia.

*Notes.* This species closely resembles *D. turbinatus* Gaertn. f. from which it can be easily distinguished by its smaller leaves and larger nuts. It is also closely related to *D. hasseltii* Blume, a Malayan species, but the silky tomentose inner side of stipules enables to easily distinguish it from the latter species in which it is totally glabrous.

Wood used for internal construction work.

**8. *Dipterocarpus mannii* King ex Kanjilal, et al., Fl. Assam 1: 133. 1934.**

*Asm.: Hollong, Holong.*

Trees, ca 50 m tall; bole ca 6.5 m in girth, cylindrical; branchlets terete, softly grey velvety pubescent. Leaves 17.5 - 30 x 10 - 17.5 cm, elliptic, ovate or oblong, rounded or slightly cordate at base, shortly acuminate at apex, repand or shallowly crenate, glabrate except for sparsely hairy midrib above, softly stellate-pubescent on nerves beneath; lateral nerves 16 - 22 pairs, prominent beneath; petioles 3.3 - 5 cm long, rather stout, stellate-pubescent; stipules 10 - 13.8 x 1.8 cm, lanceolate, silky stellate-pubescent outside, glabrous inside. Flowers subsessile, 2 - 5 in ca 7.5 cm long, axillary panicles. Calyx tube 1.3 cm long and almost as broad at mouth, silky inside; smaller lobes broadly triangular with a thin, recurved margin; larger lobes ca 18 x 4 mm, brown felted. Petals ca 5.5 x 1.3 cm, oblanceolate or strap-shaped, membranous, tufted pubescent on exposed parts outside, sparsely puberulous inside. Stamens 25; filaments ca 3 mm long, dilated; connective elongated into a bristle-like appendage. Ovary ca 4 mm in diam., globose, brown silky, tapering into 1.2 cm long style, clothed with silky hairs. Fruits ca 3.8 cm long and ca 3.2 cm in diam., densely silky outside; fruiting calyx globose with a somewhat constricted neck, smaller calyx lobes ca 2 cm long, globose, erect, with recurved margins, larger lobes 17 - 23 x 2.7 - 4.3 cm, longitudinally 3-nerved with distinct reticulations.

*Fl.* June - July; *Fr.* July - Aug.

*Distrib.* India: In hilly areas and tableland. Assam (Sibsagar and Lakhimpur districts); rare.

Endemic.

9. *Dipterocarpus retusus* Blume, Catalogus 77. 1823. *D. macrocarpus* Vesque in Compt.-Rent. 78: 627. 1870.

Asm.: *Hollong, Holong, Dhuliya gurjan, Dholi gurjan*; Eng.: *Hollong*.

Trees, ca 50 m tall; bole cylindrical, ca 5.5 m in girth; bark pale bluish-grey outside, smooth with large, raised tubercles at the base of stem, reddish-brown inside, 1.7 - 2.2 cm thick; branchlets, panicles, calyx and corolla outside densely buff puberulent or glabrous; petiole, vegetative bud and ovary rufous silky tomentose or glabrous. Leaves 15 - 25 x 10 - 15 cm, elliptic to elliptic-obovate, rounded at base, abruptly acuminate or cuspidate at apex, repand or corrugate, membranous, densely brown ciliate with fascicled hairs; lateral nerves 18 - 25 pairs, tertiary nerves transverse, subparallel with reticulations in between; petioles ca 5 cm long, sparsely pilose; stipules 7.5 - 12.5 cm long, membranous, densely pilose outside with long fascicled hairs, glabrous and punctate inside with the bases of the outside hairs. Flowers 3 - 6 in ca 7.5 cm long, axillary spikes. Calyx tube ca 1.5 x 1.3 cm at the mouth, turbinate, velvety puberulous outside, silky pubescent inside, three shorter lobes ca 2 mm long, deltoid-triangular, erect, two enlarged lobes 20 - 25 x 3 - 5 mm, strap-shaped, coriaceous, velvety. Corolla lobes falcate, oblanceolate, membranous, especially towards tip and margins, faintly longitudinally nerved, glabrate inside, stellate-puberulous in close, horizontal bands outside except on overlapped parts. Stamens 30, longer than style at anthesis; filaments filiform, dilated at base; anthers 5 - 8 mm long, linear-oblong, tapering, connective appendage ca 4 mm long, subulate. Ovary 6 x 4 mm, ovoid, silky pubescent, obscurely longitudinally ribbed; styles ca 1.5 cm long, longitudinally ribbed, silky hairy in the basal two-thirds portion. Fruit ca 5 x 4.2 cm, calyx tube glabrate and minutely punctate with stellate bases of fallen hairs; 3 smaller lobes of fruiting calyx ca 2 x 1.5 cm, orbicular ovate or ovate-elliptic, obtuse, subrevolute, 2 enlarged lobes 15 - 27 x 3.7 - 5 cm, tapering abruptly, ca 1.3 cm wide at base, leathery, puberulous, reticulately veined with 3 strong main nerves.

*Fl.* June - Nov.; *Fr.* Aug. - March.

*Distrib.* India: In tropical wet evergreen forests up to 1000 m. West Bengal (Northern parts) Assam, Arunachal Pradesh and Nagaland.

Thailand, Indo-China and Malesia (Java and Malay Islands)

*Notes.* It grows gregariously in the forests of Sibsagar and Lakhimpur in Assam. The distribution, density and persistence of the tomentum is very variable even within a single population.

This species is reported to be closely allied to *D. baudii* Korthals (in habiting the lowland Dipterocarp forests in Burma, Thailand, Cambodia and S. Vietnam), but can be

easily distinguished from the latter by its glabrous mature leaves and with marked ridges between the lateral nerves.

A well-known plywood species of Eastern India. Wood used for making tea chests, packing cases and for making railway sleepers after treatment.

**10. *Dipterocarpus turbinatus*** Gaertn. f., Suppl. Carp. 3: 51, t. 188, f. 1. 1805; Dyer in Fl. Brit. India 1: 295. 1874, p.p.

Asm.: *Kherjong, Kural Sal, Kuroil Sal, Tellya garjan, Tilia garjan*; Beng.: *Teli garjan, Kali garjan, Shweta gurjan*; Eng.: *Gurjan, The Gurjan oil tree*.

Trees, ca 45 m tall; bole clean, cylindrical, 2 - 5 m in girth; bark ca 3.8 cm thick, hard, rough and fibrous; branchlets terete or occasionally flattened with marked lenticels, whitish and glabrous or sometimes covered with minute, stellate hairs, often pubescent just below the scars of stipules. Leaves 12 - 36 x 5.5 - 15 cm, ovate or ovate-lanceolate to elliptic or elliptic-oblong, rounded or slightly cordate to rarely cuneate at base, acute or acuminate at apex, sinuate-crenate or entire, glabrous on both surfaces, glossy above, on drying slate brown; lateral nerves 10 - 20 pairs, straight; petioles 2.5 - 5 cm long, canescent to glabrous; stipules ca 5 cm long, buff tomentose. Flowers white or yellow with pink tinge, 3 - 3.5 cm long, 3 - 7 in spikes arising from the axils of fallen leaves. Calyx tube 1 - 1.3 cm long, campanulate or obconic, glabrous or pruinose; three shorter lobes ca 2 mm long, ovate to rounded, two longer lobes ca 1 cm long, linear-oblong, glabrous. Petals 2.5 - 3 cm long, linear, softly pubescent outside. Stamens ca 30; filaments ca 4 mm long, flattened; anthers ca 5 mm long; connective produced into a 4 mm long bristle. Ovary tapering towards apex, densely pilose. Fruits 3 - 3.8 cm long and 2 - 3 cm in diam. at belly, produced into a short stalk at base; wings 11 - 17.5 x 2.5 - 3.5 cm, linear-oblong to oblanceolate oblong, obtuse, pink, glabrous, more or less glaucous, strongly reticulate with 3 main nerves.

*Fl.* Jan. - March; *Fr.* May - June.

*Distrib.* India: In moist tropical evergreen forests on slopes and ridges of the hills at ca of 300 m. Assam, Meghalaya, Manipur, Tripura and Mizoram.

Bangladesh, Myanmar, Indo-China and Malesia.

*Notes.* It grows gregariously on the lower hills in Cachar, Khasi and Lushai in North-eastern India. The tree is leafless for a short period in December and new flushes appear along with flowers during January - March. Though reported by some botanists, its occurrence in the Andaman Islands is rather doubtful as many of the specimens from the Andaman Islands in the herbaria identified as this species are found to be *D. gracilis* Blume.

It closely resembles *D. retusus* Blume, but the glossy upper surface of its leaves even in dry state clearly distinguishes it from the latter species.

Wood used for temporary construction work, interior decoration, for making packing cases, dug-outs and railway sleepers after treatment. The wood oil is used for burning torches and for smearing on boats to prevent damage by molluscs. The tree is the main source of 'Gurjan oil' of Bengal. The oleo-resin is used as an external application for ulcers, ringworm and other cutaneous affections and also in the treatment of Leucorrhoea, Gonorrhoea and Gleet.

## 2. *Hopea* Roxb., nom. cons.

Resinous trees; trunk buttressed; bark at first smooth, remaining so or at length cracked and flaked or fissured. Leaves small or medium-sized, narrowly oblong with oblique base, coriaceous, often with hairy or pore-like domatia in the axils of lateral nerves; stipules small, linear, fugaceous, stipular scars inconspicuous. Flowers sessile or shortly pedicelled, ebracteate, in axillary and/or terminal, lax panicles of unilateral racemes. Calyx tube very short, during anthesis, adnate to receptacle, lobes densely stellate-tomentose outside, two outer ones longer, ovate, more or less obtuse, thickened, growing out almost immediately after anthesis, ultimately much longer than others, three inner suborbicular, often mucronate, thin along margins. Petals imbricate, oblong, fleshy, densely stellate-tomentose outside. Stamens 10 or 15, rarely numerous in 1-3 verticils or irregular, connate at base, falling with the petals; filaments subulate, outermost longer, inner most shorter and sterile; anthers short, medifixed, apiculate portion of connective very thin. Ovary 3-locular, ovules many in 2 rows in axile placentation; styles short, cylindric; stigmas thick. Fruit nut-like, globose, fibrous, 1-seeded, tightly enveloped by the base of accrescent calyx lobes, 2 of which develop into linear wings.

Tropical Asia from India and Sri Lanka eastwards to New Guinea and the Lousiade archipelago, ca 110 species; 11 in India.

### KEY TO THE SPECIES

- |   |                      |
|---|----------------------|
| 1a. Panicles tomentose  | 2                    |
| b. Panicles glabrous (sometimes minutely puberulous in <i>H. erosa</i> )  | 5                    |
| 2a. Leaves glabrous above, pale yellow or silvery (densely minute lepidote) beneath; corolla lobes fimbriate at apex                                  | 4. <i>H. helferi</i> |
| b. Leaves not as above, glabrous on both surfaces (paler beneath in <i>H. parviflora</i> ); corolla lobes not fimbriate at apex                       | 3                    |
| 3a. Fruit belly covered with gummy resin; panicle hoary with minute, silky pubescence; anthers suborbicular, mature branchlets hoary                  | 11. <i>H. utilis</i> |
| b. Fruit belly not covered with gummy resin; panicles grey tomentose; anthers ovate or narrowly ellipsoid; mature branchlets glabrous or glaucouscent | 4                    |

- 4a. Petioles with a pore and a gland in axils; corolla lobes oblong, falcate, erose, ciliate at tip; leaf bases obtuse or broadly cuneate, unequal **6. *H. odorata***
- b. Petioles without a pore or gland in axil; corolla lobes lanceolate, obtuse, dilated and crispate at tip; leaf bases cordate or subcordate, equal **7. *H. parviflora***
- 5a. Corolla lobes bilobed **2. *H. erosa***
- b. Corolla lobes not bilobed; mostly obtuse (sometimes lacerate at the tip as in *H. shingkeng*) 6
- 6a. Domatia present in axils of leaf nerves 7
- b. Domatia absent in axils of leaf nerves 8
- 7a. Enlarged wings of fruit 2.5 - 3.2 cm wide, oblong or spatulate; leaf bases acute; lateral nerves of leaves 4 - 5 pairs, obliquely curved **9. *H. racophloea***
- b. Enlarged wings of fruit 1.8 - 2.5 cm wide, oblong or broadly elliptic; leaf bases rounded or cordate, lateral nerves 6 - 10 pairs, arcuate, prolonged, parallel to margins **1. *H. canarensis***
- 8a. Branchlets densely rufous pubescent; leaves obtuse or subacute at apex; lateral nerves 7 - 10 pairs **8. *H. ponga***
- b. Branchlets glabrous; leaves obtuse or caudate-acuminate at apex; lateral nerves not exceeding 9 pairs 9
- 9a. Calyx lobes broadly lanceolate, acute; corolla lobes obtuse or lacerate at apex; branchlets lenticellate; leaf bases somewhat oblique **10. *H. shingkeng***
- b. Calyx lobes ovate, obtuse; corolla lobes obtuse at apex; branchlets not lenticellate 10
- 10a. Flowers ca 6 mm long; leaves elliptic-oblong to oblong-lanceolate, obtusely acuminate at apex; lateral nerves 6 - 9 pairs **3. *H. glabra***
- b. Flowers not exceeding 3 mm long; leaves ovate, caudate-acuminate; lateral nerves 5 - 6 pairs **5. *H. Jacobi***

**1. *Hoepa canarensis*** Hole in Ind. For. 44: 575. 1918; Saldanha & E. Rao in Saldanha, Fl. Karnataka 1: 192. 1984.

Kan.: *Malai haiga*.

Trees, ca 20 m tall; trunk ca 2.5 m in girth; bark pale brown. Leaves 10 - 17 x 2 - 9 cm, ovate or oblong, obtuse or acuminate at apex, slightly undulate, coriaceous, glabrous on both surfaces; midrib and secondary nerves prominent below, tertiary nerves parallel, perpendicular to midrib, majority of the secondary nerves have large, glabrous, gland-like swellings in their axils. Panicles fascicled, axillary, glabrous; calyx lobes glabrous, two outer lobes 4 - 5 x 3 mm, ovate-oblong to deltoid, obtuse, three inner 2 - 3 mm long and as much wider, suborbicular, acute, sparsely minute hairy along margins towards apex. Petals 8 - 9 x 3 mm, falcate-oblong, contorted to left or right, exposed portion densely stellate-pubescent. Ovary glabrous or very minutely and sparsely puberulous above; stylopodium stout, ovoid or oblong, glabrous or very minutely and sparsely puberulous; styles short, cylindrical, glabrous. Fruits 1.2 - 1.5 cm long, ovoid; two enlarged lobes erect, 5 - 8 cm long, with 9 - 12 longitudinal nerves joined by cross veins, sometimes a third calyx lobes also gets slightly enlarged.

Fl. May; Fr. July.

*Distrib.* India: Western Ghats of Karnataka.

Endemic.

*Notes.* Attempts to collect this species even in the type locality have not been successful. So far no collections are made after type.

This species is closely allied to *H. racophloea* Dyer and *H. glabra* Wight & Arn. From the former, it differs by its leaves having more than 5 pairs of lateral nerves with rounded or cordate base, ciliate calyx lobes with two outer large and ovoid or oblong stylopodium, from the latter it differs in its larger leaves, glandular nerve axils, longer petioles and broader fruit wings.

2. *Hopea erosa* (Beddome) Slooten in Reinwardtia 3: 318. 1956. *Balanocarpus erosa* Beddome, For. Man. Bot. 237. 1873 & Fl. Sylv. t. 329. 1874; Gamble, Fl. Pres. Madras 84. 1915.

Mal. & Tam.: *Karakong*.

Evergreen trees, ca 25 m tall; trunk 1 - 1.5 m girth; bark smooth, thin; young twigs and petioles glabrous. Leaves 10 - 17 x 3 - 6 cm, oblong-lanceolate, rounded or subcordate at base, obtuse and emarginate or scarcely acute at apex, entire, glabrous on both surfaces; lateral nerves 12 - 14 pairs. Panicles fascicled, few-flowered. Flowers 5 - 6 mm long. Calyx lobes unequal, glabrous or slightly puberulous. Petals long, white silky outside, glabrous inside. Fruits 2.5 x 1.5 cm, ovoid or oblong, pointed; fruiting calyx segments truncated, smooth or subtuberculate.

*Fl. & Fr.* Oct. - Jan.

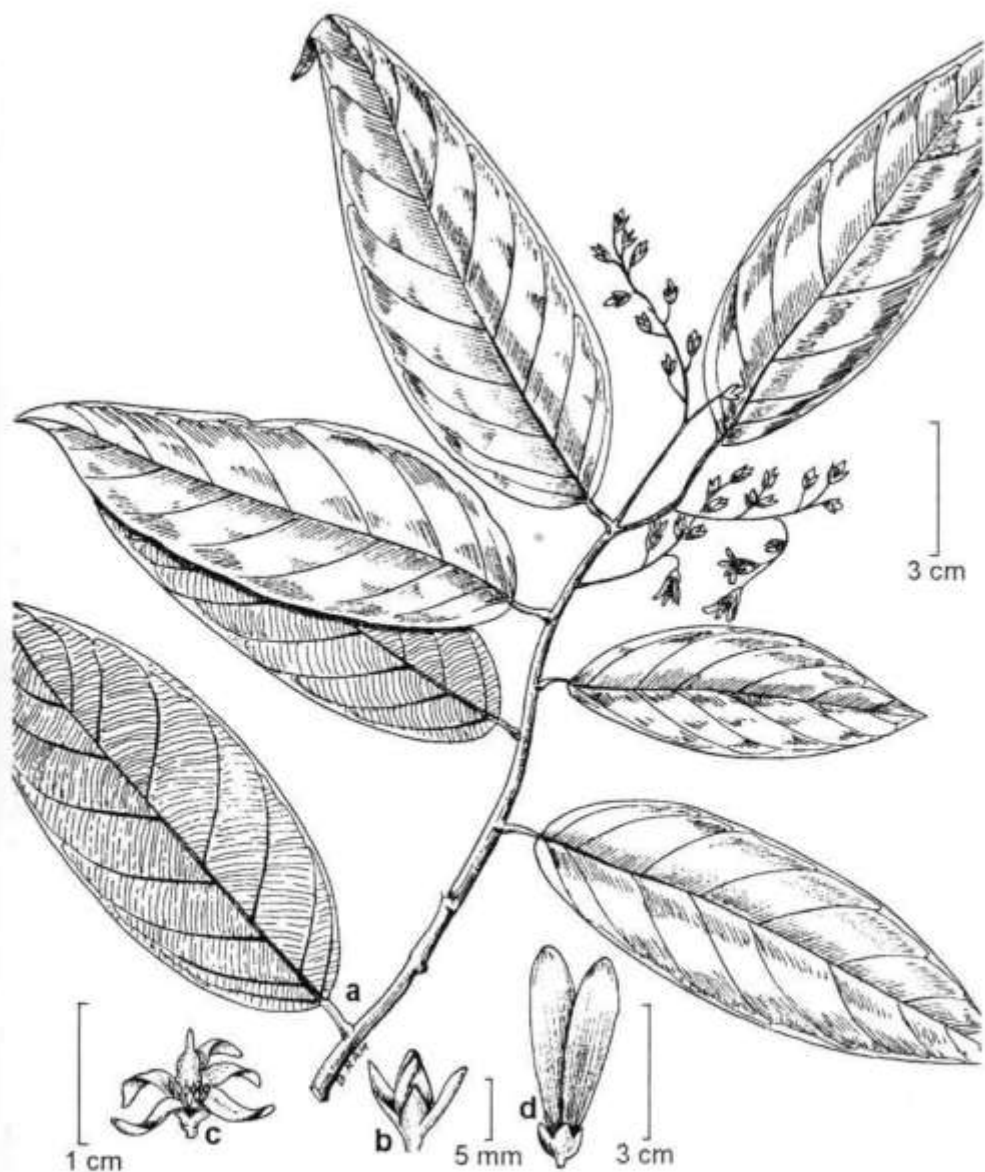
*Distrib.* India: Dry slopes Western Ghat forests at ca 600 m. Tamil Nadu (Tirunelveli) and Kerala.

Endemic.

3. *Hopea glabra* Wight & Arn., Prodr. 85. 1834; Dyer in Fl. Brit. India 1: 309. 1874. *H. wightiana* Wallich ex Wight & Arn. var. *glabra* (Wight & Arn.) Beddome, Fl. Sylv. t. 96. 1871. Fig. 56.

Mal.: *Trumbakam, Nai thambagam, Illa pongu*; Tam.: *Karu, Kongu, Kong*; Eng.: *Hopea*.

Trees, ca 7 m tall; trunk ca 1.5 m in girth buttressed at base; bark blackish-brown to dirty red, flaking off leaving irregular marking, branchlets dark coloured, glabrous. Leaves ca 10 x 4 cm, lanceolate, acute to obtuse at base, obtuse to shortly acuminate at



**Fig. 56.** *Hopea glabra* Wight & Arn. : a. flowering twig; b. flower bud; c. flower; d. fruit.

apex, glabrous and shining on both surfaces, lateral nerves ca 8 pairs, oblique, parallel to margins, prominent above; petioles ca 2 cm long. Panicles axillary and terminal, often 1 - 3 together, as long as or longer than leaves, glabrous. Flowers creamy-yellow, ca 6 mm long; bracts 4 mm long, lanceolate, obtuse. Calyx glabrous. Petals 5, slightly puberulous outside and ciliate. Stamens 10 - 15; anthers orbicular, with appendages ca 3 times longer than anthers. Ovary and stylopodium puberulous; styles glabrous. Fruit ca 1.8 cm long, ovoid or ellipsoid, pointed, smooth; two longer wings ca 6.5 x 1.5 cm, linear-oblong, 7-nerved with prominent transverse veins, reddish, glabrous, three smaller ones ca 6.8 cm long.

*Fl.* Jan. - March; *Fr.* June - July.

*Distrib.* India: In Western Ghats along streams. Karnataka, Tamil Nadu (Tirunelveli) and Kerala.

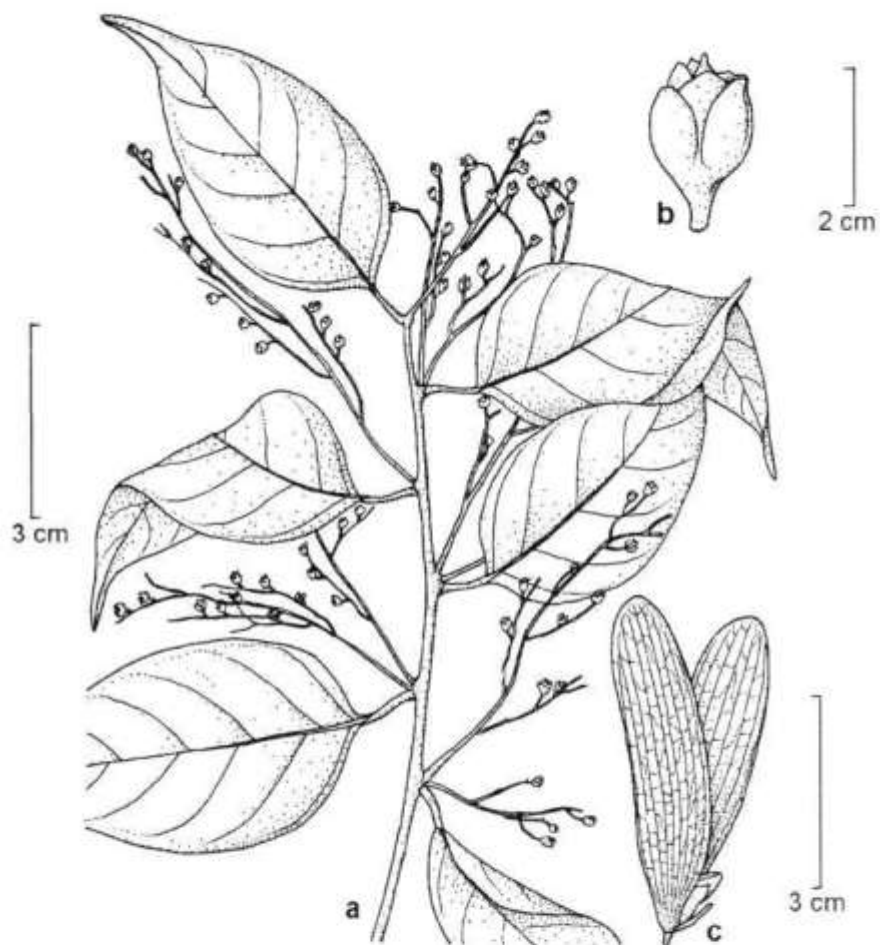
Endemic.

4. *Hopea helferi* (Dyer) Brandis in J. Linn. Soc. (Bot.) 31: 62, t. 2, 1895 & Indian Trees 67. 1921. Balakr. & N.G. Nair in Bull. Bot. Surv. India 24: 28. 1983. *Vatica helferi* Dyer in Fl. Brit. India 1: 302. 1874.

Large trees, ca 40 m tall; trunk ca 3.6 m in girth, buttresses sometimes large and coarse, blaze pinkish; bark reddish-brown, smooth, peeling off in flakes; branchlets purple black, pale fugaceous tomentose towards tips, becoming ribbed along leaf traces; young shoots, buds, petioles, leaf nervation beneath, stipules, panicles and outside of perianth densely buff-puberulent. Leaves ca 24 x 8 cm, oblong or elliptic-oblong, cuneate to occasionally cordate and usually subequal at base, broadly short acuminate or obtuse at apex, coriaceous, midrib slightly depressed above, strongly elevate-striate, fugaceous-tomentose beneath; lateral nerves 12 - 16 pairs, ascending, obscure above, prominent beneath; petioles 5 - 11 mm long, rugose, channelled above, turning black and glabrous when mature; stipules ca 9 mm long, early caducous, scars obscure. Panicles ca 12 cm long, terminal, subterminal or axillary, ultimately laxly branched; branchlets bearing 4 - 12 secund, cream-coloured flowers. Two outer calyx lobes ovate-oblong or lanceolate, subacute, tomentose except basal portion, three inner lobes shorter, ovate, acute or subacuminate, tomentose outside. Petals pale yellow, elliptic-oblong, tomentose on portion exposed in bud. Stamens 15, three appressed to each petal. Ovary and stylopodium cylindrical, subtruncate; styles shorter than ovary and stylopodium. Fruit belly 10 x 7 mm, ovoid, apiculate, striate, glabrous, shining, green when young, brown when dry, fruiting pedicels 2 - 3 mm long, slender, pale tomentose; fruiting calyx appressed to the base of nutlet, two longer lobes ca 6.5 x 1.8 cm, narrowly oblong or oblanceolate, obtuse, light brown, shining, glabrous, puberulous at base, 7 - 9-nerved, three shorter lobes 5 x 3 mm, ovate, acute, puberulous outside.

*Fl.* Oct. - Feb.; *Fr.* Nov. - April.





**Fig. 57.** *Hopea jacobi* C.E.C. Fischer : a. flowering twig; b. flower; c. fruit.

*Distrib.* India: Common especially on undulating terrain in semievergreen forests, sometimes also on rocky hill slopes. Andaman & Nicobar Islands (Andaman Islands).

Myanmar, Thailand, Cambodia and Malesia.

*Notes.* The scaly bark and large, oblong leaves which are silvery lepidote on undersurfaces are characteristic of the species and thus distinguish it from other Indian *Hopea* species.

Wood used for general construction purposes.

**5. *Hopea jacobi* C.E.C. Fischer in Bull. Misc. Inform. 1932. 245. 1932. Fig. 57.**

Trees, glabrous except for petals; twigs slender, dark brown, becoming almost black on drying. Leaves 5.5 - 9 x 2.5 - 4 cm, rounded or obtuse at apex, entire, chartaceous; petioles 7 - 10 mm long. Panicles axillary or terminal, solitary or paired, branches up to 7-flowered. Calyx lobes ca 1.5 cm long, suborbicular, coriaceous, inner ones with thin margins. Corolla lobes 3 - 3.5 mm long, oblong, obtuse, minutely ciliate, puberulous outside. Stamens 15; anthers orbicular, flat; appendages subulate, ca 3 times longer than anther forming a fine straight arista. Styles short, pointed. Fruits not seen.

*Distrib.* India: Karnataka (Madikeri District) and Kerala (Silent valley); rare.

Endemic.

**6. *Hopea odorata* Roxb., Pl. Corom. 3: 7, t. 210. 1811 & Fl. Ind. 2: 609. 1834. Dyer in Fl. Brit. India 1: 308. 1874. Fig. 58.**

Hindi: *Safed Thingan*; Kan.: Bili tirupu, Kallurala; Mal.: *Urappimpasa*; Tam.: *Urappupicin*; Eng.: *Thingan*, *White Thingan*.

Evergreen trees, 30 - 40 m tall; trunk cylindrical, ca 4 m in girth; bark smooth, grey to dark brown, longitudinally furrowed, yellow or reddish inside, often exuding resin; branches spreading, branchlets drooping, smooth to rugulose, glabrous except when young; branchlets, panicles, vegetative buds, outside of sepals (in flowers) and petals densely puberulent. Leaves 6 - 15 x 3.5 - 5 cm, ovate-oblong to oblong-lanceolate, acute or obtusely acuminate at apex, entire or undulate; lateral nerves 9 - 12 pairs, prominent beneath, arched with prominent porous, saccate domatia in the axils of lower pairs, tertiary nerves sinuate-scalariform, slender, distinct; petioles 1 - 2 cm long. Flowers yellowish-white, very short pedicelled, rather small, sweet scented, in branched panicles of ca 12 cm long; branchlets up to 9-flowered. Calyx lobes unequal, ovate, obtuse, slightly pubescent, two outer lobes ca 4 mm long, lanceolate, obtuse or subacuminate, three inner short, broadly ovate, acute. Petals pale creamy yellow, ca 4 mm long, pubescent outside. Stamens 15; filaments slender, flattened at the base, tapering above; anthers



Fig. 58. *Hopea odorata* Roxb. : a. flowering twig; b. flower; c. petals with stamens; d. fruit.

oblong with appendages usually as long as anthers. Ovary ovoid, glabrous or punctate, gradually narrowed into a conical stylopodium and a long, cylindrical style. Fruits 3 - 6 x 5 - 8 mm, ovoid, apiculate, glabrous, green when young, reddish-brown when dry; the two enlarged wings ca 3.8 cm long, oblong or oblanceolate or broadly spatulate, obtuse at both ends, saccate at base, glabrous, greenish when mature, 7 - 11-nerved, 3 smaller lobes ovate, subacuminate, as long as fruit belly.

*Fl.* Feb. - April; *Fr.* May - June.

*Distrib.* India: Generally grows along the streams in tropical evergreen forests, often associated with other *Dipterocarpus* spp. Andaman & Nicobar Islands (Andaman Islands).

Sri Lanka, Bangladesh, Myanmar, Thailand, S. Vietnam, Cambodia, Laos and Malasia.

*Notes.* One of the most hygrophilous of all Dipterocarps. The pore-like domatia in the leaf axils is characteristic of this species.

This species closely resembles *H. parviflora* Beddome, but the two larger outer calyx segments, pubescence on outer side of petals, oblong or narrowly ellipsoid anthers and puberulous nature of stylopodium easily distinguishes it from the latter species.

Wood used for planking, general construction work, boat-building and for making dug-outs in Andaman Islands. The resin forms a second quality dammar and is used in the preparation of varnishes. The tannin obtained from the leaves, bark and wood is used for tanning certain qualities of leather. Bark used in medicine as an astringent; resin in powdered form is used as styptic and applied to wounds and sores.

7. *Hopea parviflora* Beddome, Fl. Sylv. t. 7. 1869; Dyer in Fl. Brit. India 1: 308. 1874.

Fig. 59.

Kan.: *Bogi mara*, *Bovige*, *Bovu mara*, *Sannele*, *Tirupu*, *Irupu*, *Kiral bogi*; Mal.: *Iripu*, *Kambagam*, *Irumbagam*, *Thambagam*; Mar.: *Kalhoni*; Tam.: *Kongu*, *Vellai kongu*, *Karan kongu*, *Konju*, *Nir kongu*, *Pongu*, *Agil*, *Irumbagam*; Eng.: *Iron Wood of Malabar*, *White Kongu*, *Hopea*.

Evergreen trees, ca 40 m tall; trunk 5 - 6 m in girth, with long, straight, cylindrical bole and a very dense, rounded crown in mature trees; bark light brown or greyish, mottled with white markings, smooth in young trees, somewhat rough and rusty brown in older ones; branchlets reddish-brown, glaucescent. Leaves ca 11.5 x 4.5 cm, ovate to oblong or ovate-lanceolate, acute or rounded at base, acute and apiculate or bluntly acuminate at apex, glabrous on both surfaces; lateral nerves ca 10 pairs, pale beneath, domatia present in the axils of nerves beneath; petioles 1 cm long, grooved above;

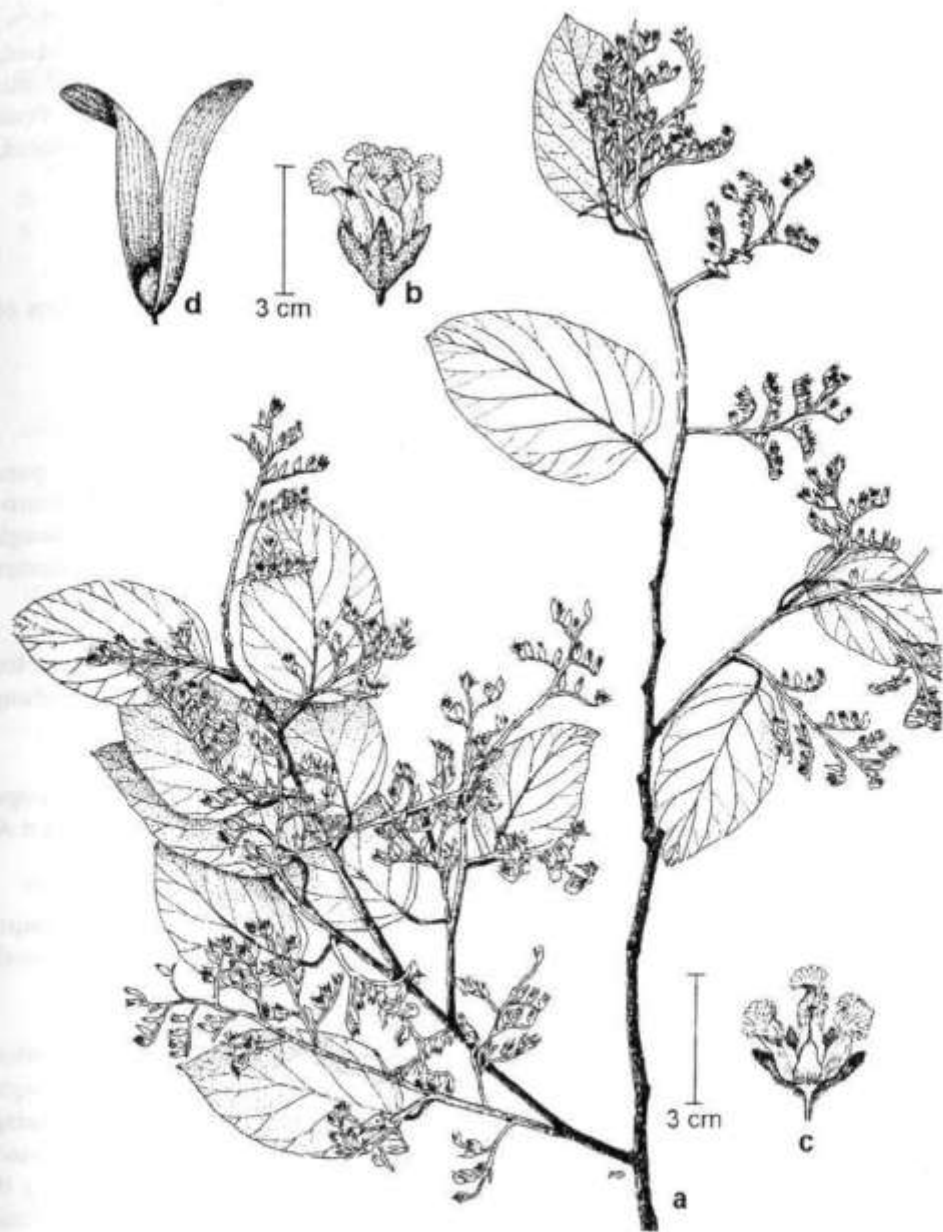


Fig. 59. *Hopea parviflora* Beddome : a. flowering part of branch; b. flower; c. flower with some petals and sepals removed; d. fruit.

stipules small, deciduous. Flowers shortly-pedicelled, small, fragrant, creamy yellow. Sepals lanceolate, obtuse, margins membranous, pubescent. Petals dilated, crisped, glabrous. Stamens 15 or rarely 10, slightly connate; connective of anthers produced into a subulate point, half a long as anthers. Ovary glabrous; styles short, subulate. Fruit belly 7 mm long; two larger calyx lobes 4.5 - 6 cm long, linear-oblong, straw-coloured, three smaller ones 7 mm long, linear.

*Fl.* Jan. - May; *Fr.* April - June.

*Distrib.* India: In tropical evergreen forests along streams and rivers in valleys of Western Ghats up to 1100 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* This species is endemic to the forests of Western Ghats, often forms pure patches especially in Madikeri district in Karnataka. A hygrophilous type of Dipterocarp thrives well at elevations ranging from almost sea level to ca 1100 m. Though evergreen, the tree loses some of its old leaves from December to April, new flushes come out simultaneously.

Wood used extensively in house construction, for planking, as piles for bridges, for making platform boards, agricultural implements, etc.; also used for making railway sleepers and electric poles. Bark used for tanning especially heavy quality leather.

**8. Hopea ponga** (Dennst.) Mabblerley in *Taxon* 28: 587. 1979. *Artocarpus ponga* Dennst. in *Schluessel Hortus Malab.* 15, 18, 30. 1818. *H. wightiana* Wallich ex Wight & Arn., *Prodr.* 85. 1834; Dyer in *Fl. Brit. India* 1: 309. 1874.

*Kan.:* Hiri bogi, Karehagalu, Bila hagalu, Kiriele bogi, Doddele bogi, Nai Iripu, Haiga, Kalbovu; *Mal.:* Pongu, Irumbagam, Nai thambagam. *Eyyakam*; *Mar.:* Kavsi, Kalthoni; *Tam.:* Ila pongu; *Eng.:* Thingam.

Evergreen trees, ca 30 - 40 m tall; trunk ca 2.5 m in girth, fluted and somewhat tapering; bark thin, smooth, dark coloured with prominent patches, exfoliating in large, rectangular plates, white or yellowish inside; branchlets softly pale pubescent becoming glabrous. Leaves 10 - 20 x 4 - 8 cm, ovate, oblong or oblanceolate, truncate at base, obtuse or acute at apex, glabrous or pubescent on nerves beneath; lateral nerves ca 10 pairs, obliquely curved, prominent above; petioles ca 1.5 cm long, stout, yellow tomentose; flowers creamy white with pink tinge, shortly pedicelled, 8 - 12 mm across, in copious, axillary, secund racemose panicles, often 2 - 3 together; bracts lanceolate, acute. Calyx lobes ovate, glabrous, two outer sepals obtuse and larger than acute inner ones. Petals 5 mm long, ovate-lanceolate or falcate-oblong, pubescent outside. Stamens 10 or 15, alternate filaments with two anthers; appendages of anthers filiform, 4 times longer than anthers. Ovary puberulous above; stylopodium glabrous. Fruit belly 1.3 cm

long, ovoid, apiculate, green turning red when mature, glabrous; two longer calyx lobes 5 - 7 x 1.3 - 1.5 cm, oblong-ovate, three smaller ones unequal, 8 - 12 mm long, ovate, acute.

#### KEY TO THE VARIETIES

- |   |                             |
|---|-----------------------------|
| 1a. Three inner calyx lobes distinctly serrate, ciliate | <b>8.1. var. cauveriana</b> |
| b. Three inner calyx lobes entire, not ciliate          | <b>8.2. var. ponga</b>      |

**8.1. var. cauveriana** Keshava. *et al.* in *Curr. Sci.* 56: 544. 1987.

Differs from the typical variety in the three inner calyx lobes having serrate and ciliate margins.

*Fl.* March

*Distrib.* India: Karnataka (along banks of Barapole river, Makut in Madikeri District).

Endemic.

**8.2. var. ponga**

*Fl.* March - April; *Fr.* May - July.

*Distrib.* India: Tropical evergreen and semievergreen forests of Western Ghats, especially along rivers, Maharashtra, Karnataka, Tamil Nadu (Tirunelveli) and Kerala.

Endemic.

*Notes.* The tree looks very beautiful when it gets covered with the reddish fruits towards the end of July.

Wood used for building construction; for posts, piles and for making cart wheels.

**9. Hopea racophloea** Dyer in *Fl. Brit. India* 1: 310. 1874. *H. malabarica* Beddome, *Icon. Pl. Ind. Or.* 42, t. 185. 1874.

Mal.: *Neduvalli Kongu*; Tam.: *Karung Kongu*.

Trees; bark blackish, peeling off in long strips from base upwards which become recurved and hang all around the trunk; young twigs, petioles, panicles and calyx glabrous. Leaves ca 11.5 x 6.5 cm, ovate, acute at base, shortly caudate-acuminate at

apex, glabrous on both surfaces with large domatia; petioles 1 - 3 cm long. Panicles 7.5 - 10 cm long, 2 - 4 clustered, axillary or terminal. Flowers yellowish-white with pink tinge, shortly pedicelled, sometimes secund, 8 mm long. Calyx lobes equal, spatulate, obtuse, glabrous, two outer ones ovate-acuminate, three inner smaller and pointed. Petals glabrous inside, hairy outside with a twisted, flattened appendage at apex. Ovary obconical; styles short, subulate; stylopodium nearly as long as ovary, cylindrical, slightly narrowed at base. Fruit belly glabrous, closely surrounded by the base of calyx; two outer calyx lobes 7.5 - 8.5 cm long, obtuse, with 7 - 11 longitudinal nerves, reddish, a third sepal occasionally somewhat enlarged.

*Fl.* April - May; *Fr.* May - Aug.

*Distrib.* India: In tropical evergreen forests of Western Ghats up to 1000 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes:* The peeled-off, recurved bark which hangs all around the trunk is characteristic of the species and gives a curious appearance to the tree.

**10. *Hopea shingkeng*** (Dunn) Bor in Ind. For. Rec. n. s. Bot. 2(3): 227. 1941. *Vatica shingkeng* Dunn in Bull. Misc. Inform. 1920: 108. 1920. **Fig. 60.**

Abor: *Shing-keng, Sing keng.*

Trees, 16 - 18 m tall; bark greyish-brown, thick, whitish when freshly cut; young branches dark brown, glabrous. Leaves 9 - 15 x 2.5 - 5 cm, oblong, elliptic-oblong, elliptic or lanceolate, chartaceous, dark green and glossy above, paler beneath; lateral nerves 7 - 8 pairs, ascending, depressed above, prominent beneath; petioles 1 cm long. Panicles axillary with ca 15 cm long branches, each branch bearing 4 - 10, shortly-pedicelled, rather distinct, secund flowers. Flowers ca 8 mm long. Petals glabrous outside. Petals ca 8 x 3 - 4 mm, subfalcate, twisted to the right, glabrous inside, outer margin and portion of outer surface densely short, appressed pubescent, prominently longitudinally nerved. Stamens 15 in 3 whorls of 5 each; connective of anthers produced into a slender awn. Ovary, stylopodium, style and stigma smooth and glabrous. Fruit belly 1.3 - 1.5 cm long, globose, shortly acuminate, tardily dehiscent or indehiscent; two outer calyx lobes ca 3 cm long, ovate, obtuse, striate, three inner lobes ca 1.5 cm long.

*Fl.* July - Oct.; *Fr.* Sept. - Oct.

*Distrib.* India: In low hills up to 160 m. Arunachal Pradesh (Abor hills).

Endemic.





Fig. 60. *Hopea shingkeng* (Dunn) Bor : a. flowering twig; b. petals with stamens.

**11. *Hopea utilis*** (Beddome) Bole in Kew Bull. 1951: 146. 1951. *Balanocarpus utilis* Beddome, For. Man. Bot. 237. 1873 & Fl. Sylv. t. 330. 1874; Gamble, Fl. Pres. Madras 84. 1915. *Hopea longifolia* Dyer in Fl. Brit. India 1: 309. 1874.

Tam.: Kong, *Karum kongu*; Eng.: *Black Kongu*

Lofty evergreen trees, ca 25 m tall; trunk 1.8 - 4.6 m in girth; bark smooth, dark brown, often with greyish patches; wood light olive-brown to pale yellowish-brown with white tangential lines (resin canals) at irregular intervals. Leaves 12.5 - 18 x 3 - 5 cm, linear-lanceolate, rounded or acutely attenuate at base, obtuse or subacute at apex, entire or slightly undulate; lateral nerves 10 - 12 pairs, oblique, tertiary nerves parallel, prominent on both surfaces, their axils often glandular; petioles ca 1.2 cm long. Panicles axillary, solitary or fascicled. Flowers yellowish-white, shortly pedicelled, secund, 3 mm long. Calyx lobes slightly connate at base, hoary outside. Petals oblong, obtuse, entire or crenulate at apex, pubescent. Stamens 15; filaments dilated at base; anthers suborbicular, appendages about half as long. Fruit belly ca 1.2 cm across, globose, pointed, shining, enclosed at the base of thickened and accrescent calyx lobes, ca 2.5 cm long, subacute, very tuberculate below.

Fl. March - June; Fr. July - Nov.

*Distrib.* India: On hill slopes close to streams, rivers and ravines in the West coast tropical evergreen and semievergreen forests up to 1000 m. Tamil Nadu (Hills around Tirunelveli, south of Courtallum) and Kerala.

Endemic.

*Notes.* Often associated with *Hopea parviflora* Beddome to which it is allied. When in flowers, it is scarcely distinguishable especially from the long leaved form of *H. parviflora*. 2 or 3 good seed years appear usually to be followed by 2 or 3 poor ones.

Wood used for general construction purposes, for making posts, beams, rafters, cart shafts and tool handles, etc.

### 3. *Shorea* Roxb. ex Gaertn. f.

Resinous trees; crown in mature trees large, hemispherical or dome-shaped; branchlets glabrous or pubescent. Leaves entire or repand, coriaceous; lateral veins subparallel; stipules large, coriaceous, persistent or small and caducous. Flowers secund, in axillary or terminal, lax, paniced cymes. Calyx tube very short, adnate to receptacle, lobes imbricate, free, three outer ones thicker, somewhat longer and narrower than two inner lobes, hairy. Petals 5, usually connate at base, sometimes free, hairy outside. Stamens 15 or 20 - 100; filaments applanate, more or less tapering; anthers subglobose, ovate or narrowly oblong, rarely linear, connective produced beyond anther,

lobes in the form of hairs. Ovary 3-locular with 2 ovules in each, glabrous or tomentose; styles subulate with or without a distinct stylopodium; stigmas entire or 3-lobed. Fruit indehiscent, nut-like or capsule, rarely 2-valved and dehiscent, closely surrounded by persistent, accrescent calyx lobes, three outer lobes are usually longer and broader than two inner ones or rarely all developed into 10-veined, linear wings, base of calyx lobes thickened, expanded and saccate; nut usually solitary, 1-seeded, with large, fleshy cotyledons.

Widely distributed in India, Sri Lanka, Bangladesh, Myanmar, throughout the mainland of S.E. Asia into Malay Peninsula, Indonesia and Philippines, ca 200 species; ca 4 in India.

*Literature.* As of family.

#### KEY TO THE SPECIES

- 1a. Stamens usually 15; appendage of the connective long, filiform and naked; ovary mostly glabrous; stylopodium absent 2
- b. Stamens 20 - 50; appendage of the connective usually ciliate, rarely eciliate, in the latter case thickened at base; ovary hairy, stylopodium present 3
- 2a. Young shoots, younger leaves and stipules usually glabrous; leaves elliptic-oblong, lateral nerves 12 - 16 pairs; calyx glabrous in flower, lobes ovate, acute; style as long as ovary 3. *S. roxburghii*
- b. Young shoots, younger leaves and stipules softly tomentose; leaves oblong-lanceolate to ovate, lateral nerves 16 - 19 pairs; calyx pubescent in flower, lobes lanceolate; style longer than ovary 1. *S. assamica*
- 3a. Peduncle and rachis densely tomentose; lateral nerves of leaves 12 - 15 pairs; petioles up to 2.5 cm long; stamens 50; wings of fruit 6 - 8 times longer than capsule 2. *S. robusta*
- b. Peduncle and rachis of the panicle hoary or nearly glabrous; lateral nerves of the leaves up to 12 pairs; petioles 2.5 - 5 cm long; stamens up to 30; wings of the fruit 2 - 3 times as long as the capsule 4. *S. tumbuggaia*

1. *Shorea assamica* Dyer in Fl. Brit. India 1: 307. 1874.

Fig. 61.

Asm.: *Mekoi*, *Mekai*, *Mekahi*; Eng.: *Makai*

Trees, ca 50 m tall; trunk ca 7 m in girth; crown spreading; bark light brown to reddish-brown, exfoliating in large flakes; branchlets dark coloured, pubescent and lenticellate. Leaves 5 - 18 x 3 - 7 cm, broadly elliptic or elliptic-oblong, rounded at base, shortly acuminate at apex, entire, glabrous and shining above, softly pubescent along midrib and nerves beneath, becoming glabrous at maturity; lateral nerves ca 17 pairs, parallel, rather prominent above; petioles 7 - 10 mm long, thinly pubescent. Flowers 1.2 - 1.5 cm long. Calyx tube very short; lobes 5 mm long, three outer lobes larger than inner two. Petals ca 1.3 cm long, white or creamy, somewhat unequal, falcate-oblong, velvety pubescent outside, glabrous inside. Ovary ca 4 mm long, ovoid, somewhat

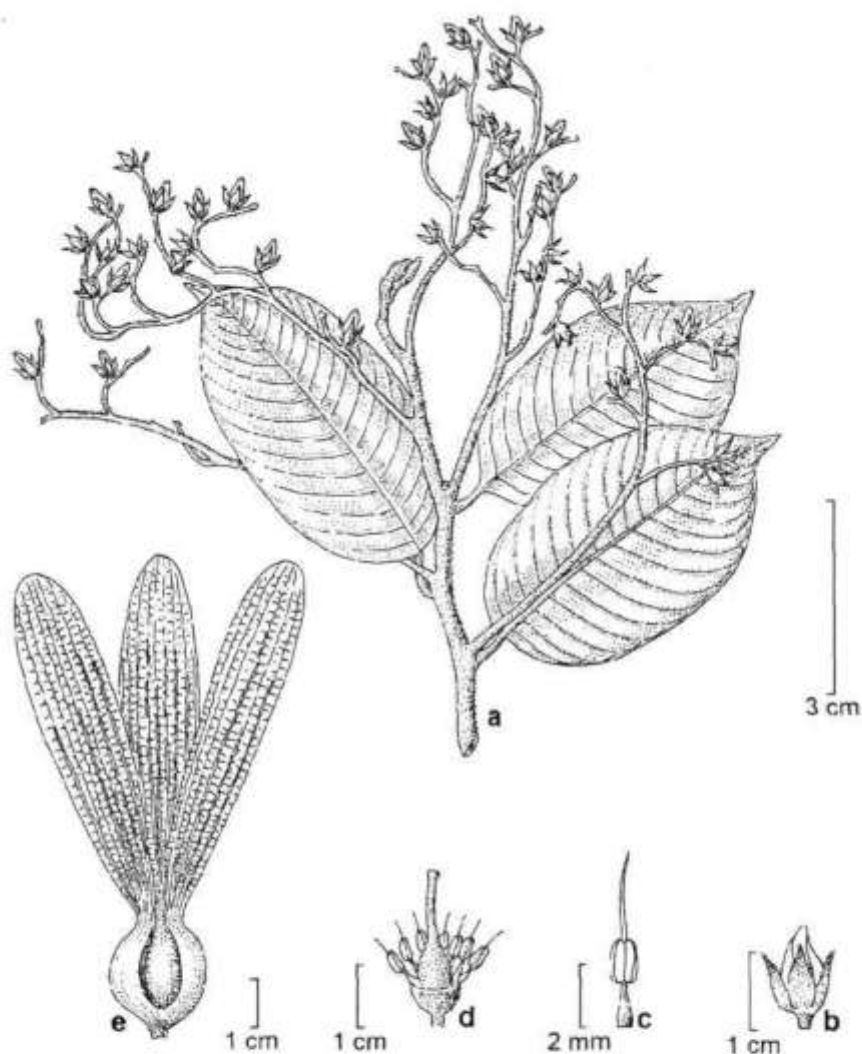


Fig. 61. *Shorea assamica* Dyer : a. flowering twig; b. flower bud; c. stamen; d. flower with sepals, petals and some stamens removed; e. fruit.

compressed; styles filiform with a few minute hairs near base. Fruit belly ca 2 cm long and 1.2 cm across, ovoid, acuminate, glabrous; three larger wings 6 - 12 x 0.8 - 2.5 cm, linear to linear-obovate, rounded to subacute, 8 - 12-nerved, shorter ones 4 - 5 cm long, broadly ovoid to spatulate, 5-nerved, glabrous and shining.

*Fl.* Aug. - Oct.; *Fr.* Nov. - March.

*Distrib.* India: In evergreen forests on slopes in valleys between 150 and 900 m. Assam (Sibsagar and Lakhimpur), Arunachal Pradesh (Tirap and Lohit) and Nagaland.

Myanmar, Thailand and Malaysia.

*Notes.* A well known species for commercial plywood in eastern India. Wood also used for general construction purposes, for making canoes, bus and truck bodies, furniture, veneers, etc. Mixed with other woods, it is also used for making paper pulp.

2. *Shorea robusta* Roxb. ex Gaertn. f., Suppl. Carp. 3: 48, t. 186. 1805; Dyer in Fl. Brit. India 1: 306. 1874. Fig. 62.

*Asm.:* Hal, Sal, Borsal; Beng. & Hindi: Sal, Sakhu, Shal; Guj. & Mar.: Ral, Rala; Kan.: Kabba; Kh.: Dieng-blei; Lep.: Taksal Kung; Mal.: Malppamarutu, Maramaram; Or.: Soringhi; Sal, Seral; Sans.: Shal; Santal: Sarjour; Tam.: Kungiliyam; Tel.: Gugal, Guggilamu, Thamba; Eng.: Sal or The Sal Tree.

Deciduous trees, ca 50 m tall; trunk ca 4 m in girth; crown spreading; bark reddish-brown or grey, smooth or longitudinally fissured; branchlets buff tomentose. Leaves 10 - 40 x 5 - 24 cm, ovate-oblong, rounded or cordate at base, very shortly acuminate ending in an obtuse point, glabrous and shining, coriaceous when mature, at first reddish or pinkish becoming dark green at maturity, lateral nerves ca 12 pairs, prominent beneath; petioles 2 - 2.5 cm long; stipules 8 mm long, falcate, densely covered with silvery peltate scales, caducous. Flowers yellow or creamy, subsessile, on ca 25 cm long, racemose panicles, branches unilateral and racemose. Calyx segments ca 2 mm long, ovate or triangular, densely yellowish pubescent. Petals 10 - 15 x 5 mm, lanceolate-acuminate, buff silky outside, almost glabrous inside, longitudinally 10 - 13-nerved. Stamens much shorter than petals; connective minutely trifid at apex. Ovary globose, pubescent; stigma tridentate. Fruit belly ca 1.5 cm long, ovoid, acute, densely pubescent; three larger wings ca 8 x 1.5 cm and two smaller wings ca 3.5 x 0.5 cm, oblong or spatulate, obtuse, 10 - 12-nerved, more or less pubescent.

*Fl.* Feb. - May; *Fr.* May - July.

*Distrib.* India: Terai region of tropical Himalayas from Himachal Pradesh to Assam and to Tripura, West Bengal, Bihar and Orissa, Eastern districts of Madhya Pradesh

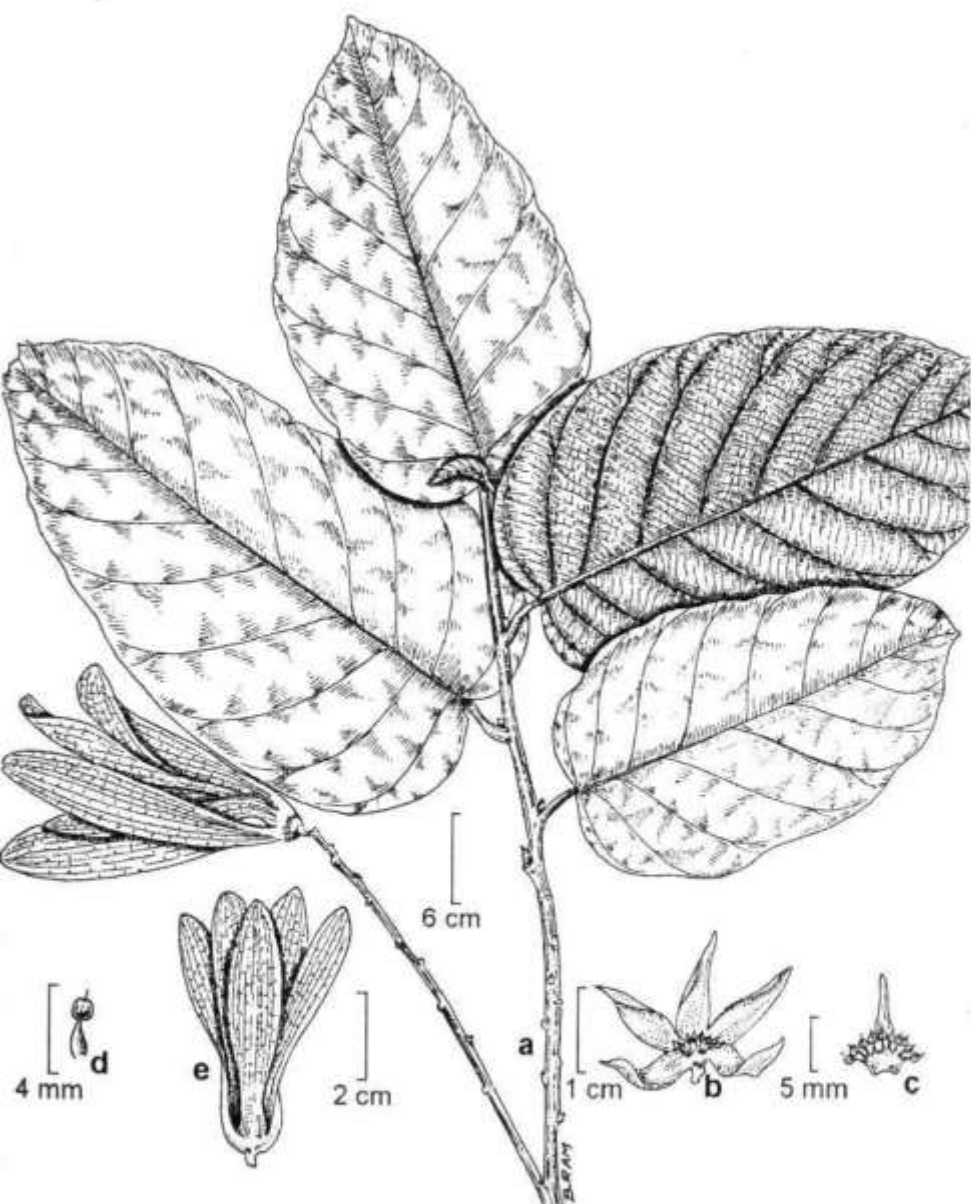


Fig. 62. *Shorea robusta* Roxb. ex Gaertn. f. : a. fruiting twig; b. flower; c. stamens and pistil; d. stamen; e. fruit.

extending further south to the Eastern Ghats in Andhra Pradesh up to an altitude of 900 m.

### Nepal and Bhutan.

*Notes.* One of the most gregarious Indian trees and under favourable conditions tends to regenerate in masses and grows up in more or less even aged crops of varying extent in which it is either pure or forms bulk of the stock mixed with other species. The inflorescence is reported to vary in its colour from pink, cream to light pink or pinkish cream depending on the age.

The Wood being strong and durable ranks next to teak and is one of the highly coveted constructional and domestic woods of North, East and Central India. It is considered as one of the best and is also used for making electrical transmission poles, agricultural implements, tool handles and in boat and ship building, etc. Oleo-resin is used in indigenous system of medicine, as an incense and as a hardening agent in making shoe polishes, carbon paper, typewriter ribbons etc. Tannin obtained from the bark, twigs, and leaves is used for tanning leather, paper, cellulose, etc. The fatty oil from the seeds (Sal butter) is used for cooking and lighting purposes. The tree is one of the primary hosts for 'tasar' silk worm.

3. *Shorea roxburghii* G. Don, Gen. Hist. 1: 813. 1831; Saldanha & E. Rao in Saldanha, Fl. Karnataka 1: 195. 1984. *S. talura* Roxb., Fl. Ind. 2: 618. 1832; Dyer in Fl. Brit. India 1: 304. 1874. *Vatica laccifera* Wight & Arn., Prodr. 84. 1834. *Shorea laccifera* (Wight & Arn.) Heyne ex Wallich in DC. Prodr. 16(2): 630. 1868. Fig. 63.

Kan.: *Jal, Jala, Jalari, Jalada, Jalaranda, Jhalla mara*; Mal.: *Talurum*; Tam.: *Kungili, Pinnamarom*; Tel.: *Talura, Talari*; Eng.: *Lac tree of S.India, Taloor Lac Tree*

Deciduous trees, ca 27 m tall; trunk ca 3 m in girth; bark light grey, fleshy, smooth or narrowly fissured; branchlets dark coloured, glabrous. Leaves ca 22 x 8.5 cm, elliptic or elliptic-oblong, rounded or subcordate at base, acute or obtuse or sometimes emarginate at apex, undulate, glabrous above, tomentose or glabrescent beneath, brownish-green when young, dark green at maturity; lateral nerves 12 - 15 pairs, slender, prominent beneath, tending to bifurcate near margin, secondary nerves slender, remote, subscalariform, midrib evident towards base, applanate to somewhat depressed above, prominent and terete beneath; petioles 1 - 4 cm long, somewhat swollen in the distal half. Flowers white or pale pink ca 2.5 cm in diam., in dense, slender, terminal or lateral, drooping, lax panicles. Calyx 4 mm long, tubular, glabrescent, whitish; lobes deltoid, acute, margins ciliolate, two inner ones subacuminate. Corolla ca 1.2 cm long, oblong-lanceolate. Stamens 15 in 3 whorls; filaments short; anthers ovate with a curved ca 2 mm long appendage. Ovary globose or ovoid, hairy; styles longer than the ovary. Fruit belly ca 2.5 x 1.5 cm, ovoid, glabrous, tapering above into a slender, remnant style;

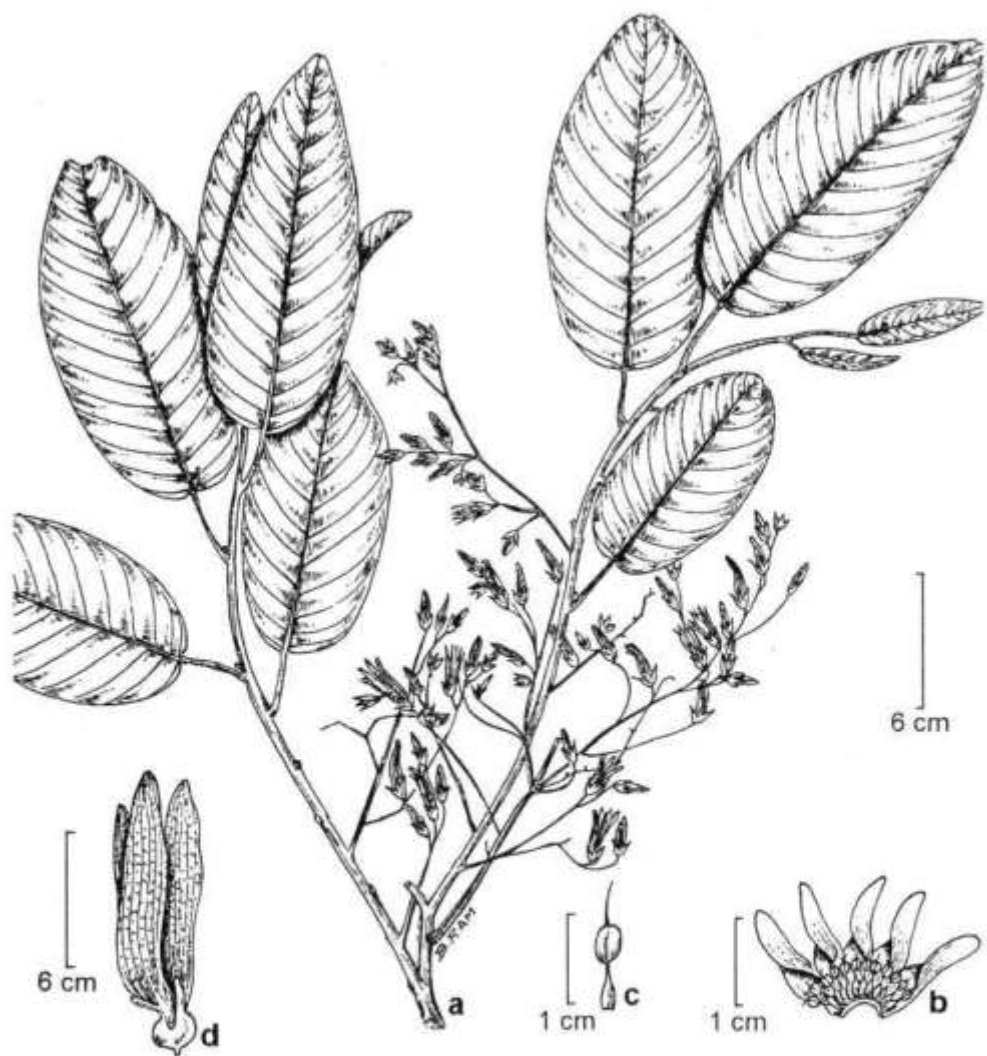


Fig. 63. *Shorea roxburghii* G. Don : a. flowering part of branch; b. petals with stamens; c. stamen; d. fruit.



three longer fruiting calyx lobes 9 - 11 cm long, spatulate, obtuse, saccate at base, with 7 - 10 slender, parallel veins; two shorter lobes ca 4.5 cm long, lorate.

*Fl.* Dec. - April; *Fr.* March - May.

*Distrib.* India: In dry deciduous forests and mixed evergreen forests up to 1000 m. Andhra Pradesh, Karnataka and Tamil Nadu.

Myanmar, Thailand, Indo-China and Malaysia.

*Notes.* An elegant tree often planted in Karnataka for its timber and also as a host tree for the lac insect. It is a xerophilous species of Dipterocarps adapted to rather rigorous conditions.

Wood used for general construction purposes such as beams, bridges, piles, etc.; also used for manufacture of rough furniture, agricultural implements, tool handles, etc. The tree is a valuable host for the lac insect (*Laccifera lacca*).

**4. *Shorea tumbergaia* Roxb.**, [Hort. Beng. 43. 1814, nom. nud.] Fl. Ind. 2: 617. 1832; Dyer in Fl. Brit. India 1: 306. 1874. *Vatica tumbergaia* (Roxb.) Wight & Arn., Prodr. 84. 1834. **Fig. 64.**

Mal.: *Tampakam*; Tam.: *Tambagom*, *Tambugai*, *Karuppu dammar*, *Kangu*, *Kungiliam*; Tel.: *Thamba*, *Guggilamu*, *Nalladammar*; Eng.: *Green Dammar Tree*.

Deciduous trees, up to 18 m tall; trunk ca 2 m in girth; bark dark brown, thick, rough, longitudinally fissured. Leaves 5.5 - 20 x 3.5 - 11.5 cm, ovate or oblong-cordiform, truncate or emarginate at base, acuminate at apex, glabrous on both surfaces; lateral nerves ca 8 pairs, prominent beneath; petioles 2 - 5 cm long, tomentose. Panicles terminal, ca 20 cm long, hoary or glabrous. Flowers shortly pedicelled, 1.5 cm long, fragrant; buds densely hairy. Corolla white, lobes attenuate upwards, softly hoary tomentose outside, glabrous and yellow inside. Staminal filaments dilated and more or less united at base; anthers with a hairy appendage. Stigma 3-lobulate. Fruit belly ca 2 cm long, ovoid, acuminate, pubescent; wings unequal, spatulate, obtuse, pubescent, three larger ones 3.5 - 4.5 x 1.5 cm, 8-10-nerved.

*Fl.* March - April; *Fr.* June - July.

*Distrib.* India: Andhra Pradesh and Tamil Nadu.

Endemic.

*Notes.* This species is distributed in Seshachalam and Veligonda hills in Cuddappah district and Tirupati hills of Chittoor district of Andhra Pradesh to North Arcot and

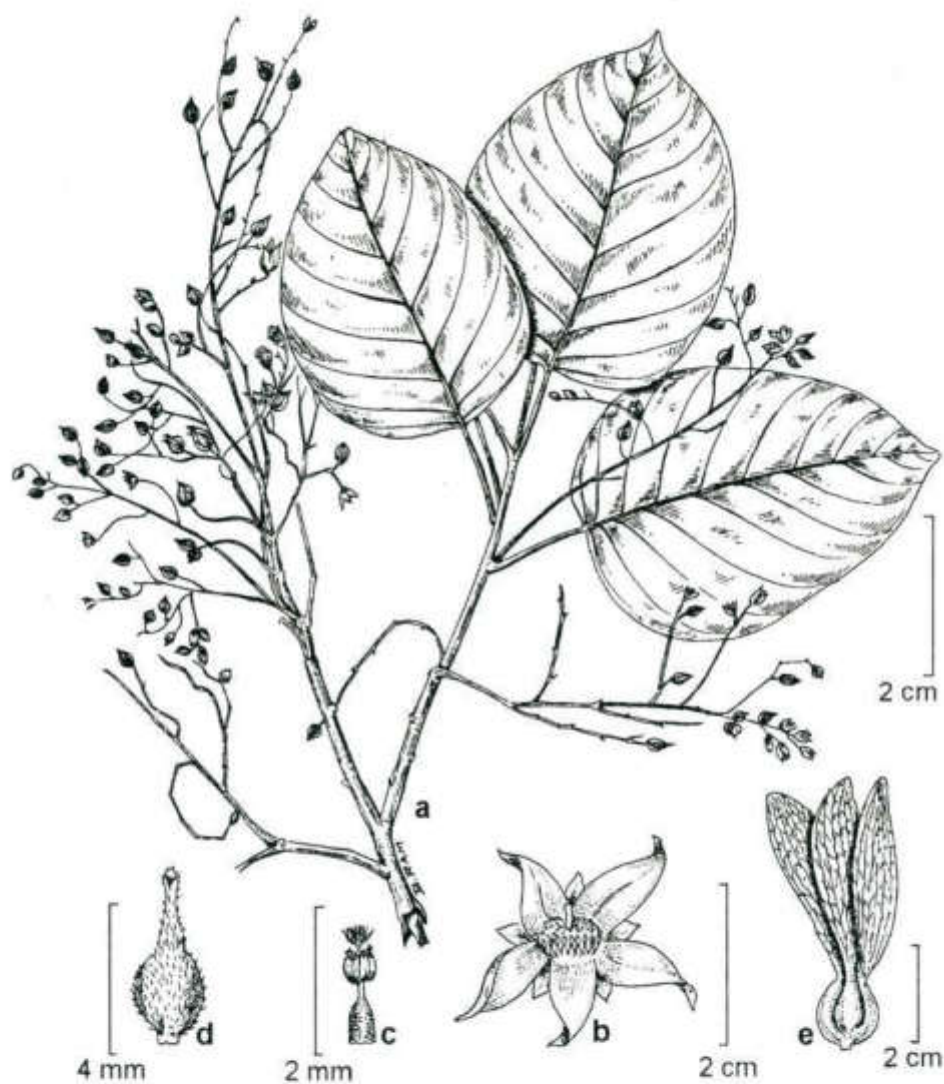


Fig. 64. *Shorea tumbuggaia* Roxb. : a. flowering twig; b. flower; c. stamen; d. pistil; e. fruit.

Chingleput districts of Tamil Nadu. The tree tends to become stunted on dry ridges and plateau.

Wood used extensively for construction work, especially for beams, posts, door and window frames and for making agricultural implements. Oleo-resin is used in the indigenous system of medicine as an external stimulant .

#### 4. *Vateria* L.

Evergreen, resinous trees; young shoots and inflorescences hoary, stellate-pubescent. Leaves coriaceous, feather veined; stipules narrow, deciduous, rarely large and persistent. Flowers pedicelled in terminal, lax, corymbose or lateral racemose panicles, panicles solitary or 2 - 3-fascicled. Calyx lobes imbricate, very shortly connate at base, persistent; lobes subequal, reflexed, scarcely enlarged in fruit. Stamens 15, rarely up to 55; anthers sessile or on very short filaments, linear or oblong, locules unequal, outer much longer, dehiscing longitudinally from apex to base, connective usually mucous. Ovary 3-locular, ovules 2 - 3 in each locule; styles subulate; stigmas minute, entire or shortly lobed. Capsules ovoid or subglobose, coriaceous, fleshy, indehiscent or 3-valved, 1-seeded, supported by reflexed, scarcely accrescent calyx. Cotyledons large, fleshy, unequal, lobed, enclosing the superior radicle.

Confined to S. India and Sri Lanka, 3 species; all 3 in India, 2 of them endemic to S. India.

#### KEY TO THE SPECIES

- 1a. Young branches and inflorescences densely dark fulvous tufted tomentose; stipules persistent, loosely clustered around the hidden apical bud; appendage of anther connective recurved 1. *V. copallifera*
- b. Young branches and inflorescences stellate-pubescent; stipules deciduous, not as above; appendage of anther connective straight 2
- 2a. Leaves acute or obtuse; lateral nerves 14 pairs; calyx lobes lanceolate, obtuse, hoary puberulous on both surfaces; corolla lobes elliptic-oblong, obtuse, hardly twice as long as sepals, sparsely pubescent outside; Capsules ovoid, ellipsoid or oblong, obtuse at apex 2. *V. indica*
- b. Leaves shortly acuminate; lateral nerves 16 - 20 pairs; calyx lobes triangular, acute, minutely sparsely pubescent outside; corolla lobes elliptic, minutely apiculate, about 4 times as long as sepals, glabrous on both surfaces; capsules ovoid, narrowed towards apex, slightly curved 3. *V. macrocarpa*

1. *Vateria copallifera* (Retz.) Alston in Trimen, Handb. Fl. Ceylon 6: 26. 1931. *Elaeocarpus copallifenus* Retz., Obs. Bot. 4: 27. 1786. *Vateria acuminata* Hayne, Getreue Darstell. Gew. 11: 5. 1830. *V. indica* Blume, Mus. Bot. 2: 29, t. 4. 1852, non L. 1753.

Fig. 65.

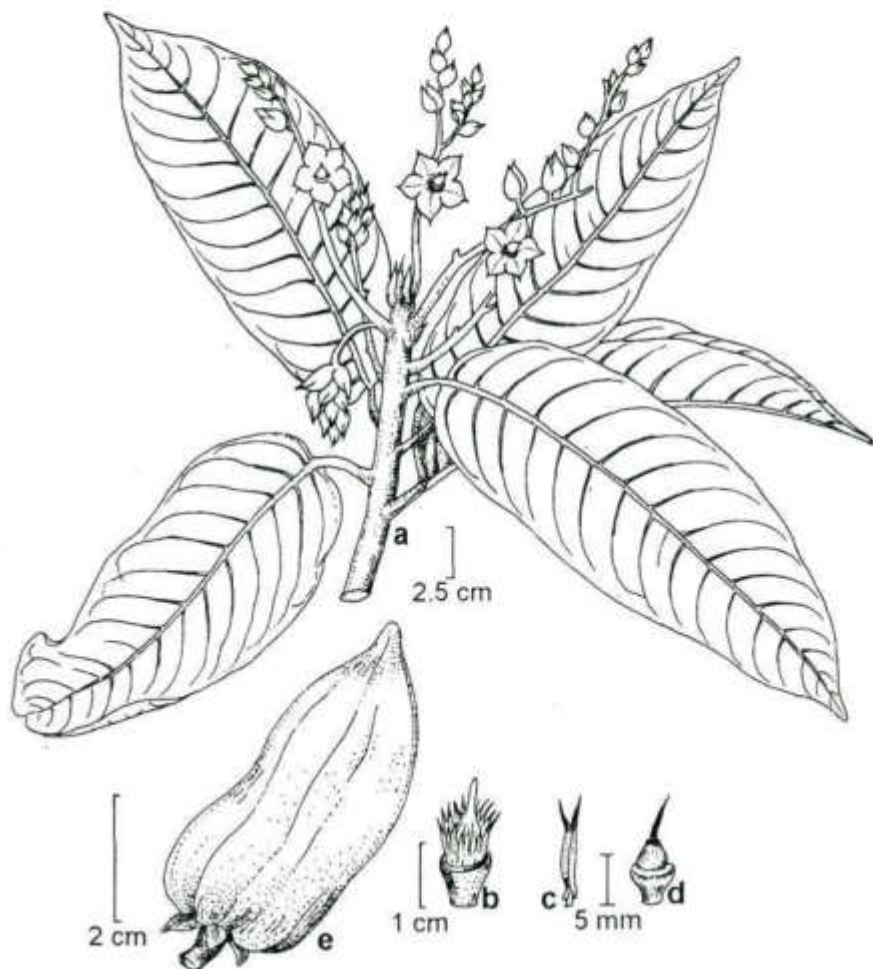


Fig. 65. *Vateria copallifera* (Retz.) Alston : a. flowering twig; b. flower with sepals and petals removed; c. stamen; d. pistil; e. fruit.

Trees, ca 30 m tall; trunk ca 4 m in girth; bark thin greyish-brown, brittle, slightly resinous; young branches, outside of stipules, inflorescences, bracts and parts of perianth exposed in bud, ovary and fruit densely fulvous-pubescent; petiole, lamina, nerves and midrib below sparsely pubescent. Leaves 15 - 20 x 8 cm, elliptic, broadly to narrowly oblong or oblong-lanceolate, obtuse or cordate to rounded at base, shortly acuminate at apex, thickly coriaceous; lateral nerves 18 - 25 pairs, prominent beneath; stipules 2 - 2.5 cm long, linear-deltoid to narrowly hastate, attenuate. Flowers creamy white, slightly fragrant, more or less secund in ca 20 cm long corymbose panicles. Calyx lobes subequal, hastate, subacute, imbricate at base only, ferruginous outside, canescent inside. Petals creamy white, oblong or orbicular, acute. Stamens 45 - 55; anthers yellow, puberulous. Nut 10 x 6 - 8 cm, ovoid, apiculate, base deeply impressed, pale brown; fruiting calyx lobes large, subequal, lanceolate, subacute, reflexed.

*Fr.* June.

*Distrib.* India: Evergreen forests of Western Ghats. Tamil Nadu (Courtallam).

Sri Lanka.

*Notes.* This species has been included here based on a single gathering of Kosterman (K) from Courtallam, Tamil Nadu, S. India.

2. *Vateria indica* L., Sp. Pl. 515. 1753; Dyer in Fl. Brit. India 1: 313. 1874. *V. malabarica* Blume, Mus. Bot. 2: 29. 1852.

Kan.: *Safed damar, Bili dupa, Velthpaini, Dhupa, Illupathla, Dhupad amara, Saldhupa, Hoogadamara, Munda dhupa, Madoi dhupa, Bilaguggala, Bilada mara, Gugle, Bila dupa, Veltha Payin* (in Coorg); Mal.: *Vella Kunturukkam, Paini maram, Perum piney, Payani, Vella Payin*; Sans.: *Dhupa, Aja karna*; Tam.: *Vellei kundirikkam, Vellei damar, Piney maram, Dhup maram, Vellei kungiliam*; Tel.: *Dhupada manu*; Eng.: *The Piney varnish Tree, The White dammar tree, The Indian Copal tree, White Dhup.*

Evergreen trees, ca 30 m tall with a clean cylindrical bole; bark smooth, white to grey, blotched with white and green, peeling off in thick, round flakes; branchlets and inflorescence stellate-canascant. Leaves ca 25 x 10 cm, ovate or oblong or elliptic-oblong, cordate or rounded at base, obtuse or acuminate at apex, bright red when young; lateral nerves slender; petioles 2.5 - 3.8 cm long, stout; stipules ca 1.3 cm long, obliquely lanceolate, acute. Flowers erect, white, fragrant in ca 20 cm long terminal or lateral corymbose panicles; pedicels ca 2 cm long. Calyx lobes lanceolate, obtuse, canescent on both surfaces. Petals white, elliptic-oblong, obtuse, spreading. Stamens 40 - 50; filaments short; anthers nearly sessile, glabrous, hairy at base, appendage of the connective as long as anther. Ovary ovoid-oblong, tomentose; styles longer than stamens, filiform, glabrous; stigmas small. Capsules pale brown, ca 11 cm long and ca 6 cm in

diam., ovoid-ellipsoid or oblong, obtuse, coriaceous, fleshy, 3-valved, reddish-white or creamy.

*Fl.* Jan. - April; *Fr.* May - July.

*Distrib.* India: Evergreen forests of the Western Ghats up to 1300 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* This species is a hygrophilous type of Dipterocarp and is a pronounced shade-bearer. Though found sporadically, this species exhibits a strong tendency to form nearly pure patches in favourable localities especially near streams with free drainage in evergreen forests. The ripe fruits are viviparous. Good seed yield occurs once in 3 to 5 years with one or two poor-seeded and one or two average-seeded years in between. Though evergreen, the tree sheds its leaves (in March) and soon after the copper-coloured or bright red new foliage begin to appear. By April - May, the tree bears new foliage. A second flush of foliage appears after the rainy season from the months of October to December.

Wood is much in demand in plywood and veneer industry; also used for making tea chests, trunks, ammunition boxes, ceilings, partitions, floorings and other interior fittings. Wood is considered to be fairly suitable for paper pulp. Bark and leaf juice are medicinal. Gum resin known in trade as 'Piney resin', 'White damar', or 'Dhupa' is used in varnish industry and for making incense. The semisolid fat, known as 'Piney tallow', 'Malabar tallow' or 'Dhupa fat' obtained from the dried kernels of the seeds is used in the manufacture of candles and soaps.

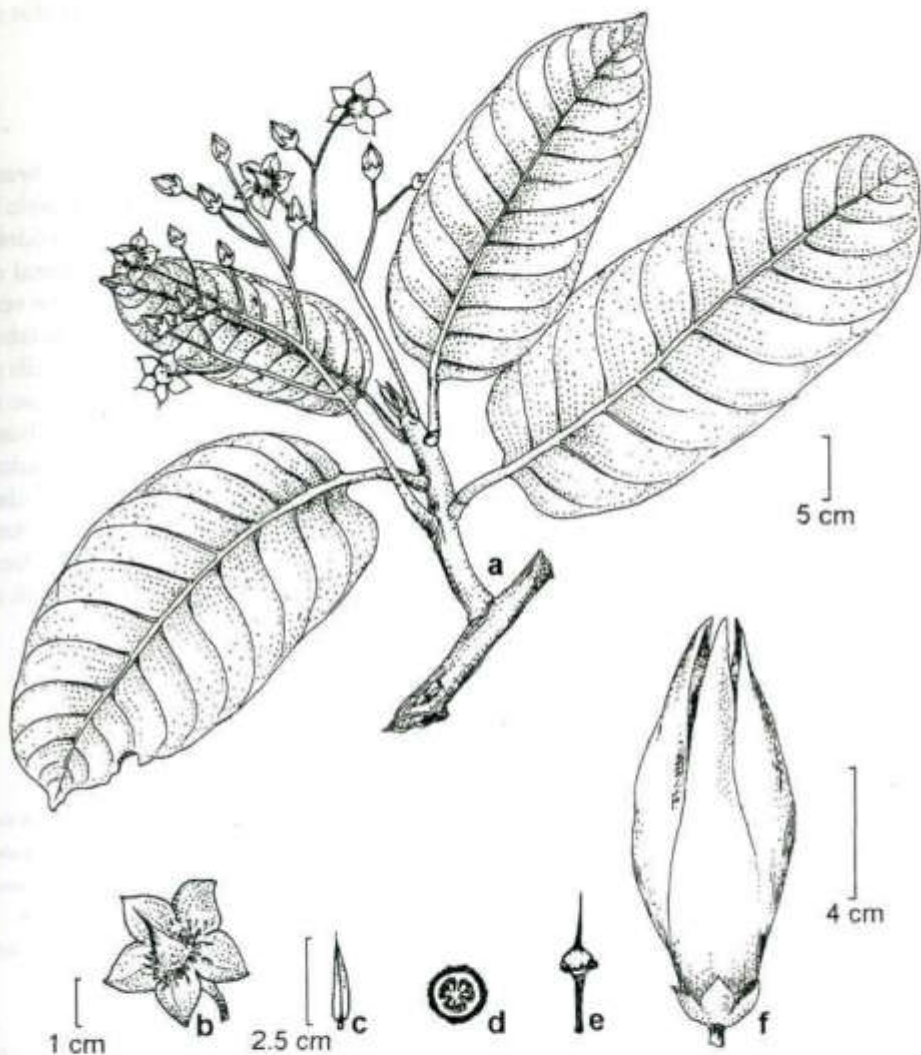
3. *Vateria macrocarpa* B.L. Gupta in Ind. For. 55: 231, t. 2. 1929.

Fig. 66.

Trees, ca 8 - 10 m tall; trunk ca 3 m in girth; bark dark grey, smooth. Leaves ca 40 x 20 cm, elliptic-oblong or oblong-lanceolate, rounded or subcordate at base, entire, coriaceous, glabrous on both surfaces, rarely with a few stellate hairs at the base on midrib beneath; lateral nerves prominent below; petioles 2.5 - 6 cm long, swollen at tip, minutely pubescent. Flowers ca 3.3 cm across, in axillary, hoary stellate-pubescent panicles; pedicels 1.5 - 2.4 cm long, jointed a little below the middle. Calyx lobes ca 3 mm long. Corolla lobes ca 1.5 cm long. Staminal filaments ca 2 mm. long; anthers linear, glabrous. Ovary 3-loculed, densely tomentose; styles slightly longer than stamens. Capsules ca 11 x 6 cm, splitting from the top downwards at maturity into three 1-seeded valves; fruiting calyx lobes reflexed.

*Fl.* March; *Fr.* June.

*Distrib.* India: Kerala (Muthikulam, Bolampatty range).



**Fig. 66.** *Vateria macrocarpa* B.L. Gupta : a. flowering twig; b. flower; c. stamen; d. l.s. of ovary; e. pistil; f. fruit.

Endemic.

*Notes.* Wood is reported to have been put to more or less the same use as that of *Vateria indica* L.

### 5. *Vatica* L.

Resinous trees, sometimes shrubs; crown irregular, oblong with sympodial branches; trunk buttressed; bark smooth, patched with dark colours. Leaves very variable in size and shape, coriaceous, nerves curved, usually somewhat oblique to the midrib, tertiary nerves reticulate; stipules small, fugaceous. Flowers fragrant in terminal or axillary, paniced spikes or racemes. Flower buds ovoid to lanceolate. Calyx tube very short, adnate to the base of ovary, lobes acute, imbricate becoming valvate. Corolla lobes usually pale creamy-white, narrowly oblong, erect. Stamens usually 15 in 3 verticils of which 10 (5 pairs) opposite to sepals; filaments of 10 outer stamens very short, those of 5 inner much longer; anthers short, glabrous, cells very unequal, diverging at base, appendage of connective obtuse. Ovary either free or half immersed in obconical receptacle, more or less broadly ovoid, conical, usually hairy, often pitted, 3-locular; styles usually shorter than ovary, often ribbed and furrowed, glabrous; stigmas capitate or conical, entire or 3-toothed, prominent. Fruit variable in size, coriaceous, 3-valved, 1 - 2-seeded, broadly ovoid or globose, free or partially embedded in calyx tube with or without a distinct apical persistent style; fruiting calyx variable.

S. and S.E.Asia from India eastwards to New Guinea, ca 87 species; 2 in India.

#### KEY TO THE SPECIES

- 1a. Young shoots and inflorescences lepidote; leaves narrowly ovate to oblong with obtuse to broadly cuneate base; petioles 2 - 5 cm long; fruits densely, persistent pinkish mauve puberulent **1. *V. chinensis***
- b. Young shoots and inflorescences mealy puberulous, becoming glabrescent; leaves elliptic-lanceolate to oblong-lanceolate with cuneate base; petioles up to 2 cm long; fruits brown velvety pubescent, ultimately glabrous and rough **2. *V. lanceafolia***

**1. *Vatica chinensis* L., Mant. Pl. 2: 242. 1771. *V. roxburghiana* (Wight & Arn.) Blume, Mus. Bot. 2: 31, t. 7. 1852; Dyer in Fl. Brit. India 1: 302. 1874. *Vateria roxburghiana* Wight ex Arn. in Ann. Nat. Hist. ser. 1, 3: 155. 1839. **Fig. 67.****

Kan.: *Uggalu dhupa*; Mal.: *Adakka payin, Adakka Payini, Vella payin, Vella payini, Cheru piney*; Tam.: *Vella Payin*

Evergreen, resinous trees, 20 - 30 m tall; trunk 2 m in girth; crown dense, irregular, spreading; bark pale grey, smooth; young shoots, buds, outside of perianth exposed in bud, ovary and fruit lepidote. Leaves 9 - 25 x 3 - 11 cm, ovate to lanceolate, rounded or



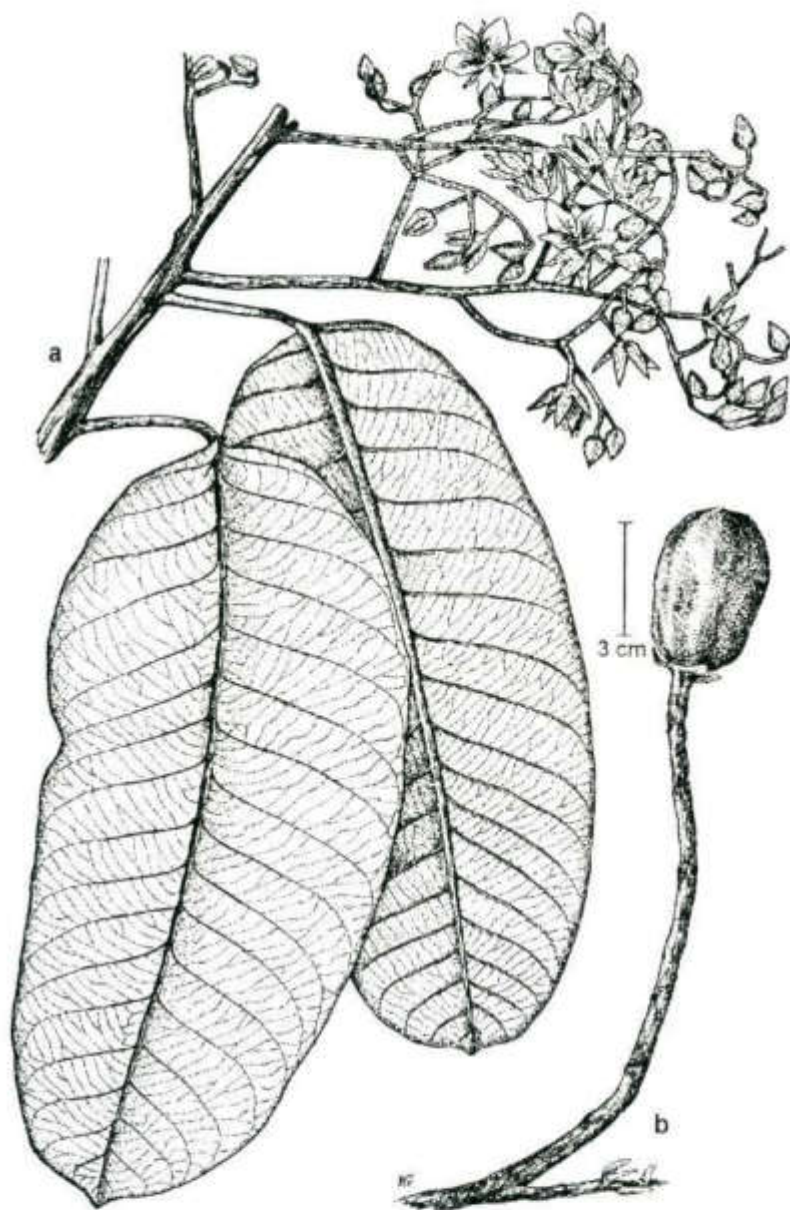


Fig. 67. *Vatica chinensis* L. : a. flowering part of branch; b. fruit.

retuse at base, tapering gradually into a subulate acumen towards the apex, glabrous; lateral nerves 10 - 14 pairs. Panicles ca 30 cm long, axillary, spreading; pedicels 5-ribbed with ribs alternating with sepals. Calyx lobes ca 2 cm long, ovoid-deltoid to lanceolate, acute, pubescent. Petals white, ca 5 times longer than calyx lobes, oblong. Stamens 15 in two rows; filaments short, flattened at base; anthers oblong, shortly apiculate. Ovary covered with large, shallow pits; styles about as long as ovary, ribbed; stigmas densely papillose, obscurely 3-lobed. Fruit indehiscent, ca 2.5 cm in diam., subglobose, shortly pointed with 3 obscure, loculicidal furrows, puberulous; pericarp coriaceous, thicker at base; testa thin, adhering to endocarp; cotyledons thick, fleshy, plane-convex, bifid to the base; fruiting calyx lobes ovate, acute, recurved and more or less appressed at the base of fruits.

*Fl.* Feb. - March; *Fr.* June.

*Distrib.* India: In evergreen forests of Western Ghats along streams at low elevations, Karnataka, Tamil Nadu and Kerala

Sri Lanka.

*Notes.* Wood durable, withstands water submersion and used for building piles, etc. The transparent yellow resin obtained from wood is used in manufacture of varnishes.

2. *Vatica lanceaefolia* (Roxb.) Blume, Mus. Bot. 2: 31. 1852; Dyer in Fl. Brit. India 1: 302. 1874. *Vateria lanceaefolia* Roxb., Fl. Ind. 2: 601. 1832.

Evergreen trees or shrubs; bark greenish-grey outside, light greyish-brown inside, mottled with faint blotches and streaks of light colour. Leaves 10 - 23 x 3 - 10 cm, elliptic-lanceolate, tapering towards base, acuminate at apex, entire, thinly coriaceous, glabrous, pale and sometimes puberulous beneath; lateral nerves 10 - 15 pairs; petioles ca 2 cm long, slightly swollen below the insertion of blade. Flowers yellowish-white, fragrant, ca 1.8 cm long, axillary, simple or in fascicled panicles. Calyx ca 3 mm long; lobes deltoid-acute, valvate in flower, accrescent with edges overlapping in fruit, densely clothed with unicellular hairs outside and with multicellular hairs inside. Corolla lobes 2 - 2.5 cm long, oblanceolate to oblong, much imbricate, tawny velvety outside on exposed portion. Stamens 2 - 3 mm long; anthers ovate-oblong with a blunt beak at base; appendage of connective as long as anthers, thick, cylindric. Ovary ovoid or turbinate, puberulous; styles as long as ovary, cylindric, thickened above; stigmas calvate, 3-toothed. Fruit 1.5 - 3 x 1.5 - 2.5 cm, ovoid or globose, apiculate, indistinctly 3-furrowed, finely tomentose, ultimately glabrous and rough; fruiting calyx lobes broadly cordate, 2 outer ones overlapping with either the right or the left edge, longitudinally 5-nerved. Testa thin, loosely enclosing embryo; cotyledons plano-convex, bifid to the base when dry, separating into four equal segments.

*Fl.* April - May; *Fr.* May - Aug.

*Distrib.* India: In tropical evergreen, semievergreen, moist deciduous and swamp forests up to 900 m. Assam (Cachar), Arunachal Pradesh, Nagaland, Meghalaya and Manipur.

Bhutan, Bangladesh and Myanmar.

*Notes.* Wood used mostly as fire wood; yields good quality charcoal. It is also considered suitable for construction purposes, for railway sleepers, electric transmission poles, etc. The clear, white, aromatic oleo-resin obtained from the bark is used as an incense in Eastern India. 'Chooa oil' obtained on distilling is used for flavouring chewing tobacco.

## ANCISTROCLADACEAE

(Silpi Das)

Evergreen, woody climbers; branches sympodial with circinate woody hooks. Leaves alternate, simple, oblanceolate, entire with scattered minute glandular pits. Flowers regular in lax terminal or lateral panicles. Calyx 5-lobed, imbricate, tube short, adnate to the base of ovary, finally turbinate and adnate to the fruit with lobes unequally enlarged, spreading and membranous. Petals 5, alternate with sepals, imbricate, white or pink. Stamens 5 or 10; filaments short, dilated and connate at base; anthers basifixed, introrse. Ovary half inferior, unilocular with one basal erect anatropous ovule; styles 3, free, articulated to a rounded or shortly cylindrical epigynous disk. Fruit a dry indehiscent nut surrounded by spreading sepals. Seeds large with strongly ruminant endosperm.

A monogeneric family confined to Tropical W. Africa, S.E. Asia and S. China, ca 12 species; 4 in India.

*Literature.* PLANCHON, J.E. (1849). Essai Monographique D'une Nouvelle Famille de Plantes, Sous le nom D'Ancistrocladus. Ann. Sci. Nat. Bot. ser. 3, 13: 316 - 319. STEENIS, C.G.G.J. VAN (1948). Ancistrocladaceae. Fl. Males. 1, 4: 8 - 10.

*Notes.* A monogeneric family and is usually placed next to Dipterocarpaceae from which it is distinguished based on unilocular ovary with a basal ovule, seeds with ruminant endosperm, climbing habit, sympodial structure, exstipulate leaves and hooked branches.

### **Ancistrocladus** Wallich, nom. cons.

Smooth climbing shrubs with short, circinate woody hooks. Leaves usually in terminal tufts, coriaceous, entire, reticulately feather-veined. Inflorescences dichotomously branched, terminal or lateral panicles. Flowers bisexual, regular, bracteate. Sepals 5, persistent. Petals 5, free. Stamens 5 - 10, filaments dilated; anthers 2-lobed, basifixed. Ovary half inferior, unilocular with a basal, erect ovule; styles 3, free; stigmas flattened. Fruit a nut.

Tropical W. Africa, S.E. Asia and S. China, ca 12 species; 4 in India.

### KEY TO THE SPECIES

- |  |                         |
|--|-------------------------|
| a. Leaves 40 - 60 cm long  | 2                       |
| b. Leaves 15 - 20 cm long  | 3                       |
| a. Panicles repeatedly dichotomous with ultimate branches recurved; bracts deltoid | 1. <b>A. attenuatus</b> |
| b. Panicles repeatedly dichotomous with ultimate branches not curved; bracts ovoid | 4. <b>A. wallichii</b>  |

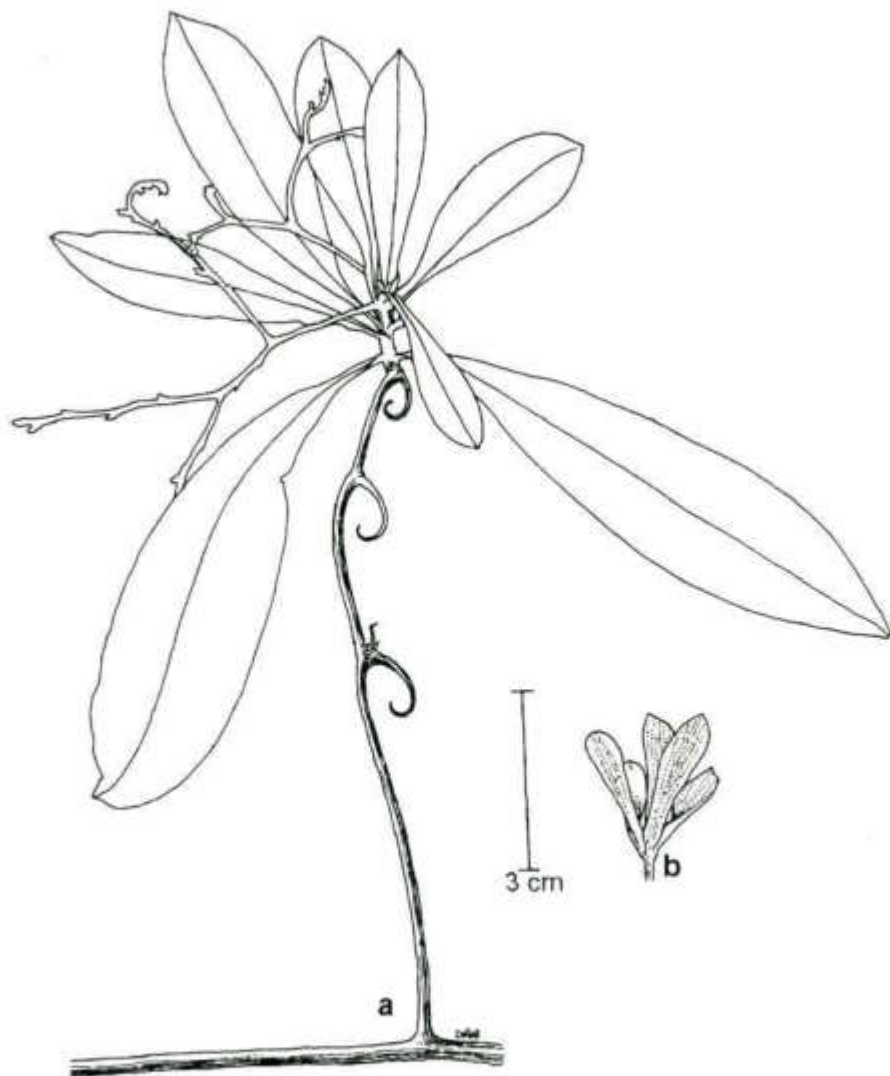


Fig. 68. *Ancistrocladus heyneanus* Wallich ex Wight : a. leafy branch with hooks; b. fruit.

- 3a. Calyx tube as long as flat topped fruit, not furrowed, lobes slightly decurrent 3. *A. tectorius*  
 b. Calyx tube longer than conical apex of the fruit, furrowed; lobes not decurrent 2. *A. heyneanus*

**1. *Ancistrocladus attenuatus* Dyer in Fl. Brit. India 1: 300. 1874.**

Climbers; stems dark coloured; with strong woody hooks. Leaves alternate, sessile, 30 - 45 x 4 - 5 cm, oblanceolate, cuneate-linear, gradually acuminate at apex, midrib prominent, lateral nerves inconspicuous. Panicles terminal, repeatedly dichotomous with divaricate stout divisions, ultimately recurved; bracts solitary, deltoid, acute. Flowers small. Calyx 5-lobed, lobes unequal, 4 - 9 x 2 - 3 mm, accrescent in fruits. Petals 5, white, 5 - 9 x 3 - 5 mm, obovate-oblong. Stamens 10; filaments 4 - 6 mm long, dilated at base; anthers basifixed. Ovary adnate to calyx, unilocular with a basal ovule; styles 3, stigmatiferous at the tips. Fruit a nut.

*Fl.* Jan. - March; *Fr.* March - May.

*Distrib.* India: In mixed evergreen forests up to 150 m. Andaman & Nicobar Islands (Andaman Islands); rare.

Myanmar.

**2. *Ancistrocladus heyneanus* Wallich ex Wight, Icon. Pl. Ind. Orient. 6: 12, t. 1987 - 88. 1853; Dyer in Fl. Brit. India 1: 299. 1874. Fig. 68.**

Scandent shrubs with woody hooks on branches. Leaves sessile, 10 - 20 x 4.5 - 6 cm, elliptic-oblong to oblanceolate, narrowed at base, acute at apex, subrepand, reticulately veined. Flowers minute, in dichotomous panicles, very caducous. Calyx 5-lobed, lobes 4 - 8 x 3 - 4 mm, oblong, rounded at apex, lobes in fruiting spatulate, with 3 longer and 2 shorter ones. Petals 5, white, 6 - 8 x 3 - 4 mm, ovate-oblong. Stamens 10; filaments 6 - 9 mm long, alternately shorter. Ovary unilocular, 1-ovuled; styles 3; stigmas discoid. Fruits 5-winged, 1-seeded. Seeds globose, somewhat depressed above, corrugated.

*Fl.* March - April.

*Distrib.* India: Western Ghats. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

**3. *Ancistrocladus tectorius* (Lour.) Merr. in Lingnan Sci. J. 6: 329. 1930; Steenis, Fl. Males. 1, 4: 8. 1948. *Bembix tectoria* Lour., Fl. Cochinch. 282. 1790. *Ancistrocladus extensus* Wallich ex Planch. in Ann. Sci. Nat. ser. 3, 13: 318. 1849; Dyer in Fl. Brit. India 1: 299. 1874. Fig. 69.**

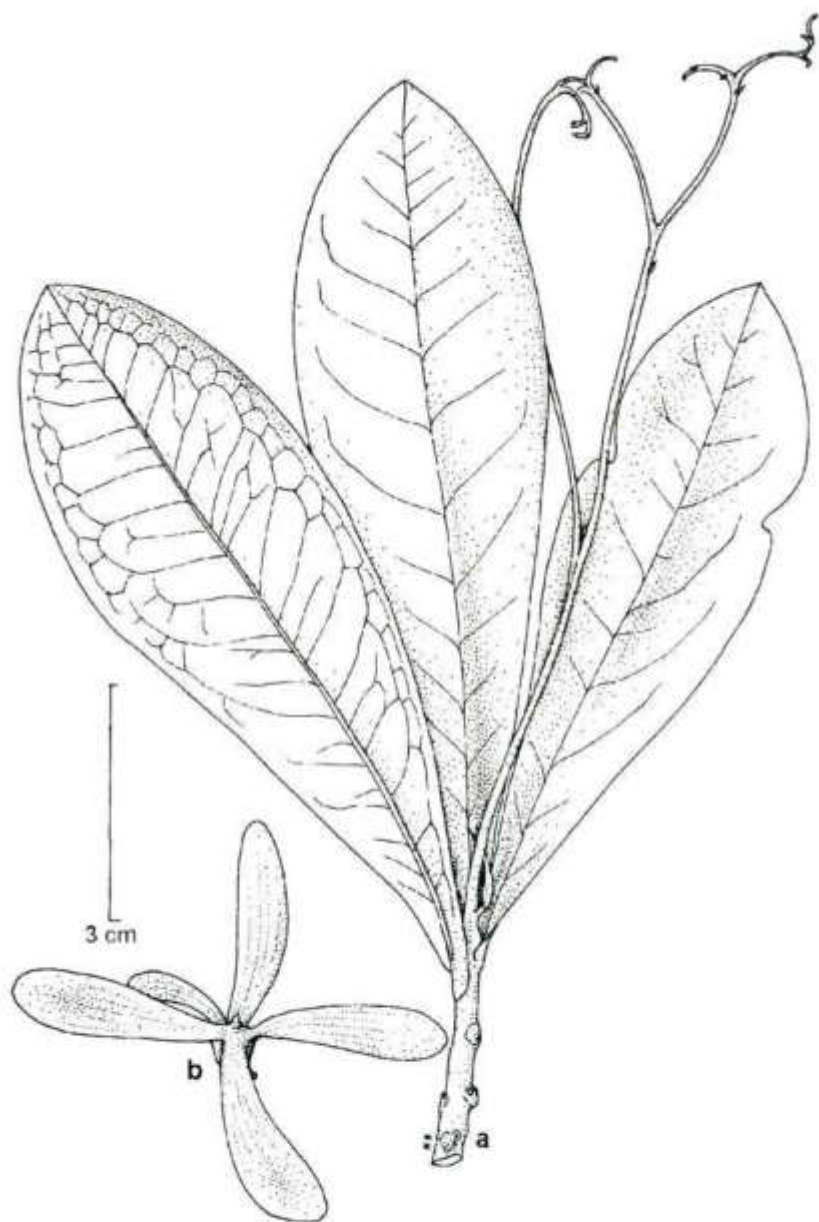


Fig. 69. *Ancistrocladus tectorius* (Lour.) Merr. : a. leafy branch with hooks on tendril like branchlets; b. fruit.

Lianas or shrubs with trailing branches; stems twisted, dark coloured, with woody hooks; some tendril-like, leafless branches with hooks arise from between and near the leaves. Leaves tufted at branch tips, sessile, 10 - 20 x 5 - 7 cm, obovate-oblong, oblanceolate, attenuate at base, subobtusate to acute at apex, glabrous, dark green, midrib prominent, lateral veins looping intramarginally, reticulate venation fine and distinct. Panicles repeatedly dichotomous, with divaricate divisions ultimately recurved; bracts ovate, acute. Calyx 5-lobed, lobes 3 - 6 x 2 - 3 mm, slightly decurrent with subparallel nervules, in fruiting 4 - 4.5 cm long. Petals 5, pink or white, 5 - 8 x 3 - 4 mm, oblique-ovate with involute margin, acute. Stamens 10; filaments 4 - 6 mm long, dilated at base; anthers basifixed. Ovary adnate to calyx, unilocular with a basal ovule; styles 3, erect; stigmas discoid. Fruit with spreading calyx wings, slightly decurrent on the obconical angular tube.

*Fl.* Jan. - March; *Fr.* March - May.

*Distrib.* India: In mixed evergreen forests up to 150 m. Andaman & Nicobar Islands (Andaman Islands).

Myanmar, Thailand, Vietnam and S. China, Malaysia and Indonesia.

*Notes.* Stem used by Andamanese for making arrows.

**4. *Ancistrocladus wallichii*** Planch. in Ann. Sci. Nat. ser. 3, 13: 319. 1849; Dyer in Fl. Brit. India 1: 300. 1874.

Climbers; stems with circinate and hooked branchlets. Leaves tufted, sessile, 40 - 55 x 5 - 7.5 cm, linear, gradually narrowed to subauricled at base, obtusely acuminate or acute at apex, midrib distinct with inconspicuous lateral veins. Panicles terminal or on short lateral branches, 2 - 3 times dichotomous; bracts ovate, denticulate, acute. Calyx lobes 5 - 6 x 3 - 4 mm, adnate to ovary, persistent, often with dorsal glandular pits; fruiting calyx lobes 2 - 2.5 cm long, obovate, obtuse, spreading. Petals 5, 5 - 8 x 3 - 5 mm, free, fleshy, imbricate. Stamens 10, slightly unequal; filaments 1 - 2 mm long, fleshy, connate at base; anthers basifixed. Ovary half inferior, ovules solitary, erect; styles 3, articulated to epigynous disc. Seeds subglobose.

*Fl.* Jan. - March; *Fr.* March - May.

*Distrib.* India: In mixed evergreen forests up to 150 m. Andaman & Nicobar Islands (Andaman Islands); rare.

Bangladesh and Myanmar.



## MALVACEAE

(T.K. Paul)

Annual or perennial herbs, shrubs, rarely trees or woody climbers (*Hibiscus scandens* Roxb.). Stems usually fibrous with mucilaginous sap; bark with dilated rays. Indumentum almost always stellate-hairy or lepidote, simple hairy, sometimes also with gland-tipped hairs. Leaves alternate, petiolate, simple, entire to variously lobed or dissected, sometimes with extra-floral nectaries on veins beneath, stipulate. Flowers actinomorphic, bisexual, rarely unisexual or subdioecious (*Kydia*), solitary, axillary or terminal and/or axillary racemes or panicles, 1- to many-flowered, sometimes disposed in terminal racemose spikes in consequence of the upper leaves being absent, pentamerous. Calyx connate up to middle or below, lobed or rarely entire or spathaceous, lobes valvate, sometimes with nectaries on veins outside, persistent or caducous, sometimes accrescent, often subtended by persistent epicalyx, epicalyx segments 3 to many, free or connate, subulate to leafy. Corolla convolute or less commonly imbricate, adnate to the base of staminal column and falling off with it, usually the limb of petals asymmetric. Stamens numerous, monadelphous, staminal column surrounds the ovary and style at base, apex of staminal column 5-toothed (tribes *Hibisceae* and *Ureneae*) or entire; anthers dorsifixed, monothechal; pollen echinate. Ovary superior, 3 - 5 or many-loculed; ovules 1 - many in each locule on axile placentation; styles as many as or twice the number of carpels, often united to various degree; stigmas as many as styles, more or less distinct or almost united. Fruit a capsule or schizocarp or rarely an anomalous kind of berry (*Malvaviscus*), capsules 3 to many-seeded; mericarps 1 - many-seeded. Seeds albuminous, hairy or glabrous; embryo mostly curved with a terete radicle and yellow twisted cotyledons.

Tropical, subtropical and temperate regions of the World; ca 88 genera and 2300 species; 22 genera and 93 species in India.

*Literature.* ABEDIN, S. (1979). Malvaceae. In: Fl. W. Pakistan 130: 1 - 107, 1 - 24. BORSSUM WAALKES, J. VAN (1966). Malesian Malvaceae revised. Blumea 14: 1 - 213, ff. 1 - 21. PAUL, T.K. & M.P. NAYAR (1988). Malvaceae in Fasc. Fl. India 19: 64 - 233, ff. 1 - 60.

### KEY TO THE TRIBES

- |   |                   |
|---|-------------------|
| 1a. Styles as many as carpels or styles undivided and stigmas entire  | 2                 |
| b. Styles twice as many as carpels  | 5. <i>Ureneae</i> |
| 2a. Fruit a capsule; staminal column 5-toothed or armed at apex, antheriferous throughout or a major portion of it or tipped with clusters of anthers | 3                 |
| b. Fruit a schizocarp, breaking into mericarps at maturity; staminal column without teeth, apex split up into numerous filaments                      | 4                 |

- 3a. Carpels remain attached to each another and to central axis at maturity; stipules simple **3. Hibisceae**
- b. Carpels separate from central axis at maturity; stipules lacinate or completely divided into 2 or 3 segments **2. Decaschisteae**
- 4a. Stigmas decurrent on the adaxial side of style **4. Malveae**
- b. Stigmas apical or nearly so, capitate, discoid or obliquely truncate **1. Abutilieae**

## KEY TO THE GENERA IN TRIBES

## Tribe 1. ABUTILEAE Endl.

- 1a. Seeds 2 or more in each mericarp **2**
- b. Seeds one in each mericarp **5**
- 2a. Epicalyx segments absent **3**
- b. Epicalyx segments present **4. Modiola**
- 3a. Carpels 1-locular, ovules 2 or more in each locule; flowers solitary, axillary, rarely in panicles **4**
- b. Carpels more or less divided into 2 superposed locules, ovules 3 in each locule; flowers in lax panicles **6. Wissadula**
- 4a. Stems erect, stout; carpels slightly inflated or not; mericarps more or less pointed, mucronate or aristate at apex, wall of mericarps thick **1. Abutilon**
- b. Stems ascending, weak; carpels prominently inflated at maturity; mericarps rounded at apex, wall of mericarps thin and papery **2. Herissantia**
- 5a. Epicalyx present **3. Malvastrum**
- b. Epicalyx absent **6**
- 6a. Lateral walls of mericarp persistent or disintegrate after maturity; leaves ovate to orbicular, lanceolate or linear **5. Sida**
- b. Lateral walls of mericarp disintegrate before maturity; leaves hastate **Anoda (cultivated)**

## Tribe 2. DECASCHISTEAE Fryxell

- Epicalyx segments 10, unequally connate below; stipules lacinate or completely divided into 2 or 3 segments; carpels separate from central axis at maturity **7. Decaschistia**

## Tribe 3. HIBISCHEAE Endl.

- 1a. Epicalyx segments winged in fruits, ultimately spreading **2**
- b. Epicalyx segments not winged, rarely spreading **4**
- 2a. Staminal column distally divided into 5-arms, each tipped by a cluster of anthers; styles 3-branched or 3-clefted; fruit loculicidally dehiscent **13. Kydia**
- b. Staminal column neither divided nor toothed; styles 2-branched (rarely 1); fruit indehiscent **3**

- 3a. Flowers in large many-flowered panicles; corolla 5 - 10 mm across; staminal column 5-toothed at apex, stamens 10 or 20 (rarely 17 - 19) **12. Julostylis**
- b. Flowers solitary or in small 2 - 5-flowered panicles; corolla 2 - 2.5 cm across; staminal column without any teeth, stamens numerous **14. Nayariphyton**
- 4a. Styles distally 5-branched, with branches spreading at maturity; stigmas more or less capitate or globose 5
- b. Styles unbranched; stigmas ribbed or lobed 7
- 5a. Calyx regularly 5-lobed, not spathaceous, persistent 6
- b. Calyx irregularly 2 - 3-lobed, spathaceous, deciduous **8. Abelmoschus**
- 6a. Capsules winged **9. Fioria**
- b. Capsules not winged **11. Hibiscus**
- 7a. Epicalyx segments 3, large, leafy, cordate, persistent 8
- b. Epicalyx segments 3 - 8, small, linear-oblongate, mostly caducous **16. Thespesia**
- 8a. Style-branches coherent into a club-shaped mass; seeds obovoid or angled, cottony **10. Gossypium**
- b. Style-branches spreading at length; seeds reniform, pubescent with minute hairs **15. Senra**

#### Tribe 4. MALVEAE A. Gray

- 1a. Epicalyx segments free **19. Malva**
- b. Epicalyx segments connate at base 2
- 2a. Epicalyx segments 3 - 6; central axis of fruit often projecting above mericarps; seeds smooth or transversely ribbed **18. Lavatera**
- b. Epicalyx segments 6 - 9; central axis of fruit not projecting above mericarps; seeds radially ribbed 3
- 3a. Staminal column 5-angled; corolla 3 cm or more in diameter; mericarps sub-bilocular **Alcea (cultivated)**
- b. Staminal column cylindrical; corolla less than 3 cm in diameter; mericarps unilocular **17. Althaea**

#### Tribe 5. URENEAE Benth. & Hook. f.

- 1a. Flowers in condensed racemes intermixed with foliaceous bracts; epicalyx absent or rarely present **20. Malachra**
- b. Flowers axillary, solitary or in clusters without foliaceous bracts; epicalyx always present 2
- 2a. Fruit berry-like, fleshy; petals auriculate **Malva viscus (cultivated)**
- b. Fruit neither berry-like nor fleshy; petals not auriculate 3
- 3a. Mericarp usually glochidiate, rarely smooth; leaves with nectaries on midrib beneath **22. Urena**
- b. Mericarps muciculate or with 1 - 3 retrorsely barbed awns at the apex, nerver glochidiate; leaves without nectaries **21. Pavonia**

## Tribe 1. ABUTILEAE Endl.

1. *Abutilon* Mill.

Annual or perennial herbs, undershrubs or shrubs. Leaves simple, entire or lobed, mostly cordate at base, acute or acuminate at apex, palminerved without nectaries. Flowers axillary, solitary, sometimes in lax panicles by reduction or decrescence of upper leaves, rarely in lax corymbose racemes; pedicels jointed in the upper half. Epicalyx absent. Calyx usually campanulate; lobes 5, divided to the middle or below. Corolla usually yellow, orange, white or pink, rarely with a dark purple centre, rotate, campanulate. Staminal column shorter than petals, much widened at base. Carpels and style-branches 5 - 40, styles filiform to clavate, capitate stigmatose at apex. Schizocarps globular, campanulate, rarely discoid; mericarps 5 - 40, dehiscent, follicular, flattened-reniform, round, acuminate or biaristate at apex, often falling leaving a slender truncate, columella. Seeds 2 - 9 in each mericarp, reniform to subreniform, upper ones ascending; lower ones pendulous or horizontal, finally falling out of mericarp.

In tropical and subtropical regions of the World, ca 150 species; 12 in India.

## KEY TO THE SPECIES

- |  |                                   |
|--|-----------------------------------|
| 1a. Carpels 5 - 12   | 2                                 |
| b. Carpels more than 15  | 10                                |
| 2a. Carpels 5  | 3                                 |
| b. Carpels 8 - 12  | 4                                 |
| 3a. Calyx lobes 7 - 10 mm long, connate at base; staminal column ca 5.5 mm long, filaments ca 15 mm long   | <b>8. <i>A. persicum</i></b>      |
| b. Calyx lobes ca 2 cm long, connate up to the middle; staminal column ca 20 mm long, filaments ca 3 mm long   | <b>10. <i>A. ranadel</i></b>      |
| 4a. Petals 2.5 - 4.5 cm long, erect, mostly red to orange  | <b>11. <i>A. striatum</i></b>     |
| b. Petals less than 2 cm long, spreading, yellow   | 5                                 |
| 5a. Schizocarp cylindric up to 1 cm long   | 6                                 |
| b. Schizocarp ovoid to subcylindric, more than 1 cm long   | 7                                 |
| 6a. Pedicels shorter than petioles; mericarps awned; seeds ca 2 mm across, minutely puberulous; leaves glabrescent or minutely stellate-pubescent above and densely stellate-pubescent beneath | <b>9. <i>A. ramosum</i></b>       |
| b. Pedicels equal to or longer than petioles; mericarps awnless; seeds 1 - 1.5 mm across, glabrate; leaves densely stellate-pubescent on both surfaces   | <b>2. <i>A. fruticosum</i></b>    |
| 7a. Flowers axillary, solitary or 2 - 3 in clusters or in terminal racemes by the reduction of upper leaves; schizocarp ovoid  | 8                                 |
| b. Flowers 2 - 5 in axillary, up to 10 cm long, peduncled cymes, rarely solitary; schizocarp subcylindric  | <b>5. <i>A. neilgherrense</i></b> |
| 8a. Staminal column stellate-hairy; mericarps with erect, less than 1 mm long awns   | 9                                 |
| b. Staminal column glabrous; mericarps with 2 erecto-patent 3 - 7 mm long awns   | <b>12. <i>A. theophrasti</i></b>  |

- 9a. Plants densely covered with long spreading patent simple hairs; calyx lobes longer or as long as schizocarp  
**A. grandifolium** (cultivated)
- b. Plants covered with appressed stellate hairs; calyx lobes shorter than schizocarp  
**6. A. pakistanicum**
- 10a. Stems, petioles and pedicels with dense long patent simple hairs, few minute stellate hairs and short viscid glandular hairs; corolla orange yellow with a purple centre  
**3. A. hirtum**
- b. Stems, petioles and pedicels densely stellate-pubescent with few simple hairs; corolla with or without purple centre  
11
- 11a. Corolla yellow to pale yellow without purple centre, calyx lobes ovate to lanceolate; mericarps dorsally and ventrally stellate-hairy; leaves ovate-cordate  
12
- b. Corolla yellow with deep brown center; calyx lobes deltoid to ovate; mericarps hairy on dorsal margin; leaves orbicular to rotund-cordate  
**7. A. pannosum**
- 12a. Staminal column 2 - 3 mm long; schizocarps ca 1 cm across; mericarps ca 10 x 5 mm, gradually acuminate  
**1. A. bidentatum**
- b. Staminal column 5 - 7 mm long; schizocarps 1.5 - 2.5 cm across; mericarps 10 - 15 x 7 - 10 mm, acute to acuminate, obtuse or rounded  
**4. A. indicum**

**1. *Abutilon bidentatum*** Hochst. ex A. Rich., Tent. Fl. Abyss. 68. 1847; Masters in Fl. Brit. India 1: 326. 1874.

Undershrubs, annual or perennial; stems, petioles and pedicels densely woolly with stellate and simple hairs. Leaves 1.5 - 20 x 1 - 17 cm, ovate, cordate at base, acute or scarcely acuminate at apex, irregularly toothed, densely pubescent with stellate and few simple hairs on both surfaces; petioles 1 - 17 cm long; stipules 1 - 2 mm long, subulate. Flowers axillary, solitary or in panicles; pedicels 2 - 4 cm long, jointed towards apex. Calyx ca 6 mm across, cup-shaped, divided up to the middle, lobes 5 - 6 x 2 - 3 mm, ovate, acute, densely pubescent with stellate and simple hairs outside and with long simple hairs inside. Corolla yellow; petals 5 - 7 x 3 - 4 cm. Staminal column 2 - 3 mm long, stellate-hairy, filaments 0.5 - 1 mm long. Schizocarps ca 1 cm across; mericarps 16 - 20, ca 10 x 5 mm, oblong, gradually acuminate, bidentate at apex, marginal portion densely stellate-hairy, 3-seeded. Seeds ca 1.5 mm across, reniform, minutely stellate-hairy, brownish black.

#### KEY TO THE VARIETIES

- 1a. Leaves 1.5 - 5 x 1 - 4.5 cm; petioles 1 - 3.5 cm long  
1.1. var. **bidentatum**
- b. Leaves 20 x 17 cm; petioles up to 17 cm long  
1.2. var. **major**

**1.1. var. bidentatum**

**Fig. 70.**

*Fl. & Fr.* Aug. - Dec.

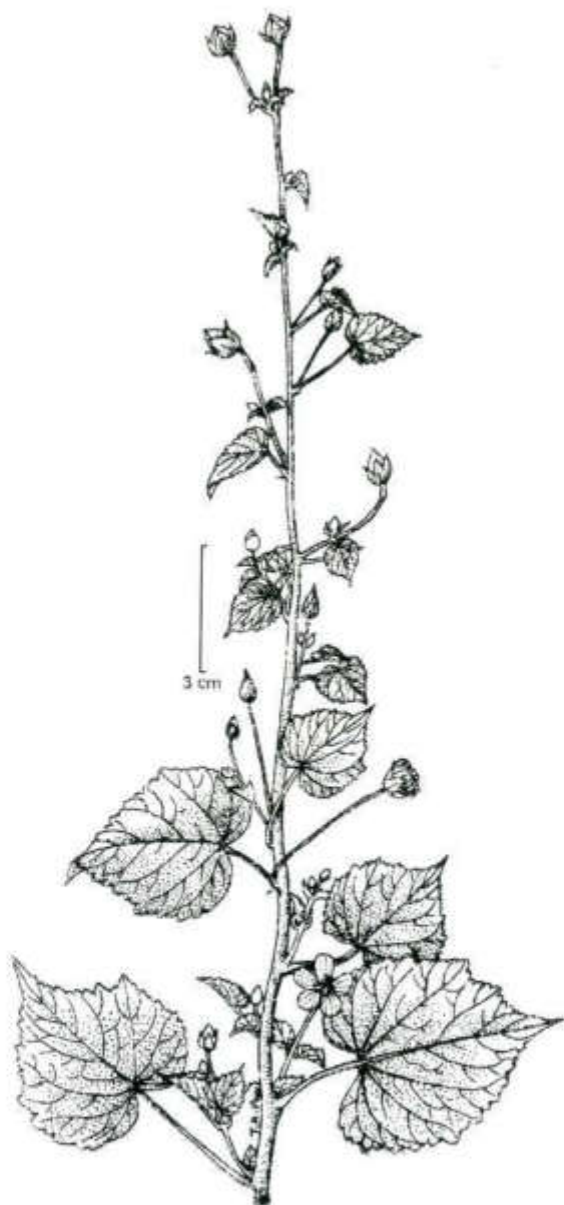


Fig. 70. *Abutilon bidentatum* Hochst. ex A. Rich. var. *bidentatum*

*Distrib.* India: Rajasthan, Gujarat, Punjab, Delhi and Maharashtra.

Pakistan, Arabia and Tropical Africa.

**1.2. var. major** (Blatt. & Hallb.) Bhandari, Fl. Ind. Des. 59. 1978. *Abutilon indicum* (L.) Sweet var. *major* Blatt. & Hallb. in J. Bombay, Nat. Hist. Soc. 26: 266. 1918.

*Distrib.* India: Rajasthan.

Endemic.

**2. *Abutilon fruticosum*** Guillemin & Perrottet in Guillemin *et al.*, Fl. Seneg. Tent. 1: 70. 1830; Masters in Fl. Brit. India 1: 328. 1874.

Erect undershrubs, 60 - 120 cm high; stems woody, densely pubescent with minute, whitish stellate hairs when young. Leaves 1.5 - 9 x 1.8 cm, deeply cordate, ovate to ovate oblong, acute at apex, crenate or denticulate, 5 - 9-nerved at base, densely pubescent with whitish stellate hairs on both surfaces; petioles 5 - 7 mm long, stellate-pubescent; stipules 1.5 - 3 mm long, linear, stellate-hairy. Flowers axillary, solitary; pedicels equal to or longer than petioles, jointed 2 - 3 mm below the calyx, stellate-pubescent. Calyx 4 - 6 mm across, campanulate, divided to the middle, lobes 4 - 5 x 2 - 3 mm, ovate, acute or slightly acuminate, 3-nerved, densely stellate-pubescent on both surfaces. Corolla yellow; petals 6 - 10 x 4 - 5 mm. Staminal column 3 - 4 mm long, antheriferous towards apex, sparsely stellate-hairy. Schizocarps 5 - 11 mm high, oblong-acute; mericarps 10, 5 - 11 x 5 - 6 mm, obliquely truncate, without awns, stellate-tomentose along margins, 2 - 3 seeded. Seeds 1 - 1.5 mm across, reniform, glabrate with stout white or brown simple straight or hooked hairs.

#### KEY TO THE VARIETIES

- 1a. Schizocarp densely stellate-hairy, golden yellow  
b. Schizocarp sparsely stellate-hairy, pale greenish

- 2.1. var. *chrysocarpa*  
2.2. var. *fruticosum*

**2.1. var. *chrysocarpa*** Blatt. & Hallb. in J. Bombay Nat. Hist. Soc. 26: 227. 1918.

*Distrib.* India: Rajasthan.

Endemic.

**2.2. var. *fruticosum***

*Fl.* Aug. - Sept.; *Fr.* Sept. - Jan.

*Distrib.* India: In dry deciduous forests up to 400 m. Rajasthan, Gujarat, Punjab and Maharashtra.

Pakistan, Arabia, Tropical Africa and Indonesia (Java).

3. *Abutilon hirtum* (Lam.) Sweet, Hort. Brit. ed. 1, 53. 1826; Wight & Arn., Prodr. 56. 1834. *Sida hirta* Lam., Encycl. 1: 7. 1783; *Sida graveolens* Roxb. [Hort. Beng. 50. 1814, nom. nud.] ex Hornem., Hort. Hafn. Suppl. 77. 1819; Roxb., Fl. Ind. 3: 179. 1832. *Abutilon graveolens* (Roxb. ex Hornem.) Wight & Arn. ex Wight, Cat. 13. 1833 & Wight & Arn., Prodr. 56. 1834; Masters in Fl. Brit. India 1: 327. 1874, incl. var. *hirtum*.

Annual herbs or undershrubs, up to 2 m high, much branched, somewhat viscid with unpleasant smell; stems, petioles and pedicels covered with long patent, simple, minute stellate and short glandular hairs. Leaves 2.5 - 12 x 3.5 - 13 cm, orbicular to broadly ovate, cordate at base, acute at apex, irregularly crenate-dentate, 7 - 9-nerved at base, pubescent with minute stellate hairs and with long simple and glandular hairs on veins beneath; petioles 3 - 20 cm long, hirsute with long patent, simple and glandular hairs; stipules 0.5 - 1 x 0.1 - 0.3 cm, linear to lanceolate, often falcate, reflexed, stellate-velutinous. Flowers axillary, solitary; pedicels 1.5 - 4.5 cm long, accrescent up to 5.5 cm long, jointed at 1 - 10 mm below apex. Calyx 7 - 10 mm diam., campanulate, divided to the middle, lobes 5 - 10 x 4 - 6 mm, accrescent up to 1.5 cm, ovate or deltoid, acute to slightly acuminate, somewhat reflexed in fruit, densely stellate-pubescent mixed with simple and glandular hairs, sericeous inside with simple hairs. Corolla orange-yellow with a purple centre; petals longer than calyx lobes, obcordate, rounded at apex, often emarginate, spreading, finally reflexed, ciliate at base, stellate-pubescent outside, glabrous inside. Staminal column 5 - 7 mm, yellow or dark purple, basal part conical and stellate-hairy, upper tubular part glabrous. Schizocarps 1 - 2 cm across, globular, indented at apex; mericarps 20 - 25, separating early, 10 - 15 mm high, radially 7 - 10 mm, broadly ovate-renaliform, shortly acuminate, sometimes rounded, dorsally stellate-tomentose, 3-seeded. Seeds ca 2.5 mm across, reniform, punctate by minute stellate hairs, longer stellate-hairy at the hilum, brownish black.

#### KEY TO THE VARIETIES

- |   |                                |
|---|--------------------------------|
| 1a. Leaves ovate, irregularly and deeply serrate    | 3.1. var. <i>heterotrichum</i> |
| b. Leaves orbicular-ovate, serrulate or denticulate | 3.2. var. <i>hirtum</i>        |

3.1. var. *heterotrichum* (Hochst. ex Mattei) Cuf. in Bull. Jard. Bot. De L' letat 29: 536. 1959; T.K. Paul in Ind. J. For. 10: 311. 1987. *Abutilon heterotrichum* Hochst. ex Mattei in Boll. Ort. Bot. Palermo n.s. 1: 90. 1915.

*Distrib.* India: Gujarat and Tamil Nadu.



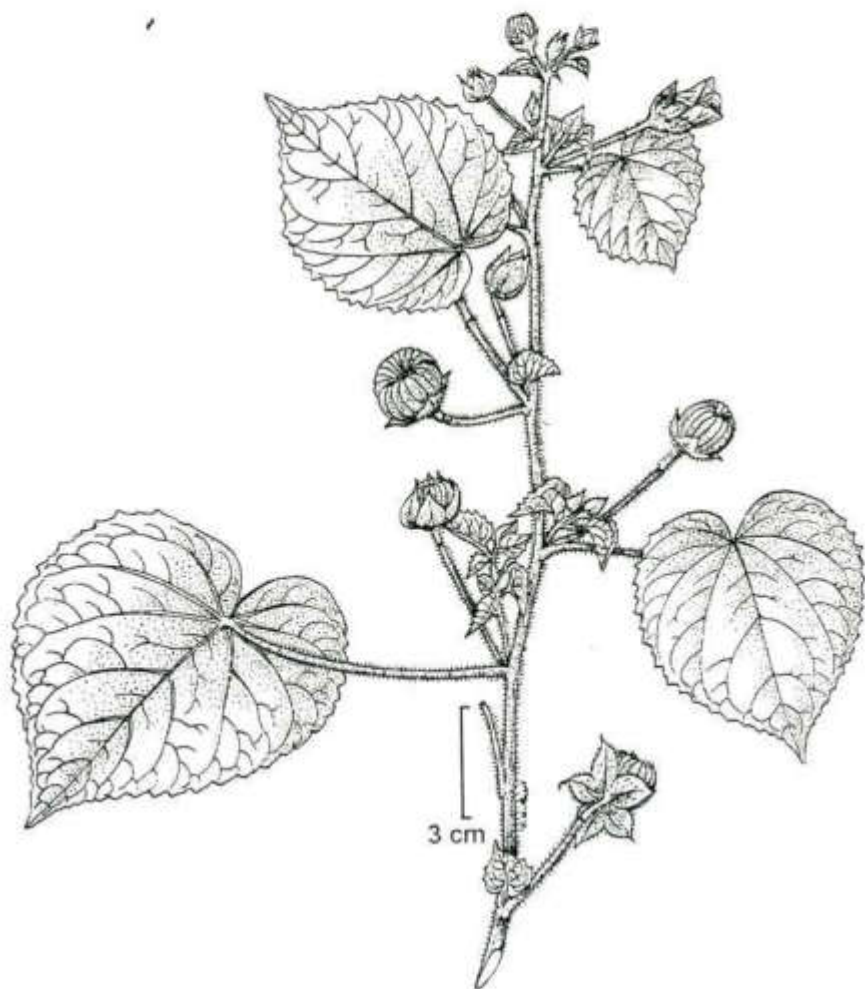


Fig. 71. *Abutilon hirtum* (Lam.) Sweet var. *hirtum*

Pakistan and Ethiopia.

**3.2. var. *hirtum***

Fig. 71.

*Fl. & Fr.* Oct. - April.

*Distrib.* India: Throughout in semiarid scrub forests up to 600 m.

Semiarid tropics of the old world, introduced in tropical America.

**4. *Abutilon indicum* (L.) Sweet, Hort. Brit. ed. 1, 54. 1826; Masters in Fl. Brit. India 1: 326. 1874; emend. Hochr. in Ann. Cons. Jard. Bot. Gener. 6: 19. 1902. *Sida indica* L. in Torner, Cent. pl. 2: 26. 1756.**

Annual or perennial herbs or undershrubs, up to 3 m high; stems, petioles and pedicels densely or sparsely velutinous with minute stellate and simple hairs. Leaves ovate to suborbicular, cordate at base, acute or acuminate at apex; petioles 2 - 18 cm long, hairy. Flowers axillary, solitary; pedicels longer than petioles, jointed towards apex, accrescent and geniculate. Calyx 5 - 8 mm across. Corolla 1.5 - 2.5 cm in diam., yellow to orange; petals broadly obovate, truncate, rounded or emarginate at apex, ciliate at base. Staminal column 5 - 7 mm long, basal part conical, stellate-hairy, upper portion tubular, glabrous. Schizocarps 1.5 - 2.5 cm in diam., globular, flat or slightly indented at apex; mericarps 15 - 27, reniform, upper part with a short acute mucro, dorsally and ventrally stellate-hairy, laterally glabrous, smooth, blackish, 2 - 3-seeded. Seeds 2 - 3 mm in diam., reniform, minutely stellate-hairy or glabrescent, brownish black.

KEY TO THE SUBSPECIES

- 1a. Calyx shorter than schizocarp, lobes spreading at maturity; mericarps shortly acuminate at apex  
4.3. subsp. *indicum*
- b. Calyx about as long as schizocarp, lobes appressed; mericarps obtuse or rounded to acute at apex, with an erect acumen  
2
- 2a. Leaves obtuse to acute or shortly acuminate at apex, coarsely stellate-hairy; mericarps long acute at apex, dorsally woolly  
4.2. subsp. *guineensis*
- b. Leaves long acuminate at apex, velutinous by small stellate hairs; mericarps usually rounded or obtuse, rarely long acute at apex, dorsally tomentose  
4.1. subsp. *albescens* var. *australiense*

**4.1. subsp. *albescens* (Miq.) Borss. var. *australiense* Hochr. in Ann. Cons. Jard. Bot. Geneve 6: 20. 1902; Chandrase in Bull. Bot. Surv. India 12: 276. 1970.**

*Distrib.* India: Andhra Pradesh.

Malesia, Australia and New Caledonia.

**4.2. subsp. guineensis** (Schumach.) Borss. in Blumea 14: 175. 1966. *Sida guineensis* Schumach. Kongl. Danske Vidensk. Selsk. Skr. 4: 81. 1829. *S. asiatica* L. in Torner, Cent. Pl. 2: 26. 1756. *Abutilon asiaticum* (L.) Sweet, Hort. Brit. ed. 1: 53. 1826; Masters in Fl. Brit. India 1: 326. 1874.

*Fl. & Fr.* Oct. - Nov.

*Distrib.* India: Central to S. India.

Tropical Asia, Tropical Africa, Australia.

**4.3. subsp. indicum**

*Fl. & Fr.* Sept. - April.

*Distrib.* India: Throughout.

Tropical and subtropical regions of the World.

*Notes.* Leaves, bark, roots and seeds are medicinal. The medicinal importance of this plant is known among the local people since long it is referred in Ayurveda and Unani systems of medicine.

**5. *Abutilon neilgherrense*** Munro ex Wight, Ill. Ind. Bot. 1: 66. 1840; Masters in Fl. Brit. India 1: 328. 1874.

Undershrubs or shrubs, 2 - 3 m high; stems and branches ascending, velutinous by minute stellate hairs. Leaves 4.5 - 11 x 2.5 - 9.5 cm, broadly ovate, cordate at base, acute to acuminate at apex, coarsely crenate to dentate or nearly entire, 7 - 11-nerved at base, stellate-pubescent on both the surfaces; petioles 2.5 - 10 cm, minutely stellate-hairy, basal portion of the main veins and petioles with both stellate and some simple hairs; stipules 5 - 20 mm long, linear, stellate-pubescent. Flowers usually 2 - 5, in axillary, long, peduncled cymes, rarely solitary; peduncles up to 10 cm long, densely stellate-pubescent; pedicels 0.5 - 5 cm long, jointed near apex, densely stellate-pubescent. Calyx 5 - 8 mm across, campanulate, divided to the middle or below, lobes 6 - 12 x 3 - 7 mm, ovate to ovate-lanceolate, acute or acuminate, each with one prominent midvein, stellate-pubescent on both surfaces. Corolla 1.5 - 3 cm across; petals 1.5 - 2 x 0.8 - 1.7 cm, broadly obovate, obtuse or truncate, ciliate at base. Staminal column 5 - 10 mm long, glabrous or densely stellate-pubescent, antheriferous towards apex. Schizocarps 1.2 x 2 cm, subcylindric, deeply indented at apex; mericarps 8 - 12, each 15 x 8 mm, flattened reniform with a short mucro, densely stellate-pubescent, 2 - 3-seeded. Seeds ca 3.5 x 2.5 mm, subreniform, tubercled, glabrous, hilum pubescent.

## KEY TO THE VARIETIES

- 1a. Staminal column 5 mm long, densely stellate-hairy 5.1. var. **fischeri**  
 b. Staminal column 8 - 10 mm long, glabrous 5.2. var. **neilgherrense**

**5.1. var. fischeri** T.K. Paul & Nayar in Bull. Bot. Surv. India 25: 183. 1985.

*Distrib.* India: Tamil Nadu.

Endemic.

**5.2. var. neilgherrense**

*Distrib.* India: Karnataka, Andhra Pradesh and Tamil Nadu. Endemic.

**6. *Abutilon pakistanicum*** Jafri & Ali in Jafri, Fl. Karachi 220. 1966. *Abutilon comutum* Dalz. ex T. Cooke, Fl. Pres. Bombay 1: 98. 1908 (Repr. 1: 104. 1958), non Sweet 1830.

Undershrubs, 20 - 100 cm high; stems and branches grey tomentose with appressed stellate hairs. Leaves 3 - 8 cm across, orbicular, cordate at base, shortly acuminate to subobtusate at apex, entire or slightly crenate-denticulate; petioles 1 - 9 cm long; stipules 5 - 8 mm long, linear, densely pubescent. Flowers axillary, solitary or in terminal racemes by reduction of the upper leaves; pedicels 0.8 - 1.8 cm long, slender, jointed in the middle. Calyx lobes connate at base, 7 - 10 x 4 - 5 mm, lanceolate to ovate, acute or mucronate. Corolla 2 cm in diam., pale yellow; petals 7 - 9 x 5 - 7 mm, obovate. Staminal column very short, stellate-hairy. Schizocarps 1 cm or more across; mericarps 8 - 10, 1.2 - 0.6 cm, with 1 mm long awns; seeds 3 per mericarp, ca 2 mm across, furfuraceous dotted.

*Fl. & Fr.* Aug. - Dec.

*Distrib.* India: N.W. Rajasthan.

Pakistan.

**7. *Abutilon pannosum*** (G.Forst.) Schlect., Bot. Zeit. 9: 828. 1851. *Sida pannosa* G.Forst. in Comment. Soc. Reg. Sci. Gotting ser. 2: 9. 1787. *S. mutica* Delile ex DC., Prodr. 1: 470. 1824. *Abutilon muticum* (Delile ex DC.) Sweet, Hort. Brit. ed 2: 65. 1830. Masters in Fl. Brit. India 1: 327. 1874.

Guj.: *Makhmali kapat.*

Undershrubs or shrubs, up to 2 m high; stems slender, tomentose by stellate and some simple hairs. Leaves 2 - 8 x 2 - 7.9 cm, orbicular to rounded-cordate, acute at apex, irregularly dentate, 5 - 9-nerved at base, densely stellate-hairy on both surfaces; petioles 1.5 - 6 cm, tomentose by stellate and simple hairs; stipules 3 - 6 mm long, linear, hairy. Flowers axillary, solitary, sometimes in terminal racemes by reduction of the upper leaves; pedicels 1 - 4 cm long, slender, jointed towards apex, pubescent by stellate and some simple hairs. Calyx campanulate, divided to the middle, lobes 8 - 15 x 5 - 8 mm, deltoid, densely stellate-hairy outside and with simple hairs inside. Corolla 1.5 - 2 cm across, yellow with deep brown centre; petals 1 - 2 x 1 - 1.5 cm, obliquely triangular, glabrous. Staminal column 5 - 8 mm long, not exceeding petals, antheriferous throughout, stellate-pubescent. Schizocarps 0.5 - 1 cm high, 1 - 2 cm across, subglobose, depressed at the top, downy; mericarps 20 - 25, 6 - 10 x 5 mm, reniform with awn, compressed on sides, hairy on the dorsal margin, 2 - 3-seeded. Seeds ca 1.5 mm across, minutely hairy or glabrous, brownish.

*Fl. & Fr.* Oct. - March.

*Distrib.* India: North Western to Central India and Deccan plateau in waste places up to 300 m. Rajasthan, Gujarat, Punjab, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and Kerala.

Sri Lanka, Pakistan, Afghanistan, Egypt and Tropical Africa.

*Notes.* Stem yields fibre of poor quality. Mucilaginous leaves used as pectoral.

**8. *Abutilon persicum*** (Burm. f.) Merr. in Philipp. J. Sci. 19: 364. 1921. *Sida persica* Burm. f., Fl. Ind. 148, t. 47, f. 1. 1768. *S. polyandra* Roxb., Fl. Ind. 3: 173. 1832. *Abutilon polyandrum* (Roxb.) Wight & Arn. ex Wight, Cat. No. 12. 1833, non G. Don 1831; Masters in Fl. Brit. India 1: 325. 1874. **Fig. 72.**

Undershrubs or herbs, 1 - 3 m high; stems, petioles and pedicels velutinous or tomentose by minute stellate hairs, with a few patent simple and some gland-tipped hairs. Leaves 2 - 20 x 1 - 25 cm, lower ones ovate-cordate, acute to acuminate at apex, upper ones ovate to lanceolate, gradually long acuminate at apex, crenate-dentate, 5 - 9-nerved at base with transverse connection like cobweb, densely stellate-hairy or glabrescent above, velutinous with minute stellate hairs with some scattered simple hairs on nerves beneath; petioles 0.5 - 12 cm, pubescent with stellate and simple hairs; stipules ca 6 mm, linear to subulate. Flowers solitary, axillary or partly in terminal panicles or racemes by reduction of upper leaves; pedicels 2.5 - 7 cm, accrescent up to 8 cm, jointed 1 - 2 cm below calyx, stellate-pubescent. Calyx 4 - 6 mm across, cup-shaped, divided to the middle or towards base, lobes 7 - 10 x 3 - 6 mm, ovate to lanceolate, acute to acuminate, densely hairy with minute stellate and some scattered simple hairs outside, velutinous with short simple hairs inside. Corolla yellow; petals 2 - 3.5 x 1.5 cm, obovate, outer margins hairy. Staminal column ca 5.5 mm long, basal part conical, glabrous, upper part

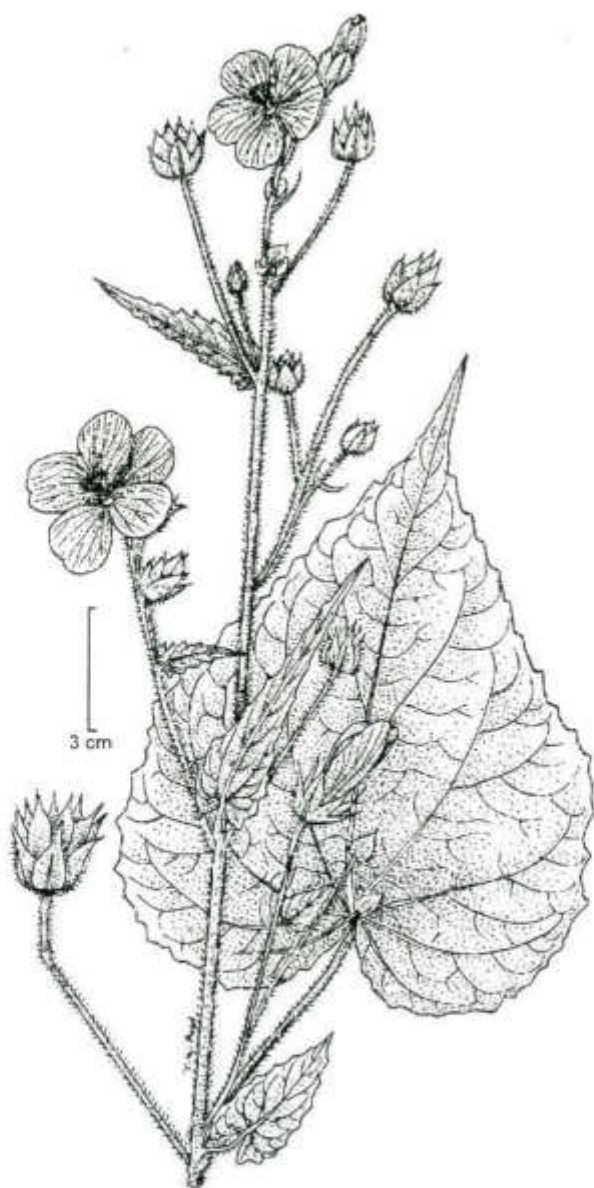


Fig. 72. *Abutilon persium* (Burm. f.) Merr.

stellate-hairy, filaments ca 15 mm long. Schizocarps 15 - 20 x 12 - 20 mm, more or less campanulate; mericarps 5, 15 - 20 x 12 - 20 mm and radially ca 5 mm with 2 stout, erecto-patent, ca 3 mm long awns, stellate and simple hairy outside, glabrous inside, 4 - 6-seeded. Seeds ca 2 mm across, reniform, glabrous or minutely punctate by stellate hairs, blackish-brown.

*Fl. & Fr.* Nov. - April.

*Distrib.* India: Throughout in dry deciduous forest up to 1000 m.

Bhutan, Myanmar, China and Malesia.

**9. *Abutilon ramosum* (Cav.) Guillemin & Perrottet** in Guillemin *et al.*, *Fl. Seneg. Tent.* 1: 68. 1830; Masters in *Fl. Brit. India* 1: 328. 1874. *Sida ramosa* Cav., *Diss.* 1: 28. t. 6. f. 1. 1785. *Abutilon sidoides* Dalz. & Gibs., *Bombay Fl.* 18. 1861. **Fig. 73.**

*Guj.*: *Dholi kapat.*

Perennial herbs or undershrubs, 1 - 3.5 m high; stems ash-coloured, densely stellate and simple hairy, glabrescent. Leaves 2.5 - 12 x 2.5 - 11 cm, ovate, cordate at base, acute to acuminate at apex, sometimes 3-angled, crenate-serrate, palmately 5 - 7-nerved at base, upper surface glabrescent or minutely stellate-pubescent and lower surface densely stellate-pubescent; petioles 2 - 12 cm long, stellate-hairy; stipules 5 - 10 mm long, linear, hairy. Flowers axillary or terminal, solitary or paired, or divided above dichotomously as in cyme; peduncles 1.5 - 4.5 cm long, tomentose; pedicels shorter than petioles, jointed towards apex, pubescent with stellate and simple hairs. Calyx campanulate, 3 - 5 mm across, divided to the middle, lobes 4 - 6 x 2.5 - 3 mm, accrescent up to 8 x 5 mm, ovate-acuminate, densely stellate-pubescent outside, minutely stellate and appressed simple hairy inside with middle portion glabrescent. Corolla yellow, ca 1 cm across; petals ca 5 x 8 mm, glabrous. Staminal column ca 2.5 mm long, antheriferous towards tip, stellate-hairy. Schizocarps ca 1 x 1 cm; mericarps 8 - 10, 6 - 10 x 3 - 5 mm, each with 2 long villose spreading or reflexed awns, dehiscing through dorsal suture, 2 - 3-seeded. Seeds ca 2 mm across, reniform, minutely stellate-puberulous, glabrescent, brownish-black.

*Fl.* Aug. - Oct. ; *Fr.* Sept. - March.

*Distrib.* India: Jammu & Kashmir, Punjab, Uttar Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Tamil Nadu and Kerala.

Pakistan and Tropical Africa.

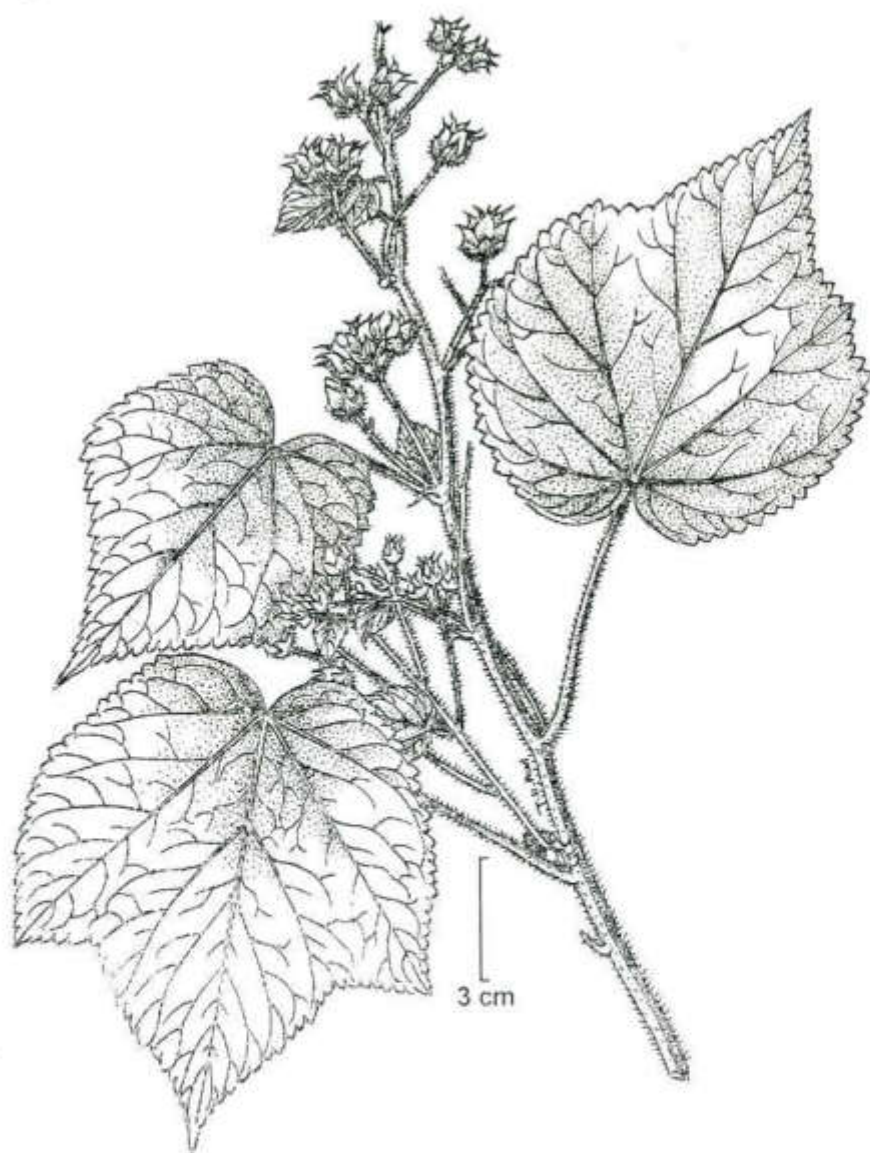


Fig. 73. *Abutilon ramosum* (Cav.) Guilleman & Perrottet.



**10. *Abutilon ranadei*** Woodrow & Stapf in Bull. Misc. Inform. 1894: 99. 1894; Cooke, Fl. Pres. Bombay 1: 96. 1901 (Repr. ed. 1: 101. 1958).

Undershrubs, ca 120 cm high; stems densely pubescent with minute stellate hairs when young, glabrous at maturity. Leaves 4 - 20 x 3 - 15 cm, ovate to rounded-ovate, cordate at base, acute to acuminate at apex, crenate to dentate, 7 - 11-nerved at base, stellate-hairy, on both surfaces, densely so on lower surface, upper surface occasionally glabrescent; petioles 2 - 15 cm long, densely stellate-pubescent; stipules ca 5 mm long, linear, stellate-pubescent, deciduous. Flowers axillary, solitary; pedicels 1.5 - 3 cm long, jointed near calyx, densely stellate-pubescent. Calyx ca 1.5 cm across, campanulate, divided to the middle, lobes ca 2 x 0.5 cm, ovate-lanceolate, acute with 3 prominent veins, stellate-hairy. Corolla ca 2.5 cm across, orange-yellow, campanulate; petals about two times longer than calyx lobes, more or less rounded at apex, tomentose towards apex outside, glabrous inside. Staminal column ca 2 cm long, glabrous; filaments ca 3 mm long. Carpels 5, acuminate, mucronate, densely hairy throughout. Seeds large, dusky-black, furfuraceous-dotted.

*Fl. & Fr.* Nov. - Jan.

*Distrib.* India: Maharashtra (Ambeghat).

Endemic.

**11. *Abutilon striatum*** Dickson ex Lindley, Bot. Reg. Misc. Nat. 39. 1839; T.K. Paul & Nayar in Fasc. Fl. India 19: 96. 1988. *Sida striata* (Dickson ex Lindley) D. Dietr., Syn. Pl. 4: 852. 1847.

Shrubs, 1 - 2 m high; branchlets, petioles and pedicels densely stellate-hairy, rarely glabrous. Leaves 2 - 12 x 1 - 10 cm, orbicular to broadly ovate, cordate, 5 - 7-nerved at base, 3 - 5 lobed or parted; lobes deltoid, ovate or oblong, acute or acuminate at apex, coarsely crenate to serrate, scattered stellate and simple hairy above, stellate-hairy beneath; petioles 1 - 6 cm long; stipules 3 - 6 cm, linear. Flowers axillary, solitary, mostly nodding; pedicels 3 - 10 cm long. Calyx campanulate, slightly inflated at base; lobes 5 - 10 x 5 - 8 mm, deltoid, acute or slightly acuminate, stellate-tomentose on both surfaces, densely papillose at base inside. Petals orange or pink with purple veins, 2.5 - 4 x 2 - 3 cm, obliquely obovate. Staminal column as long as petals. Schizocarps 1.5 - 2 cm across, globular; mericarps 8 - 11, ca 15 x 6 mm, reniform, rounded at apex, 7 - 9-seeded.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Cultivated as an ornamental in the gardens, occasionally running wild in Cherrapunji hills (Meghalaya) and Nilgiri hills (Tamil Nadu).

Native of Central America.

12. *Abutilon theophrasti* Medikus, Malv. 28. 1787. *Sida abutilon* L., Sp. Pl. 685. 1753. *A. avicennae* Gaertn., Fruct. Sem. Pl. 2: 251. t. 135. f. 1. 1791; Masters in Fl. Brit. India 1: 327. 1874.

Guj.: *Nani kapat*

Annual, undershrubs, stout, up to 1 m high; stems slender; bark fibrous when mature; stems, petioles and pedicels densely velutinous with stellate hairs and some scattered simple hairs. Leaves 3.5 - 16 x 4 - 13 cm, orbicular, cordate at base, shortly acuminate at apex, irregularly crenate to dentate or entire, 5 - 7-nerved at base, densely stellate-hairy on both surfaces, more densely on lower surface with larger hairs on nerves; petioles 5 - 18 cm long, pubescent; stipules 6 - 8 mm long, linear to filiform, acute. Flowers axillary, solitary; pedicels 1.5 - 4.5 cm long, shorter than petioles, jointed towards apex, usually geniculate, stellate-pubescent. Calyx ca 1 cm across, campanulate, divided to the middle or base, lobes 7 - 10 x 4 - 6 mm, ovate, acuminate, slightly accrescent, spreading, velutinous to tomentose by stellate hairs outside, with simple and stellate hairs inside. Corolla yellow, 1.5 - 2 cm across; petals 1.5 x 0.6 cm, obovate to orbicular, rounded at apex, glabrous. Staminal column 2 - 3 mm long, without tubular part, glabrous. Schizocarps 1 - 2 cm high, 1 - 2 cm across, exceeding the persistent calyx; mericarps 10 - 16, 10 - 15 x 7 mm, reniform, apex with 2 stout, sharp erecto-patent, 3 - 7 mm long awns, densely stellate-hairy, 1 - 2-seeded. Seeds 3 - 4 mm across, reniform, pubescent with minute stellate hairs particularly at the hilum, blackish-brown.

*Fl. & Fr.* May - Aug.

*Distrib.* India: N.W. India and Deccan plateau between 300 - 1500 m. Jammu & Kashmir, Punjab, Rajasthan, Gujarat and Tamil Nadu.

Subtropics of the world, probably native in the Mediterranean region.

*Notes.* Stem yields good fibre known as 'China Jute' or 'Tientsin jute'. The leaves are demulcent and the bark is astringent.

## 2. *Herissantia* Medikus

Herbs, often trailing, pubescent. Leaves ovate, cordate at base, acuminate at apex, crenate to serrate. Flowers solitary, axillary; pedicels filiform, jointed, geniculate. Epicalyx absent. Calyx stellate to widely campanulate, lobes almost free to the base. Corolla slightly exceeding calyx, petals obovate. Staminal column short, glabrous. Schizocarps globular, indented at apex; mericarps 10 - 15, inflated, membranous, shiny at maturity, rounded at apex, 2 or 3-seeded. Seeds reniform.

America, Australia, India and China (Hainan Islands), ca 3 species; one in India.

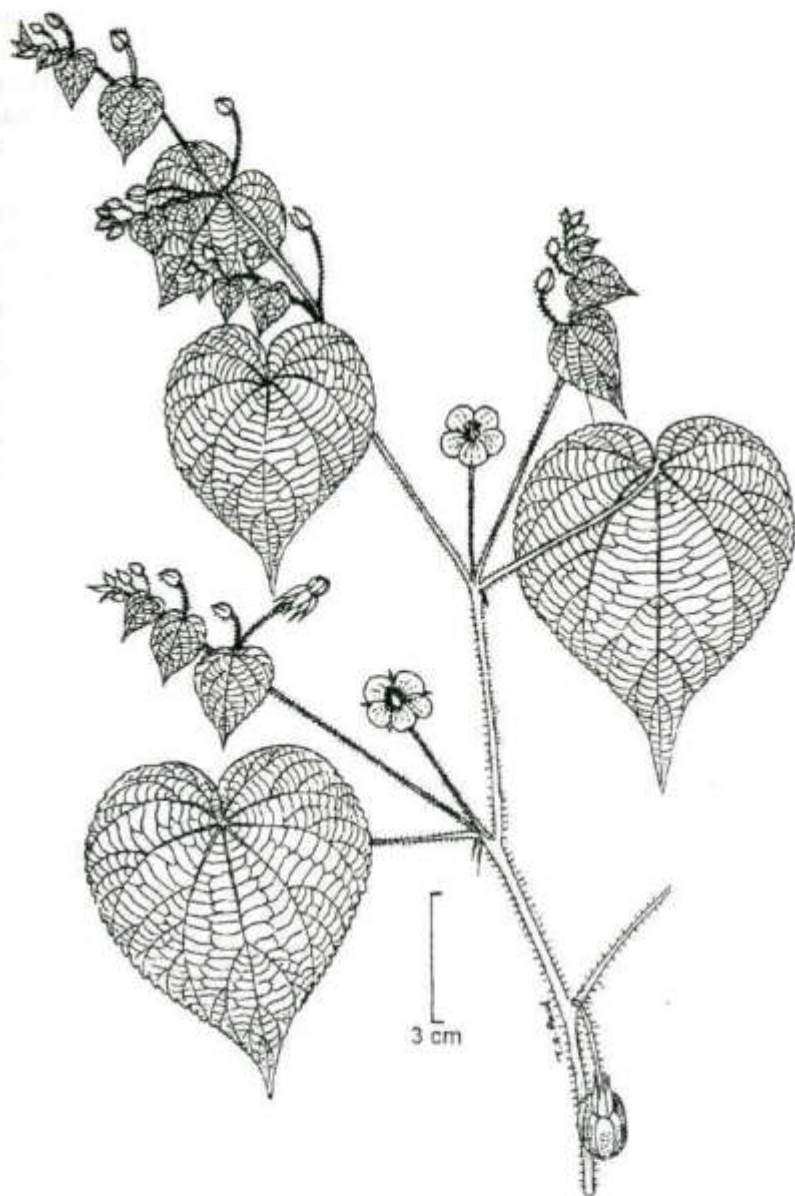


Fig. 74. *Herissantia crispera* (L.) Medikus

*Note.* This genus is allied to the *Abutilon* Mill. but can be well distinguished by its inflated carpels with rounded apex, thin chartaceous pericarp and vine-like weak stems.

***Herissantia crispa* (L.) Medikus, Phil. Bot. 1: 90. 1789; Brizicky in J. Arn. Arb. 49: 279. 1968. *Sida crispa* L., Sp. Pl. 685. 1753. *Abutilon crispum* (L.) Medikus, Malv. 29. 1787; Masters in Fl. Brit. India 1: 327. 1874. **Fig. 74.****

Herbs, 1 - 1.5 m high; stems ascending or decumbent, slender with flaccid branches; stems, petioles and pedicels densely minute stellate and simple hairy, rarely tomentose. Leaves 2 - 10 x 1.5 - 8 cm, ovate, cordate at base, acuminate at apex, crenate to serrate, 7 - 9-nerved, stellate-hairy on both surfaces, densely so beneath and with simple hairs on nerves; petioles 0.5 - 6.5 cm long; stipules 3 - 6 mm long, filiform, both reflexed. Flowers axillary, solitary, pedicels 1.5 - 3 cm, accrescent, up to 4.5 cm long, filiform, jointed above middle. Calyx ca 8 mm across, campanulate, 5-lobed; lobes 4 - 7 x 2 - 2.5 cm, ovate to linear-triangular or lanceolate, densely stellate-hairy. Corolla as long as or slightly shorter than calyx, white or pale yellow, ca 4.5 mm across; petals broadly obovate, ca 10 mm long, glabrous except for ciliate base. Staminal column 2 - 2.5 mm long, glabrous. Schizocarps 10 - 15 mm across, globular, indented at apex; nodding; mericarps 10 - 15, 10 - 15 mm radially, elliptic, inflated, rounded at apex and base, awnless, dorsally with coarse simple and minute stellate hairs, lateral walls silvery, membranous and more or less transparent, 2 - 3-seeded. Seeds 1.5 - 2 mm across, reniform, covered with curved, appressed, simple hairs, brownish black.

*Fl. & Fr.* July - Feb.

*Distrib.* India: Western Ghats and Deccan plateau in dry deciduous forests up to 800 m; Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Native of America, now a pantropical weed.

### 3. *Malvastrum* A. Gray, nom. cons.

Herbs or undershrubs. Leaves entire, rarely shallowly or deeply lobed, penninerved. Flowers axillary, solitary, or in clusters or in terminal and axillary spikes; pedicels short. Epicalyx segments 3, slightly adnate to calyx. Calyx campanulate, 5-parted. Corolla yellow, rotate. Staminal column shorter than petals. Carpels 10 - 15; style-branches as many as carpels, filiform with clavate, truncate or capitate-stigmatose tips. Schizocarps discoid; mericarps flattened, reniform, with or without awns, indehiscent, laterally and radially separating from the axis leaving a short columella in centre, veined.

Native in tropical and subtropical America, ca 3 species, 2 of them naturalised in most tropical countries including India. In India one is naturalised and other rarely cultivated in gardens.

## KEY TO THE SPECIES

- 1a. Mericarps without awns; flowers in dense spikes subtended by bracts; stems, petioles and pedicels appressed with 5 - 10- armed stellate hairs pointing in all directions **1. *M. americanum***
- b. Mericarps with 3 awns; flowers axillary, solitary or in clusters, ebracteolate; stems, petioles and pedicels appressed with 4-armed stellate hairs, two arms of which pointing upwards and two downwards **2. *M. coromandelianum***

**1. *Malvastrum americanum* (L.) Torr.** Rep. U.S. Mex. Bound. Surv. 2: 38. 1859; *Malva americana* L., Sp. Pl. 687. 1753. *M. spicata* L. Syst. Nat. ed. 10, 2. 389. 1759. *Malvastrum spicatum* (L.) A. Gray, Mem. American Acad. Sci. Sec. II, 4 (Pl. Fendl.) 22. 1849; Masters in Fl. Brit. India 1: 321. 1874.

Erect, annual herbs or undershrubs, up to 2 m high. Leaves 2 - 7 x 1 - 5 cm, ovate to oblong, acute to obtuse or truncate to shallowly cordate at base, acute at apex, rarely 3-lobed, serrate to crenate, 5 - 7-nerved at base, stellate-tomentose on both surfaces; petioles 0.5 - 3.5 cm long; stipules 4 - 5 mm long, filiform. Flowers in axillary or terminal, up to 6 cm long spikes; bracts 4 - 6 x 1.5 - 2.5 mm, ovate, bifid or biparted, with acute or acuminate segments, densely covered with simple and minute stellate hairs outside, glabrous inside, caducous. Epicalyx segments 8 - 10 x 1.5 - 2.5 mm, linear to lanceolate, acuminate, with simple and minute stellate hairs outside, glabrous inside. Calyx 5 - 7 mm across, slightly accrescent, 5-fid or parted; lobes ca 4 x 3 mm, triangular, acuminate, densely long, appressed simple hairy outside, stellate-hairy along margins inside. Corolla yellow, 1 - 1.5 cm across; petals obliquely obovate, emarginate at apex, ciliate at base by stellate hairs. Staminal column 2 - 3 mm long, conical at base, tubular towards apex, stellate-hairy. Mericarps 10 - 15, ca 2 mm across, strongly curved, obtuse at apex, dorsally with sharp edges and covered with erecto-patent simple hairs mixed with minute stellate hairs, laterally with radial, prominent veins. Seeds ca 1 mm across, reniform brown-grey, glabrous.

*Distrib.* India: Rare.

Semi-arid tropical and subtropical regions of both hemispheres.

**2. *Malvastrum coromandelianum* (L.) Garcke** in Bonplandia 5: 295. 1857. *Malva coromandeliana* L. Sp. Pl. 687. 1753. *M. tricuspidata* R. Br. in Aiton l., Hort. Kew. ed. 2. 4: 210. 1812. *Malvastrum tricuspidatum* (R. Br.) A. Gray, Pl. Wright 1: 16. 1852; Masters in Fl. Brit. India 1: 321. 1874. **Fig. 75.**

Annual, erect herbs or undershrubs up to 1 m high; stems, petioles and pedicels with 4-armed appressed stellate hairs, two arms of which pointing upwards and two downwards. Leaves 1.5 - 6.5 x 0.5 - 3.5 cm, ovate to oblong, sometimes lanceolate, acute, obtuse or rounded at base, obtuse to acute at apex, coarsely serrate or dentate, 5-nerved at base, appressed simple hairy on both surfaces, nerves densely covered with 4-armed

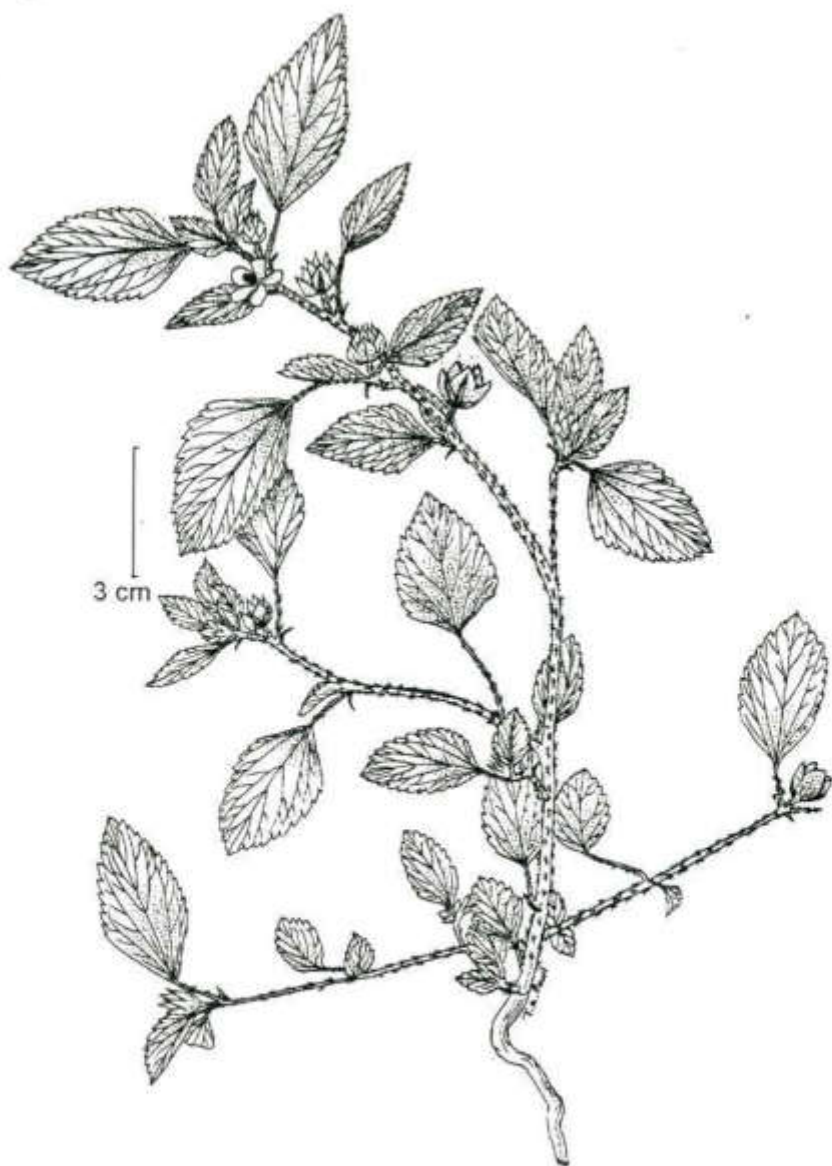


Fig. 75. *Malvastrum coromandelianum* (L.) Garcke

stellate hairs beneath; petioles 0.5 - 4 cm long; stipules 3 - 8 mm long, linear to lanceolate, acuminate, entire or faintly serrate, hairy. Flowers axillary, solitary or 2 - 4 in clusters; pedicels 2 - 6 mm long, accrescent up to 10 mm. Epicalyx segments 4 - 7 x 0.7 - 1 mm, linear to lanceolate, acute, sparsely 4-armed stellate-hairy. Calyx 6 - 8 mm high, 8 - 12 mm across, campanulate, lobes 5 - 10 x 3 - 5 mm, slightly accrescent, deltoid to ovate, acuminate, 4-armed, stellate-hairy outside, margin densely stiff simple hairy, marginal and apical portion of the inside densely pubescent with minute stellate hairs, otherwise glabrous or nearly so. Corolla yellow, ca 1.5 cm across; petals obliquely obovate, rounded or emarginate at apex, ciliate at base. Staminal column ca 2.5 mm long, conical, glabrous. Schizocarps ca 2 mm high, 5 - 8 mm across, globular; mericarps 10 - 14, ca 2 mm high, radially 2.5 mm; strongly curved, dorsally with sharp-edged, with 0.5 - 1 mm long, apical awn, at the middle with ca 0.5 mm long awns pointing outwards, dorsally above the middle with erecto-patent simple hairs, below the middle with minute stellate hairs or glabrous, laterally with prominent radial veins, 1-seeded. Seeds ca 1.5 mm across, glabrous, brownish-black.

*Distrib.* India: Throughout in waste places, road sides, fallow fields and as secondary vegetation up to 1100 m.

Pantropical.

*Notes.* This species is often confused with the *Sida* species especially *S. acuta*, but can be easily distinguished from the latter by its epicalyx and strigose indumentum on stems, petioles and pedicels.

It shows a wide range of variation in the shape and size of leaves often on the same plant.

#### 4. *Modiola* Moench

Annual herbs, prostrate with tuberous root stock, stellate-pubescent. Leaves digitately divided. Flowers axillary, solitary; pedicels jointed. Epicalyx segments 3, free, lanceolate. Calyx 5-lobed. Petals 5, red. Staminal column divided at apex into numerous filaments. Carpels numerous, locules 3 or 2-ovulate; styles as many as carpels; stigmas capitate. Fruit a schizocarp; mericarps separating with 2 crests on the back, 3-valved, transversely septate between seeds, setose-pilose. Seeds reniform.

Tropical and subtropical regions of America, ca 5 species; one in India.

*Modiola caroliniana* (L.) G. Don, Gen. Hist. 1: 465. 1831; Gamble, Fl. Pres. Madras 102. 1915. *Malva caroliniana* L., Sp. Pl. 688. 1753.

Herbs; stems and branches prostrate, densely stellate-pubescent. Leaves 3-fid, each lobe again dissected; petioles 0.5 - 3.5 cm long; stipules ca 3 mm long. Flowers

solitary, axillary; pedicels jointed. Epicalyx segments 3, free, lanceolate. Calyx lobes triangular, 3-nerved. Petals 3 - 4 mm long, hardly longer than calyx. Schizocarps with more than 20 mericarps, hairy, mericarps 2-seeded. Seeds glabrous.

*Distrib.* India: Uttar Pradesh (Chakrata) and Tamil Nadu (Ootacamund).

Native of America.

### 5. *Sida* L.

Annual or perennial herbs or undershrubs. Leaves ovate, rhomboid, obovoid, retuse or lanceolate, entire, rarely lobed or divided, palmi- or penninerved. Flowers axillary, solitary or in clusters by development of accessory buds or in racemes or panicles by reduction of upper leaves. Epicalyx absent. Calyx mostly campanulate, 5-lobed. Corolla yellow or yellowish white, rotate, connate at base and adnate to the staminal column. Staminal column shorter than petals, hairy or glabrous. Carpels 5 - 14, uniovulate; styles as many as carpels; stigmas capitate. Schizocarps globular to oblate, depressed; mericarps more or less trigonous, mucous or with two beaks or biaristate at apex, outer surface smooth or prominently reticulate, indehiscent or dehiscent along mid-dorsal line, rarely along inner margin or by withering of lateral or basal walls. Seeds ovoid-oblong to reniform, glabrous or hairy.

Tropics and subtropics of the World, ca 200 species; 12 in India.

#### KEY TO THE SPECIES

- |   |  |
|---|--|
| 1a. Mericarps 5   | 2  |
| b. Mericarps 6 - 12   | 8  |
| 2a. Mericarps smooth, mucronate; seeds dispersed by withering of wall; leaves palminerved                 | 3  |
| b. Mericarps with prominent reticulation, awned; seeds dispersed by apical dehiscence; leaves penninerved | 6  |
| 3a. Erect herbs or undershrubs; flowers in axillary or terminal racemes or panicles                       | 4  |
| b. Prostrate or diffuse herbs; flowers usually solitary or in few-flowered racemes                        | 5  |
| 4a. Plants viscid with glandular hairs; staminal column glabrous  | 7. <i>S. mysorensis</i>                      |
| b. Plants not viscid; staminal column pubescent   | 5. <i>S. elongata</i> var. <i>balica</i>     |
| 5a. Stems never rooting at nodes; pedicels jointed near middle; mericarps glabrous                        | 3. <i>S. cordata</i>                         |
| b. Stems rooting at nodes; pedicels jointed near apex; mericarps hairy                                    | 6. <i>S. javensis</i> subsp. <i>expilosa</i> |
| 6a. Leaves wedge-shaped, oblong, apex retuse with a small toothlet in the middle                          | 10. <i>S. schimperiana</i>                   |
| b. Leaves ovate, oblong or lanceolate, apex acute   | 7  |
| 7a. Stems with 1 - 2 spiny emergences at the base of petioles; mericarps with 2 divergent apical awns     | 11. <i>S. spinosa</i>                        |
| b. Stems without any spiny emergence; mericarps with a pair of convergent apical awns                     | 2. <i>S. alba</i>                            |



- 8a. Stipules of each pair dissimilar, one linear to lanceolate and other linear to filiform; leaves sparsely hairy, soon glabrescent **1. *S. acuta***
- b. Stipules of each pair not dissimilar; leaves densely pubescent 9
- 9a. Mericarps dehiscent 10
- b. Mericarps indehiscent 11
- 10a. Mericarps with 2 awns, awns retrorsely hairy **4. *S. cordifolia***
- b. Mericarps with or without awns, awns never retrorsely hairy **9. *S. rhombifolia***
- 11a. Schizocarps completely enclosed by calyces; calyx lobes 8 - 9 x 5 - 7 mm; mericarps with 2 outgrowths just below the awns **12. *S. tiagli***
- b. Schizocarps not completely enclosed by calyces; calyx lobes 5 - 7 x 3 - 5 mm; mericarps without outgrowths below the awns **8. *S. ovata***

**1. *Sida acuta*** Burm. f., Fl. Ind. 147. 1768; Roxb., Fl. Ind. 3: 171. 1832; emend. K. Schum. in Fl. Brasil. 12, 3: 326. 1891. *S. lanceolata* Retz., Obs. Bot. 4: 119. 1786; Roxb., Hort. Beng. 50. 1814 & Fl. Ind. 3: 175. 1832. *S. carpinifolia* auct. non L.f. 1785; Masters in Fl. Brit. India 1: 323. 1874. **Fig. 76.**

Annual, erect or ascending herbs or undershrubs, 0.5 - 2 m high; stems pubescent with minute stellate hairs mixed with some simple hairs, ultimately glabrescent. Leaves 1 - 9 x 0.5 - 2.5 cm, lanceolate to linear, elliptic-lanceolate or ovate-oblong, acute, rarely obtuse or rounded at base, acute at apex, mostly coarsely or remotely serrate, 3-nerved at base, sparsely stellate and simple hairy on both surfaces, soon glabrescent; petioles 2 - 6 mm long, pubescent with minute stellate hairs; stipules 6 - 12 x 1 - 1.5 mm, each pair different with one lanceolate to linear 3-6-nerved another linear to filiform, 1 - 4-nerved. Flowers axillary, solitary or 2 - 8 in clusters of 3 - 12 mm long. Calyx 5 - 6 mm across, campanulate, slightly accrescent, 5-fid; lobes ca 7 x 3 mm, triangular, acuminate, stellate and simple hairy outside, glabrous inside. Corolla light yellow, 8 - 10 mm across; petals as long as or slightly exceeding, calyx lobes obliquely obovate, usually emarginate, ciliate at base, sparsely glandular hairy outside. Staminal column ca 4 mm long with simple and glandular hairs, antheriferous towards apex. Ovary 1.5 mm across, ovoid or globular. Mericarps 6 - 10, ca 4 mm long, somewhat tetrahedral, birostrate, awns ca 1.5 mm long with a groove in between, glabrous, reticulately striate, 1-seeded. Seeds ca 2 mm long, triangularly ovoid, glabrous, except for hairy hilum, dark brown.

*Fl. & Fr.* Sept. - May.

*Distrib.* India: Along roadsides, in wastelands, both shady and open places up to 1200 m. Throughout.

Pantropical.

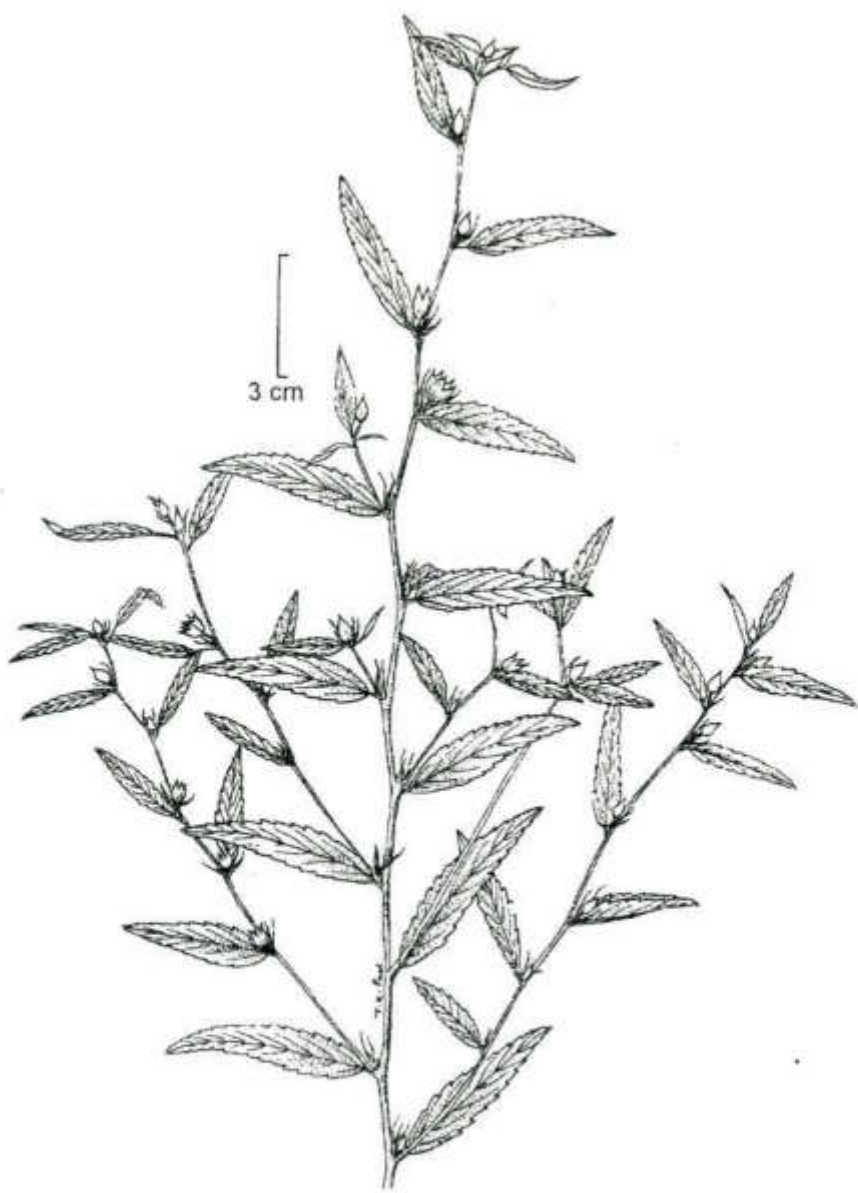


Fig. 76. *Sida acuta* Burm. f.

2. *Sida alba* L., Sp. Pl. ed. 2. 966. 1763. *S. alnifolia* L. var. *obovata* Hu, Fl. China, fam 153. 22, t. 16 f. 5. 1955, non *S. rhombifolia* L. var. *obovate* Wallich ex Masters in Fl. Brit. India 1: 324. 1874.

Undershrubs or herbs, up to 1 m high, stellate-pubescent. Leaves 1 - 2.5 x 0.5 - 2 cm, elliptic-obovate, cuneate or obtuse at base, acute at apex, crenate-serrate, glabrescent above, minutely stellate-pubescent beneath; petioles 0.5 - 1 cm long; stipules ca 5 mm long, filiform. Flowers axillary, solitary or paired; pedicels 3 - 6 mm long, fruiting pedicel 1 - 2 cm long. Calyx 3 - 5 mm across, campanulate, free above the middle, lobes 2 - 4 x 1 - 2 mm, deltoid, acute. Corolla yellow slightly exceeding the calyx. Schizocarps 4 - 5 mm across, depressed globose; mericarps 5, ca 2 x 15 mm, stellate-pubescent, with 2 convergent apical awns; awns ca 0.8 mm long, hairy, mericarps dehiscing at base. Seeds ca 1.5 mm long, glabrous, brownish black.

*Fl. & Fr.* Sept. - Dec.

*Distrib.* India: Throughout.

Pakistan.

3. *Sida cordata* (Burm. f.) Borss. in Blumea 14: 182. 1966. *Melochia cordata* Burm. f., Fl. Ind. 143. 1768. *Sida veronicifolia* Lam., Encycl. 1: 5. 1783. *S. humilis* Cav., Diss. 5, t. 134, f. 2. 1788; Masters in Fl. Brit. India 1: 322, 1874, incl. var. *veronicifolia*. *S. beddomei* Jacob in J. Bombay Nat. Hist. Soc. 47: 50, 1950. Fig. 77.

Herbs, prostrate or ascending, up to 1 m high, branched throughout or mostly towards base, rarely rooting at nodes in trailing condition; stems, petioles and pedicels pubescent with scattered, long, patent simple and minute stellate hairs. Leaves 0.5 - 8 x 0.3 - 5.5 cm, ovate to orbicular, cordate, acute to acuminate at apex, crenate-dentate or serrate, 5 - 7-nerved at base, appressed simple hairy mixed with some stellate-hairs on both surfaces; petioles 1.5 - 30 mm long; stipules 1 - 3 mm long, linear, filiform, hairy. Flowers axillary, solitary, ultimately in few-flowered racemes, either by development of accessory buds or by decrescens of upper leaves; pedicels 1 - 2.5 cm long, slender, slightly accrescent, jointed above the middle. Calyx ca 3 mm across, campanulate, 5-fid, lobes connate up to just above the middle, 4 - 6 x 0.2 mm, deltoid to triangular, acuminate, prominently uninerved, simple and some stellate-hairy outside, glabrous inside except along margin. Corolla yellow to light yellow, ca 10 mm across; petals ca 5 x 4 mm, obovate, ciliate at base. Staminal column ca 3 mm long, basal portion conical, tubular part short, glabrous or with some short, simple hairs. Schizocarps ca 4 x 3 mm, globose, enclosed in persistent calyx, brownish black; mericarps 5, ca 4 x 2 mm, slightly longitudinally keeled on the back, tetrahedral with rounded angles, awnless. Seeds ca 2 x 1 mm, brownish black, glabrous, dispersed by withering of wall.

*Fl. & Fr.* Throughout the year, mainly during Sept. - Nov.

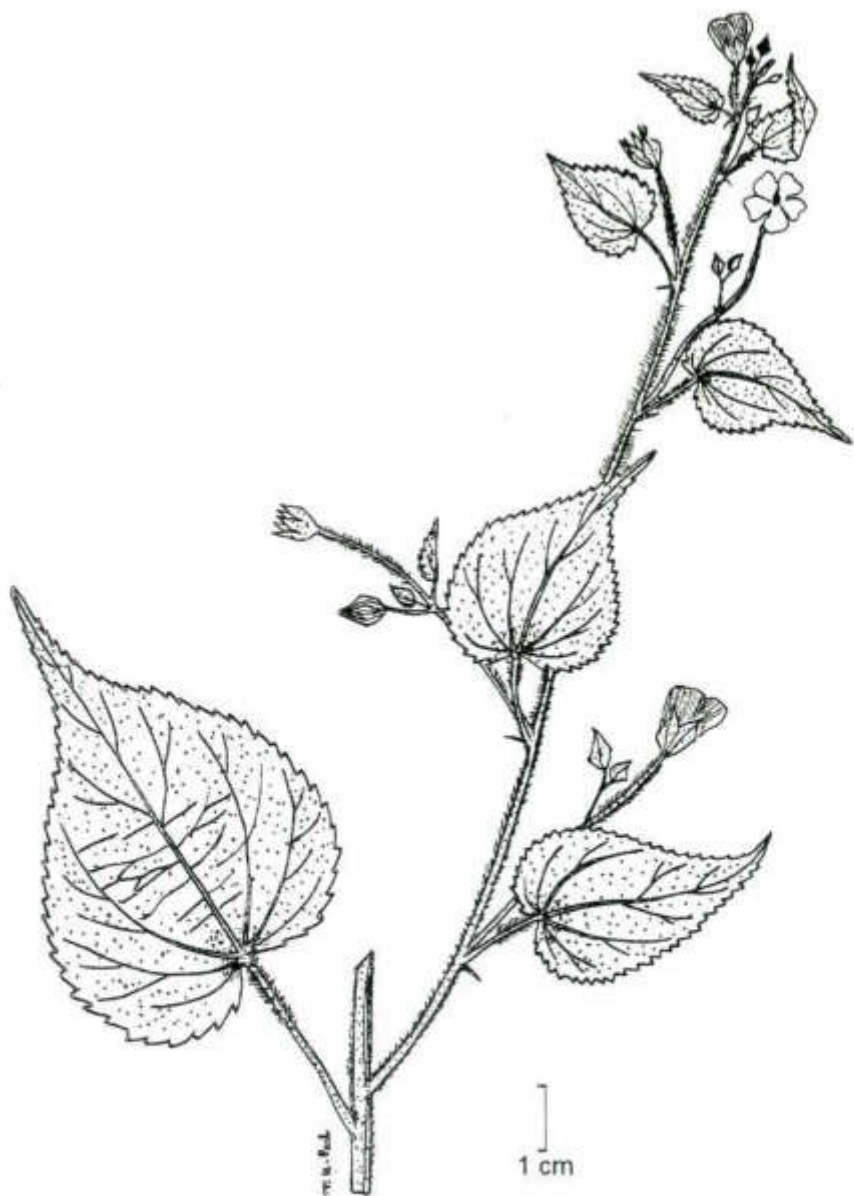


Fig. 77. *Sida cordata* (Burm. f.) Borss.

*Distrib.* India: In waste lands, humid and shady places up to 1500 m. Throughout.

Pantropical.

*Note.* Stems, leaves and root bark are medicinal. Stem yields good fibre.

4. *Sida cordifolia* L., Sp. Pl. 684. 1753; Masters in Fl. Brit. India 1: 324. 1874.

Beng. & Hindi : *Bariala, Berala*; Sans.: *Batyulaka*

Undershrubs, up to 1 m high, with an unpleasant smell; stems, petioles and pedicels velutinous to tomentose or densely pubescent with minute stellate hairs mixed with simple hairs. Leaves 0.5 - 6 x 0.4 - 5 cm, ovate to oblong or orbicular, shallowly cordate at base, obtuse or acute, occasionally rounded or truncate at apex, crenate-serrate, 5 - 7-nerved at base, densely velutinous with minute stellate hairs on both surfaces; occasionally with some patent simple hairs on lower surface particularly on veins; petioles 4 - 5 mm long; stipules 3 - 10 mm long, filiform, densely stellate-hairy mixed with some simple hairs. Flowers axillary, solitary or 2 - 5 in clusters particularly towards apices of branchlets; pedicels 2 - 10 mm long, accrescent up to 2 cm, jointed towards apex. Calyx 5 - 9 mm across, campanulate, somewhat accrescent; lobes triangular acute to acuminate, densely stellate-pubescent mixed with some simple hairs outside, sparsely stellate-hairy towards apex inside. Corolla yellow or whitish yellow, ca 15 mm across; petals obliquely obovate, truncate at apex; ciliate at base. Staminal column ca 2.5 mm long, simple hairy or glabrous. Ovary conical, stellate-hairy. Mericarps 8 - 10, ca 3.5 mm long excluding awns, radially ca 2 mm, both dorsal and ventral surfaces with prominent reticulations, and apical portion stellate-hairy, apex of mericarp with a pair of awns, 3 - 4.5 mm long, retrorsely hairy. Seeds ca 2 mm across, flattened reniform, glabrous except for a few short hairs near hilum, dark brown or black.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: In dry waste places. Throughout.

Pantropical.

5. *Sida elongata* Blume var. *balica* (Miq.) Borss. in Blumea 14: 182. 1966; Mathew & Sivarajan in J. Econ Tax. Bot. 4: 617. 1983. *S. balica* Miq., Fl. Ind. Bat. 1, 2: 141. 1858.

Annual, erect herbs or undershrubs, ca 1.5 m high; stems terete, densely pubescent with coarse stellate and simple hairs. Leaves 2.5 - 10 x 1 - 8 cm, ovate to orbicular, cordate at base, acute to acuminate at apex, irregularly crenate, 7 - 9-nerved at base, densely pubescent with stellate and simple hairs; petioles 3 - 6 mm long, pubescent; stipules 6 - 7 mm long, linear, hairy. Flowers axillary, initially solitary, ultimately in lax racemes or panicles by development of accessory buds or by decrescence of leaves;

pedicels 1 - 2 cm long, accrescent up to 4 cm, slender, jointed in the middle. Calyx ca 3 mm long, campanulate, 5-lobed; lobes as long as tube, triangular, ciliate. Corolla yellow, ca 20 mm across; petals ca 10 mm long, obovate, rounded at apex, glabrous. Staminal column ca 5 mm long, hairy, base conical, antheriferous at apex. Mericarps 5, tetrahedral with blunt angles, ca 2.5 mm long, awnless, dorsally short hairy. Seeds ca 2.5 mm long, ovoid, slightly trigonous, glabrous, greyish to blackish brown.

*Distrib.* India: Kerala.

Malesia (Java and lesser Sunda Islands).

**6. *Sida javensis*** Cav. subsp. *expilosa* Borss. in *Blumea* 14: 185. 1966; Mathew & Sivarajan in *J. Econ. Tax. Bot.* 4: 619. 1983.

Herbs, prostrate, branched at base, with stems rooting at nodes; stems, petioles and pedicels densely covered with minute stellate and long simple hairs. Leaves 5 x 5 cm, orbicular, cordate at base, rounded or obtuse, rarely acute, appressed, short, simple hairy above, minute stellate-hairy beneath; petioles 1.5 - 5 cm, hairy. Flowers axillary, solitary initially, ultimately in few-flowered racemes by development of accessory buds; pedicels 7 - 12 mm, accrescent up to 2 cm. Calyx ca 4 mm across; lobes 2 - 3 x 1.5 - 2 mm, long simple and minute stellate-hairy outside, glabrous inside except along margin. Corolla ca 8 mm across; petals 7 - 8 x 4 - 5 mm, obovate. Staminal column ca 1.5 mm long, with patent simple hairs, basal part wide, conical, apical part short, tubular. Mericarps 5, tetrahedral with rounded angles, hairy with 2 awns. Seeds 2 - 2.5 mm long, ovoid, hilum short hairy, brown black.

*Distrib.* India: Kerala.

West Indies and Malesia.

**7. *Sida mysorensis*** Wight & Arn., *Prodr.* 59. 1834; Masters in *Fl. Brit. India* 1: 322. 1874. *S. urticifolia* Wight & Arn. *Prodr.* 59. 1834, non St. Hill. 1828. *S. wightiana* D. Dietr., *Syn. Pl.* 4: 845. 1847. *S. glutinosa* Roxb., [*Hort. Beng.* 97. 1814, nom. nud.] *Fl. Ind.* 3: 172. 1832. **Fig. 78.**

Annual or perennial herbs or undershrubs, much branched odorous, ca 90 cm high; stems, petioles and pedicels densely pubescent with minute stellate hairs, mixed with gland-tipped hairs and some long patent simple hairs. Leaves 1.5 - 8 x 1 - 7 cm, ovate, occasionally the upper leaves oblong or orbicular, cordate at base, acute to acuminate at apex, serrate to crenate, 5 - 11-nerved at base, pubescent with stellate and gland-tipped hairs on both surfaces, densely so on lower surface; petioles 1 - 7 cm long; stipules 3 - 6 mm long, filiform, hairy. Flowers axillary, solitary initially, ultimately in condensed



Fig. 78. *Sida mysorensis* Wight & Arn.

racemes or panicles by development of accessory buds; pedicels 3 - 20 mm long, slightly accrescent, thinner than petiole, jointed towards apex. Calyx 5 - 10 x 3 - 4 mm, widely campanulate, 5-fid, lobes connate up to the middle, 2.5 - 5 x 2 - 2.5 mm, deltoid, acute to acuminate, with one prominent midvein, pubescent with stellate and few long patent simple hairs outside, glabrous except along margins inside. Corolla yellow, 5 - 20 mm across; slightly exceeding calyx; petals obtriangular, glabrous. Staminal column ca 4 mm long, antheriferous towards apex, with basal part wide, conical, upper part narrow tubular and glabrous. Ovary ca 1 mm long, brownish black; styles ca 4 mm long, connate up to the middle. Mericarps 5, 2.5 - 3 mm, tetrahedral with rounded angles, acute and short hairy at apex. Seeds ca 2 mm long, ovoid to obtriangular, glabrous, brown-black, dispersed by withering of wall.

*Fl. & Fr.* Oct. - Feb.

*Distrib.* India: Along roadsides and in wastelands up to 600 m. Bihar, West Bengal, Meghalaya, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

S. and S.E. Asia.

*Notes.* Most of the botanists have treated *Sida mysorensis* Wight & Arn. as synonym of *Sida glutinosa* Comm. ex Cav. but it can be easily distinguished from the latter by its awnless mericarps. Borssum-Waalkes (1966) placed *S. mysorensis* Wight & Arn. and *S. glutinosa* Cav. in two different sections like *Nela vaga* and *Sida* respectively.

**8. *Sida ovata*** Forsskal, Fl. Aegypt.-Arab. 124. 1775. *S. grewioides* Guillemin & Perrottet in Guillemin *et al.* Fl. Seneg. Tent. 1: 71. 1830; Masters in Fl. Brit. India 1: 323. 1874.

**Fig. 81 c-d.**

Undershrubs, ca 30 cm high; stems, petioles and pedicels pubescent with stellate hairs. Leaves 1.5 - 5 x 1 - 4 cm, ovate-oblong, rounded at base, obtuse at apex, crenate, densely stellate-velutinous on both surfaces; petioles 0.5 - 1.5 cm long; stipules up to 1 cm long, linear to lanceolate, stellate-pubescent. Flowers axillary, solitary or sometimes paired; pedicels 0.5 - 1 cm long, shorter than petioles, jointed above the middle. Calyx 5 - 8 mm across, campanulate, accrescent up to 1.5 cm; lobes 5 - 7 x 3 - 5 mm, ovate, accrescent up to ca 10 x 7 mm, densely stellate-pubescent outside, glabrous except for stellate and few simple hairs towards apical margins inside. Corolla yellow or yellowish white; petals ca 1 x 0.5 cm, obliquely truncate, sparsely covered with bulbous based hairs, glabrous inside. Staminal column ca 7 mm long, simple and stellate-hairy. Schizocarps ca 5 mm across, indehiscent or nearly so, blackish; mericarps 8, 3 - 4 mm across, with prominent reticulate, on dorsal and ventral surface sparsely hairy, 2-awned at apex, awns compressed, ca 1 mm long. Seeds 2 mm in diam., rounded-reniform, glabrous, hilum with few short stellate hairs, blackish.



*Fl. & Fr.* July - Feb.

*Distrib.* India: In dry open areas up to 600 m. Punjab, Uttar Pradesh, Rajasthan, Gujarat, Maharashtra and Andhra Pradesh.

Pakistan, Iran, Arabia and Africa.

9. *Sida rhombifolia* L., Sp. Pl. 684. 1753; emend. Masters in Fl. Brit. India 1: 323. 1874.

Annual or perennial herbs or undershrubs. Stems, petioles and pedicels covered with minute stellate hairs or rigid hairs, ultimately glabrescent. Leaves ovate to oblong, often more or less rhomboid, ovoid, or lanceolate, apically serrate to crenate, entire towards base, minutely stellate-pubescent or tomentose by more or less stiff simple hairs on both surfaces; stipules filiform. Flowers axillary, solitary or 2 - 5 in clusters. Calyx campanulate, free up to or above the middle, lobes triangular to ovate, acuminate. Corolla yellow to pale orange; petals oblique, usually emarginate at apex, cuneate at base, glabrous. Staminal column shorter than petals, hairy or glabrous. Ovary conical, minutely stellate-hairy; styles 9 - 12. Mericarps 6 - 12, with 2 short awns, dorsally and awns stellate-hairy or glabrous. Seeds ca 2 mm across, flattened glabrous, reniform, brown or black.

*Fl. & Fr.* July - Dec.

*Distrib.* India: Throughout from sea level to 1500 m.

Pantropical.

#### KEY TO THE SUBSPECIES

- 1a. Prostrate or ascending undershrubs; leaves obovate to orbicular; pedicels as long as petioles or slightly longer; corolla 2 - 2.5 cm across 9.1. subsp. *retusa*
- b. Erect herbs or undershrubs; leaves ovate to oblong, rhomboid or lanceolate; pedicels much longer than petioles; corolla 1 - 1.8 cm across 9.2. subsp. *rhombifolia*

9.1. subsp. *retusa* (L.) Borss. in Blumea 14: 198. 1966. *S. retusa* L., Sp. Pl. ed. 2: 961. 1763. *S. rhombifolia* var. *retusa* (L.) Masters in Fl. Brit. India 1: 324. 1874.

Undershrubs, ascending or prostrate, up to 0.5 m high with erecto-patent to patent branches. Leaves 0.5 - 6 x 0.5 - 4 cm, obovate to orbicular, upper leaves sometimes lanceolate, acute to acuminate at base, mostly retuse rounded or truncate at apex. Pedicels as long as or slightly longer than petioles jointed above or below middle. Calyx 5 - 6 mm high, accrescent, up to 10 mm. Corolla 2 - 2.5 cm across. Mericarps with 2 short, up to 1.5 mm long awns. Seeds glabrous, hilum with few stellate hairs.

*Distrib.* Similar to var. *rhombifolia*.

## 9.2. subsp. *rhombifolia*

Herbs or undershrubs up to 1.5 m high, with erect or suberect branches. Leaves 0.5 - 8 x 0.3 - 5 cm, ovate to oblong, elliptic, rhomboid or lanceolate, covered with minute stellate or rigid hairs; petioles 2 - 15 mm long. Pedicels up to 4 cm long. Calyx 4 - 6 x 3 - 5 mm, accrescent up to 8 mm; Corolla ca 15 mm across. Mericarps mostly muticous or with 2 mucros, occasionally with 2 awns, 1 - 2.5 mm long. Seeds glabrous.

### KEY TO THE VARIETIES

- |   |                                |
|---|--------------------------------|
| 1a. Plants cinereous with minute stellate hairs, branches erect           | 9.2.1. var. <i>rhombifolia</i> |
| b. Plants covered with rigid simple and stellate hairs, branches suberect | 9.2.2. var. <i>scabrida</i>    |

#### 9.2.1. var. *rhombifolia*

Fig. 79.

*S. rhomboidea* Roxb. ex Fleming in *Asiat. Res.* 6: 178. 1810. *S. rhombifolia* L. var. *rhomboidea* (Roxb. ex Fleming) Masters in *Fl. Brit. India* 1: 324. 1874. *S. rhombifolia* L. var. *obovata* Wallich ex Masters in *Fl. Brit. India* 1: 324. 1874. *S. microphylla* Cav., *Diss.* 1: 22, t. 12. f. 2. 1785. *S. rhombifolia* L. var. *microphylla* (Cav.) Masters in *Fl. Brit. India* 1: 324. 1874. *S. yunnanensis* Hu, *Fl. China, Fam.* 153: 16, t. 16 f. 7. 1955. *S. fryxellii* Sivaraman & Pradeep in *Kew Bull.* 45: 725. 1990, **syn. nov.**

Herbs or undershrubs, up to 1.5 m high. Leaves 0.5 - 8 x 0.3 - 5 cm, ovate to oblong, often more or less rhomboid, mostly acute, sometimes rounded, truncate or slightly cordate at base; acute to acuminate or obtuse, rarely rounded at apex; petioles 0.2 - 1.5 cm long. Pedicels longer than petioles, up to 3.5 cm long. Calyx 4 - 6 mm long, accrescent up to 8 mm in fruits. Corolla 1 - 1.8 cm across. Mericarps with 2 mucros or muticous, occasionally with 2 awns, awns 1 - 2.5 mm long.

*Distrib.* India: Throughout in tropical and subtropical regions.

Pantropical.

*Note.* *Sida fryxellii* Sivaraman & Pradeep (l.c.) is reported to be allied to *S. cordifolia* L. but a critical study of the protologue, drawings and type (India, Kerala State, Beypore, Pradeep 6018 -K), it is found that *S. fryxellii* is more allied to *S. rhombifolia* L. and is only a variant of it.

9.2.2. var. *scabrida* (Wight & Arn.) Masters in *Fl. Brit. India* 1: 324. 1874. *S. scabrida* Wight & Arn., *Prodr.* 57. 1834.



Fig. 79. *Sida rhombifolia* L. subsp. *rhombifolia* var. *rhombifolia*

Herbs, ca 30 cm high, sprinkled with rigid simple and stellate hairs. Leaves 1.5 - 3.5 x 0.6 - 1 cm, ovate-rhomboid or oblong, lanceolate, cuneate at base, acute or obtuse at apex, dentate, with rigid simple and stellate hairs on both surfaces; petioles 3 - 6 mm long. Pedicels 0.5 - 2 cm long. Calyx ca 6 mm long. Mericarps 9 - 11, bicuspidate.

*Distrib.* Similar to var. *rhombifolia*.

**10. *Sida schimperiana*** Hochst. ex A. Rich. Fl. Abyss. 1: 66. 1847; Masters in Fl. Brit. India 1: 322. 1874. **Fig. 80 a-b.**

Perennial undershrubs or herbs, up to 90 cm high; stems woody, erect or procumbent; Stems, petioles and pedicels appressed stellate-hairy. Leaves 0.5 - 15 x 3 - 5 mm, wedge-shaped, oblong, cuneate at base, retuse at apex with a small toothlet in the hollow middle, entire, glabrous above, densely appressed stellate-hairy beneath; petioles 1 - 3 mm; stipules 1 - 2 mm, linear, subulate. Flowers axillary, solitary, sometimes crowded towards the end of branchlets; pedicels ca 1 mm long. Calyx divided more or less up to the middle; lobes 3 - 5 x 1 - 2 mm, ovate, acute, appressed stellate-hairy outside, long ciliate along margins, glabrous inside except towards apex with some long simple and stellate hairs. Corolla yellow; petals ca 5 x 2 mm, glabrous. Staminal column ca 1.5 mm long, stellate-hairy. Ovary ca 1 mm high, ovoid, glabrous. Schizocarps ca 5 mm across; mericarps 5, ca 3 mm, prominently reticulate, shortly beaked with beak bent inwards, sparsely pubescent with appressed stellate hairs, dehiscing along inner edge. Seeds ca 1.5 mm across, glabrous, brownish.

*Fl. & Fr.* Nov. - March.

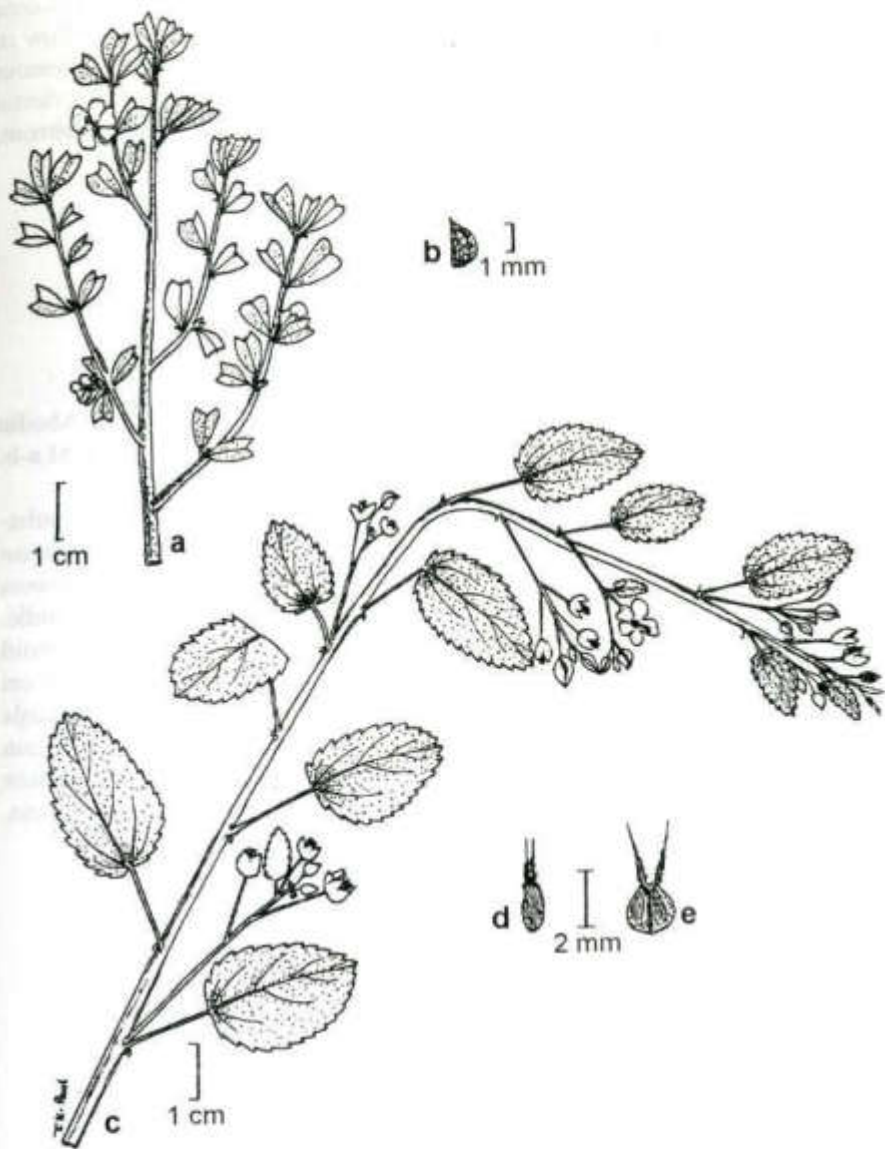
*Distrib.* India: Deccan plateau in dry places up to 300 m. Karnataka, Andhra Pradesh, Tamil Nadu and Kerala.

Africa.

**11. *Sida spinosa*** L., Sp. Pl. 683. 1753; Masters in Fl. Brit. India 1: 323. 1874.

**Fig. 80 c-e.**

Annual or perennial, erect or diffuse herbs or undershrubs, ca 60 cm high; stems with 1 - 2 spiny emergences at the base of petioles; stems, petioles and pedicels cinereous with minute stellate hairs. Leaves 6 - 30 x 4 - 25 mm, ovate to oblong, rarely orbicular, acute rounded or truncate at base and apex, serrate, 3 - 5-nerved at base, stellate-pubescent on both surfaces, sometimes glabrescent above; petioles 2 - 25 mm long; stipules 1 - 2.5 mm long, linear, hairy. Flowers axillary, solitary or 2 - 5 in clusters; pedicels 2 - 8 mm long, accrescent up to 8 mm, jointed above the middle. Calyx 3 - 5 mm across, campanulate, lobes free above the middle, 1 - 2 x 1.5 - 2 mm, triangular adnate to



**Fig. 80.** a-b. *Sida schimperiana* Hochst. ex A. Rich. : a. flowering part of branch; b. mericarp; c-e. *Sida spinosa* . c. flowering part of a branch; d. ventral view of mericarp; e. dorsal view of mericarp.

acuminate with a prominent midvein, cinereous with minute stellate and scattered simple hairs outside, glabrous inside except for apical margins. Corolla yellow or yellowish white. Schizocarps enclosed within calyx; mericarps 5, 2-3 mm long, trigonous with 2 divergent, 1-1.5 mm long awns, apex of mericarps and awns stellate-hairy, dorsal portion with prominent reticulation. Seeds 1-1.5 mm long, slightly trigonous, glabrous, brownish-black.

*Fl. & Fr.* March - Dec.

*Distrib.* India: In waste places up to ca 900 m. Throughout.

Pantropical.

12. *Sida tiagii* Bhandari in Ann. Arid Zone 16: 455. 1977. *S. pakistanica* S. Abedin in Pakistan J. Bot. 11: 55. 1979. **Fig. 81 a-b.**

Perennial, suberect herbs, up to 40 cm high, lower branches prostrate, stellate-pubescent. Leaves 1.5-4.5 x 1-3 cm, ovate, ovate-oblong to obovate, rounded at base, obtuse at apex, crenate-serrate; petioles 1-1.5 cm long; stipules 0.5-1 cm long, linear. Flowers axillary, solitary; pedicels 0.2-1 cm long, ca 2 cm long in fruit, jointed above middle. Calyx 6-10 mm across, cyathiform, lobes free up to the middle, 8-9 x 5-7 mm, deltoid or triangular, stellate-pubescent, accrescent in fruit. Corolla pale yellow, ca 1.8 cm across; petals 8-12 x 5-7 mm, obliquely obovate. Staminal column hirsute. Schizocarps ca 9 mm across, pentangular-globose, enclosed within calyx; mericarps 7-8, ca 3 x 2 mm (excluding awns), radially reticulate, dorsally strongly rugose, studded with minute glandular hairs, apical awns 2, ca 1 mm long, hairy with 2 outgrowths just below awns. Seeds ca 2 mm long, reniform, glabrous except the stellate-hairy hilum, blackish.

*Fl. & Fr.* Sept. - Nov.

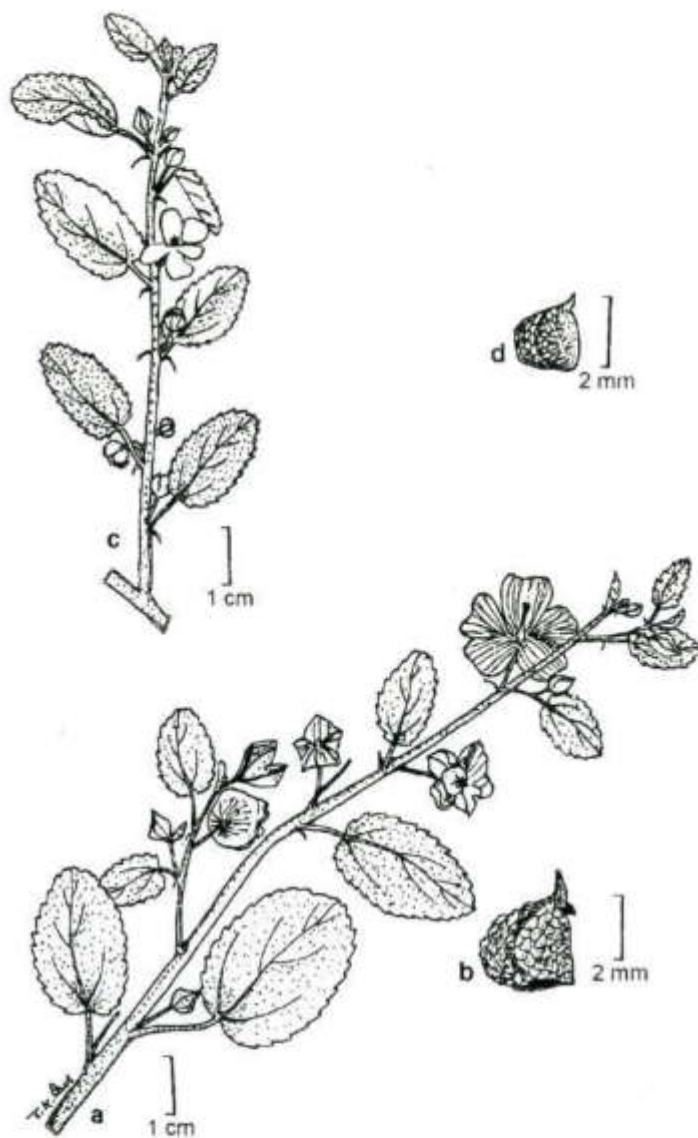
*Distrib.* India: Rajasthan.

Pakistan.

## Tribe 2. DECASCHISTEAE Fryxell

### 7. *Decaschistia* Wight & Arn.

Shrubs or herbs, tomentose. Leaves coriaceous entire, serrate or lobed, densely pubescent on both surfaces, middle nerve with a nectary near its base on lower surface. Flowers shortly pedicelled, axillary or clustered in uppermost axils or at tips of branches. Epicalyx segments 10, unequally connate at base. Calyx 5-lobed, connate at base, lobes linear, acute or acuminate. Petals 5, connate at base and adnate to staminal tube, broader above, twisted. Staminal column antheriferous throughout. Ovary 10-loculed;



**Fig. 81.** a-b. *Sida tiagii* Bhandari: a. flowering part of branch; b. mericarp; c-d. *Sida ovata* Forsskal: c. flowering part of branch; d. mericarp.

styler-branches 10 with capitate stigmas. Capsules depressed globose, loculicidally 10-valved, valves attached to a short conical 10-angled central column by their bases. Seeds reniform, ascending.

Tropical Asia and Australia, ca 17 species; 4 in India - all endemic.

#### KEY TO THE SPECIES

- |  |                                   |
|--|-----------------------------------|
| 1a. Middle and lower leaves not lobed, ovate or ovate-lanceolate   | 2                                 |
| b. Middle and lower leaves deeply trilobed   | <b>4. <i>D. trilobata</i></b>     |
| 2a. Leaves ovate-lanceolate, acute at apex, serrate or nearly entire; stem with dense white tomentum; seeds glabrous       | <b>1. <i>D. crotonifolia</i></b>  |
| b. Leaves ovate to rounded, obtuse at apex; nearly entire; stem with reddish-yellow tomentum; seeds sparsely pubescent     | 3                                 |
| 3a. Leaves almost orbicular (3.5 - 7.5 x 4 - 7 cm), rounded at apex; petioles ca 1.5 - 3.5 cm; calyx lobes 1 - 1.2 cm long | <b>3. <i>D. rufa</i></b>          |
| b. Leaves ovate or oblong (8 - 13 x 5 - 8 cm), obtuse at apex; petioles 1 - 1.5 cm; calyx lobes 1.6 - 2 cm long            | <b>2. <i>D. cuddapahensis</i></b> |

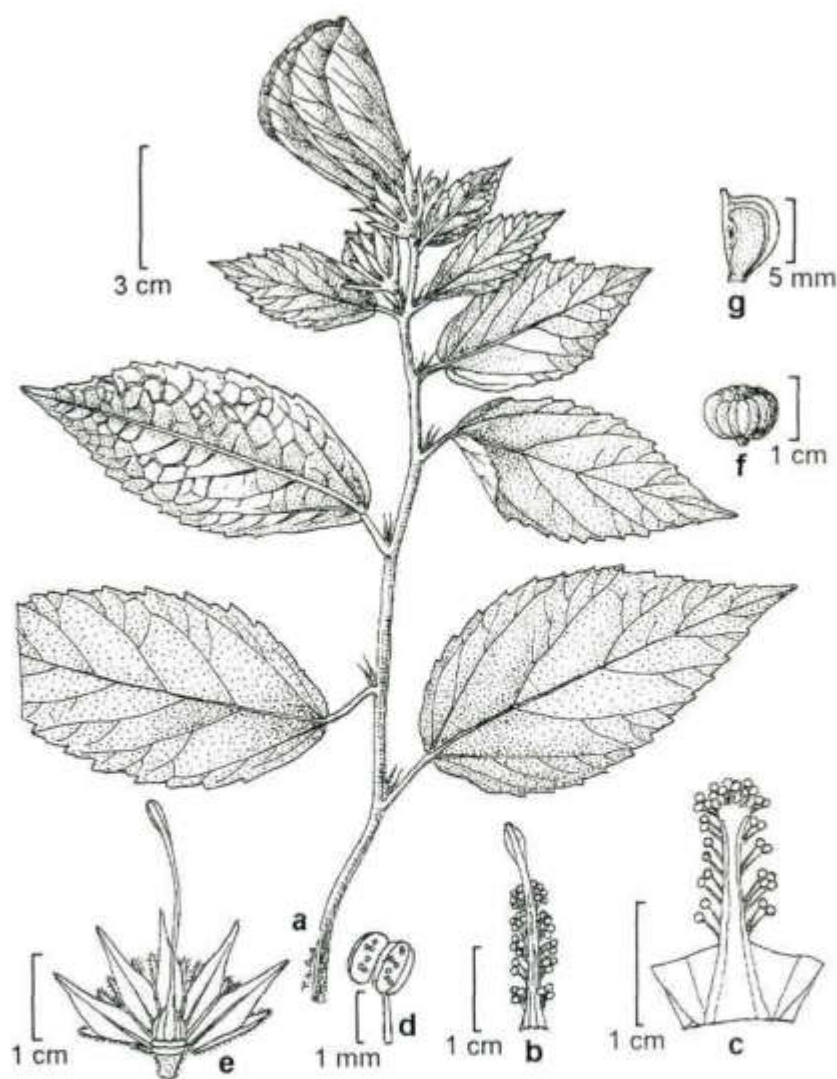
**1. *Decaschistia crotonifolia* Wight & Arn., Prodr. 52. 1834; Masters in Fl. Brit. India 1: 332. 1874.** **Fig. 82.**

Shrubs, ca 2 m high; stems and branches densely whitish stellate-tomentose. Leaves 3 - 4 x 1.5 - 8 cm, ovate-lanceolate, cordate-rounded at base, acute at apex, coarsely serrate, stellate-pubescent on both surfaces, densely so beneath; petioles 1 - 4 cm long, densely stellate-pubescent; stipules ca 1 cm long, linear-subulate. Flowers solitary, axillary or 2 - 5 in terminal clusters by reduction of upper leaves; pedicels 3 - 15 mm long, densely stellate-pubescent. Epicalyx segments 5 - 10 x 1 - 1.5 mm, linear, connate at base, densely pubescent on both surfaces. Calyx campanulate, divided to the middle, lobes 10 - 15 x 3 - 5 mm, deltoid-acuminate, persistent. Corolla with dark maroon centre, 5 - 6 cm across; petals 3 - 4 x 2.5 cm, obovate, densely stellate-pubescent outside, glabrous inside. Staminal column ca 2 cm long, antheriferous throughout. Ovary ovoid with 10 carpels attached by the base to a short conical 10-angled central column. Capsules 1.5 - 2 x 1 - 1.5 cm, enclosed in the calyx, densely stellate-pubescent, dehiscing into 10-valves, inner surface of valves glossy, glabrous. Seeds ca 4 x 2.5 mm, reniform, glabrous, brownish black.

*Fl.* March - June; *Fr.* May - Nov.

*Distrib.* India: In deciduous forests of Western Ghats and Deccan plateau, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.





**Fig. 82.** *Decaschista crotonifolia* Wight & Arn. : a. flowering part of branch; b. androecium with projecting stigma; c. sectioned staminal column showing attachment to petal; d. stamen; e. flower dissected with petals and staminal column removed; f. fruit; g. seed in a locule.

2. *Decaschistia cuddapahensis* T. K. Paul & Nayar in Geobios New Rep. 2: 156. 1983 & in Fasc. Fl. India 19: 105. 1988.

Perennial shrubs; young stems and branches pubescent with yellowish brown stellate hairs. Leaves 8 - 13 x 5 - 8 cm, ovate or oblong subcordate at base, obtuse at apex, crenate-serrate or denticulate, densely stellate-velutinous on both surfaces, upper surface dark brown, lower surface yellowish-brown, 5 - 7-nerved at base, middle nerve beneath with an elliptical gland at base petioles 1 - 1.5 cm long, indumentum like on stem; stipules 4 - 8 mm long, entire or 2 - 3 parted, densely stellate-pubescent, deciduous. Flowers axillary, solitary; pedicels 1 - 1.5 cm long, stellate-tomentose. Epicalyx segments 8 - 12 x 3 - 5 mm, connate at base, lanceolate to ovate, acute, densely stellate-hairy outside, appressed stellate-hairy inside. Calyx 1 - 1.5 cm across, divided to the middle, lobes 1.6 - 2 x 4 - 6 mm, deltoid, acuminate with one prominent nerve, densely stellate-hairy outside, sparsely appressed with stellate hairs inside, glabrescent except margins and apical portion. Corolla yellow with a purple centre; petals 3 - 5 cm long, densely stellate-pubescent outside, glabrous inside. Staminal column 1.5 - 1.8 cm long, antheriferous throughout. Capsules ca 1 x 1 cm, globose, enclosed within calyx, 10-valved, loculicidally dehiscent, densely stellate-hairy outside, glabrous and glossy inside. Seed 1 in each locule, ca 5 x 3 mm, reniform, ascending, sparsely hairy.

*Fl. & Fr.* July - March.

*Distrib.* India: Deccan plateau in scrub forests between 150 and 700m. Andhra Pradesh and Tamil Nadu.

Endemic.

3. *Decaschistia rufa* Craib in Bull. Misc. Inform. 1912: 35. 1912; Gamble, Fl. Pres. Madras 94. 1915.

Shrubs; young branches pubescent with reddish hairs becoming paler at maturity. Leaves 3.5 - 7.5 x 4 - 7 cm, almost rounded, subcordate or rounded at base, shortly acuminate, acute or subobtuse at apex, crenate densely stellate-pubescent on both surfaces, densely beneath; 7-nerved at base; petioles 1.5 - 3.5 cm long, densely pubescent; stipules 4 - 8 mm long, linear, 1 or 2 - 3-lobed, pubescent, deciduous. Flowers axillary, solitary; pedicels 1.5 - 2 cm long, stout, densely stellate-pubescent, reddish. Epicalyx segments ca 10 x 4 mm, ovate lanceolate, connate at base, acuminate or subacute, densely stellate-pubescent. Calyx campanulate, divided to the middle, lobes 1 - 1.2 cm long, broadly deltoid, densely stellate-pubescent outside, appressed stellate-hairy inside. Corolla 2.5 - 3 cm across; petals 2 - 2.5 x 1 - 1.5 cm, densely stellate-hairy outside, glabrous outside. Staminal column ca 1.2 cm long, antheriferous throughout. Ovary ovoid, ca 3 x 2.2 mm.



Fig. 83. *Decaschistia trilobata* Wight

*Distrib.* India: Andhra Pradesh and Tamil Nadu.

Endemic.

**4. Decaschistia trilobata** Wight, *Icon. Pl. Ind. Orient.* 1: t. 88. 1840; Masters in *Fl. Brit. India* 1: 332. 1874. **Fig. 83.**

Shrubs; stems and young branches densely tomentose. Leaves sessile, often unlobed, 3 - 6.5 x 1 - 5 cm, lanceolate or oblong-lanceolate, acute and mucronate at apex, dentate, veins prominent beneath; lower leaves deeply trilobed, lobes 4 - 8 x 1 - 2.5 cm, lanceolate to oblong-lanceolate, acute to rounded and 3-nerved at base, acute at apex, elliptical gland present at base on midnerve beneath, densely stellate-tomentose, dark above, paler beneath; petioles 1 - 3 cm long, densely hispid or tomentose by stellate hairs; stipules equal to or longer than petioles, linear, simple or 2 - 3-lobed, hairy. Flowers axillary, solitary or crowded towards apices of branches by reduction of leaves; pedicels ca 1 cm long, hairy. Epicalyx segments 10, 5 - 8 x 1.5 mm, linear to lanceolate, connate at base, stellate-pubescent on both surfaces. Calyx divided to the middle, lobes 8 - 12 x 5 - 7 mm, acute, distinctly 3-nerved, outer surface with long and short simple hairs, inner surface with dense appressed 2-armed stellate hairs. Corolla yellow with purple centre, ca 4 cm across; petals ca 5 x 3 cm, obovate, twisted, densely stellate-hairy outside, glabrous inside. Staminal column 2 - 2.5 cm long, antheriferous throughout. Ovary ovoid, 10-loculed; styles divided at the top into 10 branches of ca 2 mm long, ending in capitate stigmas. Capsules 8 - 10 x 10 - 15 mm, densely hairy, inner surface of valves glossy. Seeds ca 5 x 3 mm, reniform, stellate-pubescent, brownish black.

*Fl. & Fr.* Oct. - Dec.

*Distrib.* India: In evergreen and deciduous forests of Western Ghats and Deccan plateau. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

### Tribe 3. HIBISCEAE Endl.

#### 8. *Abelmoschus* Medikus

Herbs, undershrubs or trees, often prickly hairy. Leaves palmilobed to-parted, often hastate or sagittate or with pennilobed to -parted segments, rarely entire, extrafloral nectaries absent. Flowers solitary, axillary or in terminal racemes by reduction of upper leaves; pedicels inarticulate. Epicalyx segments 4 - 16, usually free, rarely connate at base, persistent or caducous. Calyx spathaceous, lobed or toothed at tip, split to the base on one side, adnate and falling with corolla. Corolla large, mostly yellow with a dark purple centre, sometimes creamy white or pink. Staminal column included, antheriferous throughout. Ovary 5-locular, many-ovuled; style 1, distally 5-branched;

stigmas discoid. Capsules ovoid to oblong or cylindric, beaked or mucronate, loculicidally dehiscent with longitudinal slits towards base. Seeds many in each locule, reniform.

Throughout tropical, subtropical and temperate regions of the old world, chiefly in southeast Asia, ca 15 species; 6 in India.

#### KEY TO THE SPECIES

- 1a. Epicalyx segments 6 - 16, linear to lanceolate, caducous after dehiscence of the capsule 2
- b. Epicalyx segments 4 - 6, ovate, caducous after dehiscence of the capsule, if linear to lanceolate, then caducous before anthesis 5
- 2a. Capsules not exceeding epicalyx; epicalyx segments 10 - 16, 2 - 5 cm long 2. *A. crinitus*
- b. Capsules exceeding epicalyx; epicalyx segments 6 - 10 (rarely 12), 1 - 1.5 cm long 3
- 3a. Capsules ovoid to oblong, up to 8 cm long 5. *A. moschatus*
- b. Capsules fusiform, up to 25 cm long 4
- 4a. Capsules sparsely hairy or glabrescent, 7 - 25 cm long; corolla 5 - 8 cm across  
*A. esculentus* (cultivated)
- b. Capsules densely studded with bristle bearing tubercles, 1.5 - 5 cm long; corolla 1.5 - 2.5 cm across 6. *A. tuberculatus*
- 5a. Epicalyx segments linear to lanceolate, caducous before expansion of the corolla; calyx in bud lageniform; capsules ovoid-oblong, shortly beaked with short stiff hairs 3. *A. ficulneus*
- b. Epicalyx segments ovate, caducous after dehiscence of the capsule; calyx in bud ovate; capsules ovoid-prismatical, hispid and usually prickly by long stiff hairs 6
- 6a. Epicalyx segments 1 - 2.5 x 0.5 - 1 cm, free, segments shorter than capsule 4. *A. manihot*
- b. Epicalyx segments 2 - 3 x 1 - 2 cm, connate at base, segments as long as capsule or longer 1. *A. angulosus*

1. *Abelmoschus angulosus* Wallich ex Wight & Arn., Prodr. 53. 1834. *Hibiscus angulosus* (Wallich ex Wight & Arn.) Steudel, Nomen. Bot. ed. 2, 1: 758. 1840; Masters in Fl. Brit. India 1: 341. 1874, incl. vars.

Guj.: *Makhaniyo Bhido*.

Herbs or undershrubs, ca 2.5 m high; young branches covered with simple and stellate hairs. Leaves 3 - 15 cm across, transversely elliptic to orbicular, cordate and 5 - 7-nerved at base, palmilobed to-parted, segments 3 - 7, triangular ovate to lanceolate, acute, crenate to serrate, adpressed stiff simple hairy on both surfaces, ultimately glabrescent; petioles longer than lamina; stipules 10 - 15 x 3 - 5 mm. Flowers solitary; pedicels 2 - 6 cm long, accrescent, up to 10 cm. Epicalyx 4 - 5-parted, segments 2 - 3 x 1 - 2 cm. Calyx ca 3 cm long, membranous, hairy. Corolla yellow with deep purple centre, rarely white, sometimes ultimately deep pink; petals ca 8 x 6 cm, obovate, glabrous. Capsules 3 - 4.5 x 1.5 - 2 cm, ovoid to oblong, acute to acuminate, densely hispid; valves puberulous inside. Seeds 3 - 4 mm long, minutely hairy in concentric rings, blackish.

*Fl. & Fr.* Throughout the year particularly from Nov. - Feb.

*Distrib.* India: Gujarat, Maharashtra, Tamil Nadu and Kerala.

Pakistan, Sri Lanka, Cambodia, Vietnam, Laos and Indonesia.

*Notes.* This is an extremely variable species with regard to shape of leaves, colour of corolla and indumentum, but it can be easily distinguished from the other species of the genus by its chartaceous, angular, accrescent epicalyx consisting 4 - 5 connate segments.

2. *Abelmoschus crinitus* Wallich, Pl. Asiat. Rar. 1: 39, t. 44, 1830. *Bamia crinita* Wallich [Cat. No. 1920. 1829, nom. nud.]. *Hibiscus crinitus* (Wallich) G. Don, Gen. Hist. 1: 380. 1831. *H. cancellatus* Roxb., [Hort. Beng. 51. 1814, nom. nud.] Fl. Ind. 3: 201. 1832, non L. f. 1781; Masters in Fl. Brit. India 1: 342. 1874. *Abelmoschus cancellatus* (Roxb.) Voigt, Hort. Sub. Calc. 119. 1845.

Fig. 84.

Herbs, 0.5 - 1.5 m high with tuber-like tap root; stems, branches, petioles and pedicels hirsute by shiny simple and stellate hairs, ultimately glabrescent. Leaves 5 - 8 cm across, deeply cordate and 5 - 7-nerved at base, angular or 5 - 7-palmilobed to palmiparted, lobes acute or acuminate at apex, coarsely dentate-serrate, hirsute on both surfaces; petioles 0.5 - 24 cm long; stipules 1 - 3 cm long, linear to filiform, hairy. Epicalyx segments 10 - 16, 2 - 5 cm long, linear, ciliate, sparsely stellate-hairy. Calyx 2 - 5 cm long, densely puberulous to tomentose. Corolla yellow with purple centre; petals 4 - 9 x 2 - 4 cm, broadly obovoid, glabrous. Capsules 2 - 4 x 2 - 3 cm, ovoid-globose, shortly acuminate or rounded, hirsute. Seeds 3 - 5 mm long, globose to reniform, rusty tomentose in concentric rings, rarely glabrous.

*Fl. & Fr.* July - Dec.

*Distrib.* India: Throughout in tropical and subtropical evergreen forests.

Pakistan, Nepal, Bhutan, Myanmar, China, Indo-China and Malesia (Indonesia and Philippines).

*Notes.* This species shows great variation in the degree of incision of the leaves and the density of the indumentum. The capsules are more or less enclosed by the epicalyx segments.

The tuber-like swollen tap root enables the species to withstand periodic burning of the vegetation (Borssum Waalkes in Blumea 14: 103. 1966).

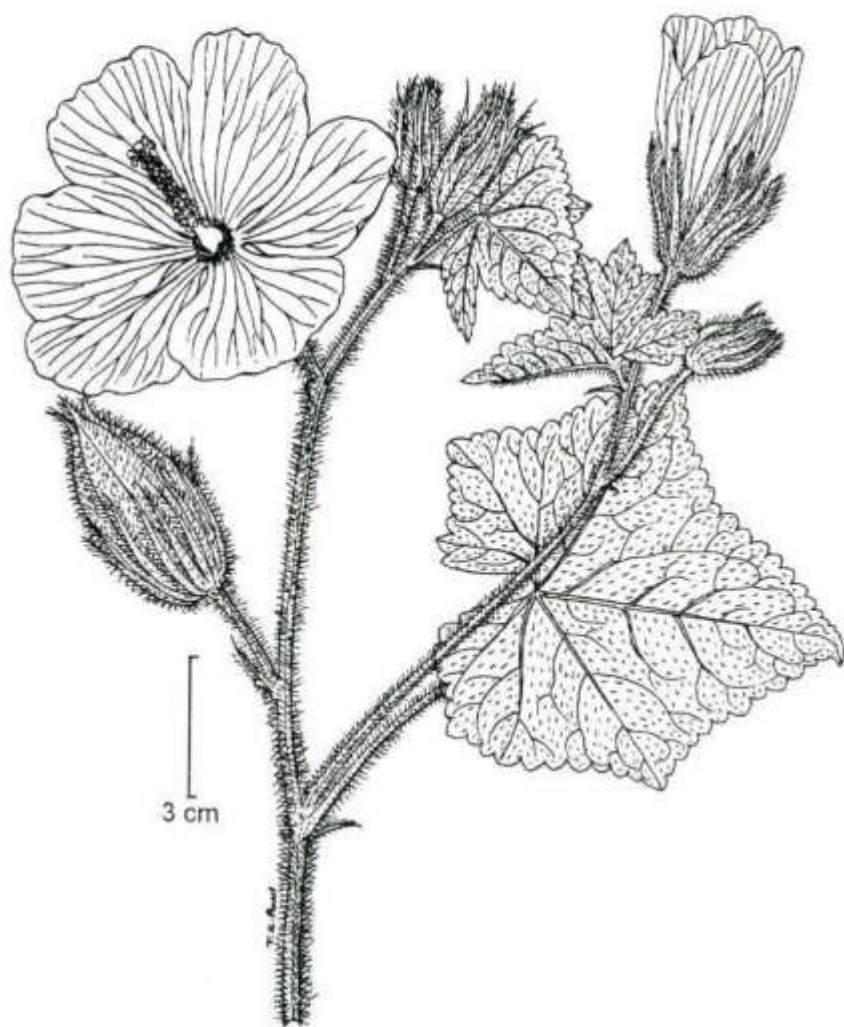


Fig. 84. *Abelmoschus crinitus* Wallich

3. *Abelmoschus ficulneus* (L.) Wight & Arn. ex Wight, Cat. No.14. 1833; Wight & Arn., Prodr. 53. 1834. *Hibiscus ficulneus* L., Sp. Pl. 695. 1753; Masters in Fl. Brit. India 1: 340.1874.

Fig. 85.

Beng.: *Ban-dheras*, *Jangli bhindi*; Hindi: *Ran bhendi*; Punj.: *Deola dula*, *Kapasiya*; Tam.: *Kattu vendai*; Tel.: *Nela benda*, *Parupubenda*.

Herbs or undershrubs, 0.5 - 2 m high; branchlets simple hairy, rarely hairs small, prickly with bulbous bases, ultimately glabrescent. Leaves 2 - 12 cm across, orbicular, palmately 3 - 5-lobed, cordate at base, lobes 2 - 8 x 1 - 4 cm, obovate to spatulate, rounded or obtuse at apex, serrate, sparsely stiff simple hairy on both surfaces, also mixed with stellate hairs beneath; petioles 1.5 - 20 cm long; stipules 4 - 10 mm long, linear to filiform, hairy. Flowers axillary, solitary or in terminal racemes by decrescens of upper leaves; pedicels 1 - 1.5 cm long, accrescent up to 3 cm. Epicalyx segments 5 - 6, 5 - 10 x 1 - 1.5 cm, linear to lanceolate, acute, hirsute, caducous. Calyx in bud lageniform with 3 mm long linear lobes. Corolla white becoming pink with deep purple centre, 1.5 - 2 cm in across; petals 2 - 3 x 1 - 2 cm, obovate, rounded at apex, glabrous. Capsules 2 - 4.5 x 1.5 - 2 cm, ovoid, 5-angular, obtuse, rarely short acuminate, tomentose with simple hairs, glabrescent; valves hirsute inside with short simple hairs. Seeds ca 3 mm across, globular, stellate-tomentose in concentric rings, blackish.

Fl. Sept. - Nov.; Fr. Nov. - March

*Distrib.* India: In tropical forests between 300 to 1200 m. Uttar Pradesh, Bihar, West Bengal, Rajasthan, Andhra Pradesh, Tamil Nadu and Kerala.

Pakistan, Sri Lanka, Africa, Malesia and N. Australia.

*Notes.* This species can be easily recognised by its flask-shaped calyx in buds and blunt, hairy capsules. The leaves resemble those of *Ficus carica* L., hence the specific epithet.

Seeds yield an oil and are also used for flavouring coffee. Stems yield an excellent fibre.

4. *Abelmoschus manihot* (L.) Medikus, Malv. 46. 1787, ampl. Hochr. in Candollea 2: 87. 1924. *Hibiscus manihot* L., Sp. Pl.696. 1753; Masters in Fl. Brit. India 1: 341. 1874.

Herbs or undershrubs; stems terete, stout, fistular, glabrous or densely hispid. Leaves extremely variable in size and shape, 5 - 30 cm across, usually orbicular to broadly ovate, cordate and 5 - 9-nerved at base, usually 3 - 9-lobed or -parted, rarely unlobed, segments variously shaped, acute to acuminate at apex, dentate or serrate, sometimes entire, glabrous or tomentose on both surfaces or only on lower surface; petioles 2.5 - 23 cm long, glabrous or hispid; stipules 5 - 25 x 1 - 5 mm, linear to filiform or lanceolate,



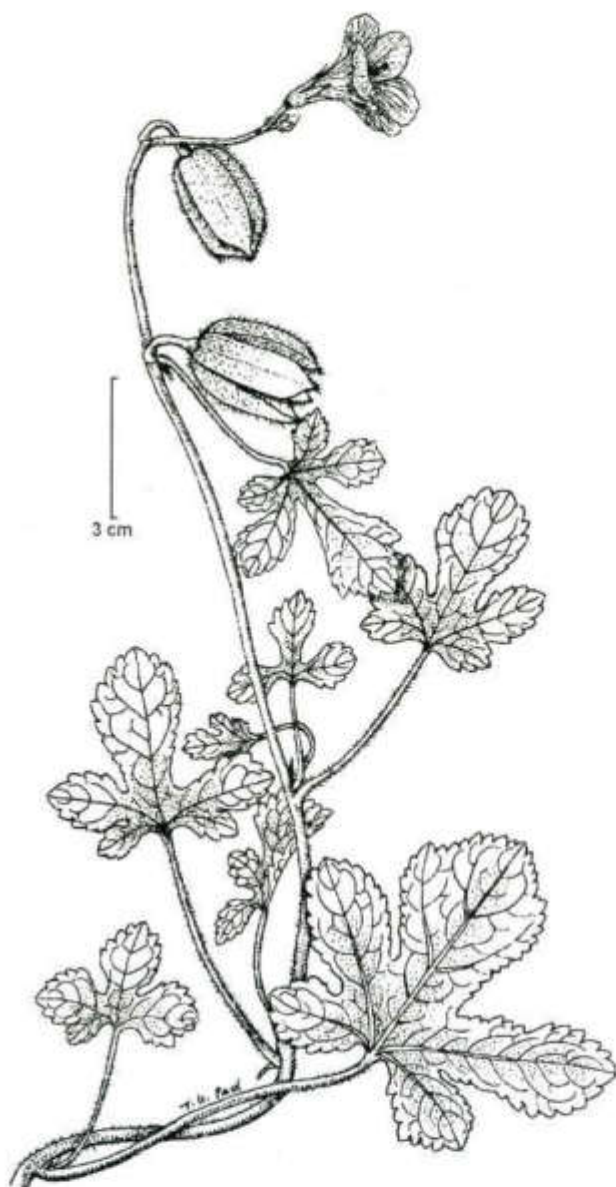


Fig. 85. *Abelmoschus ficulneus* (L.) Wight & Arn. ex Wight

acute to acuminate, stellate-hairy. Flowers axillary, solitary or in terminal racemes by reduction of leaves; pedicels 1 - 4 cm long, accrescent up to 6.5 cm long. Epicalyx segments 4 - 6, rarely free, 1 - 2.5 x 0.5 - 1 cm, ovate to oblong, acute to acuminate, stiff hairy on both surfaces. Calyx 2 - 3 x 0.5 - 2 cm, velutinous outside, sericeous inside. Corolla white or yellow with a purple centre; petals 3.5 - 8 x 2.5 - 6 cm, obovate to orbicular, fleshy at base, glabrous. Ovary ovoid, hirsute; styles hairy. Capsules 3 - 7 x 1.5 - 2.5 cm, ovoid-oblong, 5-angular, acuminate with 5 prominent costa. Seeds 3 - 4 mm with stellate hairs in concentric rings, dark brown or blackish.

*Notes.* Hochreutiner (Ann. Cons. Jard. Bot. Geneve 4: 153. 1900) recognised 4 varieties under this species viz. *genuinus*, *timorensis*, *tetraphyllus* and *pungens* based on leaf characters. while Borssum Waalkes (l.c.) recognised 2 subspecies viz *manihot* and *tetraphyllus*. He included cultivated forms under the former and the wild ones under the latter. Under the subsp. *tetraphyllus* 2 varieties viz., *tetraphyllus* and *pungens* were recognised based on indumentum of epicalyx. Further, according to Borssum Waalkes (l.c.) both these varieties show distribution preference to altitude that is var. *tetraphyllus* prefers areas between sea level and 400 m. and var. *pungens* between 400 and 1600 m. In India although they are distinct, do not show any distinct altitudinal preferences as var. *tetraphylla* is recorded from sealevel to 800 m and var. *pungens* up to 1800 m.

#### KEY TO THE SUBSPECIES

- |  |                                 |
|--|---------------------------------|
| 1a. Stems without prickly hairs                          | 4.1. subsp. <i>manihot</i>      |
| b. Stems more or less densely covered with prickly hairs | 4.2. subsp. <i>tetraphyllus</i> |

#### 4.1. subsp. *manihot*

*Fl. & Fr.* July - Dec.

*Distrib.* Mainly cultivated in southeast Asia and sometimes occurs as an escape from cultivation.

*Notes.* The mucilage extracted from root is used for sizing paper in China and Japan. The plants of this species yield a tough fibre resembling jute. The leaves are eaten as vegetable. Due to deliberate selection and propagation many cultivators have acquired smooth forms quite different from wild ones which are hairy and prickly.

4.2. subsp. *tetraphyllus* (Roxb. ex Hornem.) Borss. in *Blumea* 14: 97. 1966. *Hibiscus tetraphyllus* Roxb. ex Hornem., *Hort. Hafn.* 661. 1815.

Undershrubs, ca 3 m tall; stems, petioles, pedicels and veins of leaves densely hirsute by stiff shiny simple hairs, other parts pubescent with minute stellate and simple hairs or glabrous.



5. *Abelmoschus moschatus* Medikus, Malv. 46. 1787; ampl. Hochr. in Candollea 2: 86. 1924. *Hibiscus abelmoschus* L., Sp. pl. 696. 1753; Masters in Fl. Brit. India 1: 342. 1874. **Fig. 86.**

Asm.: *Gorukhia-korai*; Beng.: *Muskdana*; Kan.: *Kadukasthuri*; Mal.: *Kattukasthuri*; Mar.: *Kasturibhendi*; Sans.: *Lata kasturika*; Tel.: *Kasturi benda*; Tam.: *Vertilai kasthuri*, *Kattukasthuri*.

Herbs or undershrubs, up to 3 m high, hirsute all over, rarely glabrous; tap root tuber-like. Leaves extremely variable in shape and size, 4 - 18 x 3 - 20 cm, angular or 3 - 7-palmilobed to palmiparted, upper leaves narrower, often hastate or sagittate; lobes linear, lanceolate, ovate, obovate-oblong, obtuse, acute or acuminate at apex, coarsely serrate to dentate, rarely entire, 5 - 9-nerved at base; petioles 2 - 20 cm long; stipules 5 - 10 mm long, linear to filiform, hairy. Flowers axillary, solitary; pedicels 1.5 - 6 cm, accrescent up to 15 cm. Epicalyx segments 6 - 10, free 10 - 15 x 1 - 2 mm, linear, persistent. Calyx 1.5 - 3 cm long, stellate-tomentose outside, sericeous inside. Corolla yellow with dark purple centre, ca 10 cm across; petals obovate, rounded at apex, fleshy and ciliate at base. Capsules 4 - 8 x 2.5 cm, ovoid to globose, acuminate with a rostrum of ca 5 mm. Seeds 3 - 4 mm, concentrically ribbed, glabrous or minutely stellate-hairy, often musk scented.

*Fl.* July - Oct.; *Fr.* Oct. - Dec.

*Distrib.* India: Throughout up to 1500 m.

Bangladesh, China, Indo-china, Thailand, Malesia (Malaya Peninsula, Indonesia) and Fiji Islands.

*Notes.* 'Ambrette seed oil' is extracted by distillation of crushed seeds and it is used in high grade perfumery. The seeds are reported to be used as a flavouring agent for coffee. In India, they are mostly employed as an adulterant for animal musk and in perfume.

6. *Abelmoschus tuberculatus* Pal & Singh in Bot. Gaz. 113. 458. 1952.

Herbs or undershrubs, ca 1 m high; stems strigose with simple hairs, ultimately glabrescent. Leaves 4 - 12 x 5 - 15 cm, lower and middle leaves 5 - 7-lobed, lobes ovate-oblong with 2 - 3 lobules, upper leaves 3 - 5-lobed, palmatisect, 4 - 6 x 6 - 8 cm; petioles 2 - 15 cm long; stipules 3 - 8 mm long. Pedicels 4 - 8 mm long, accrescent up to 1.5 cm. Epicalyx segments 9 - 12, ca 1 cm long. Calyx lobes 1 - 2.5 x 1 cm. Corolla yellow or white with deep purple centre; petals 1.5 - 3.5 x 1 - 1.5 cm. Capsules 1.5 - 5 cm long, 1 - 1.5 cm across, densely studded with bristle bearing tubercles. Seeds 3 - 5 mm in diam., glabrous or densely villous, dark brown or black.

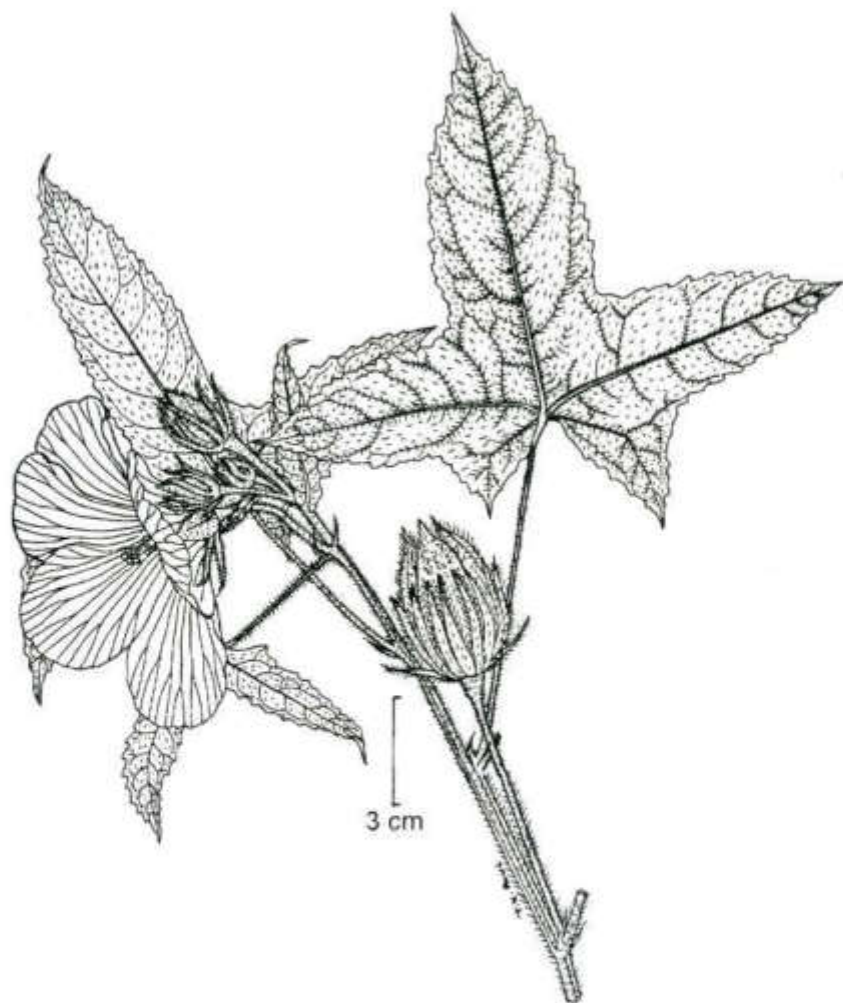


Fig. 86. *Abelmoschus moschatus* Medikus

## KEY TO THE VARIETIES

- 1a. Leaves deltoid, 3 - 5-lobed. Seeds 4 - 5 mm in diam., densely villous 6.1. var. **deltoideifolius**  
 b. Leaves palmilobed to palmatisect; seeds 3 mm in diam., glabrous 6.2. var. **tuberculatus**

**6.1. var. deltoideifolius** T.K. Paul & Nayar in Bull. Bot. Surv. India 24: 215. 1982.

*Fl. & Fr.* Sept. - Nov.

*Distrib.* India: In scrub forests up to 900 m. Madhya Pradesh, Rajasthan and Gujarat.

Endemic.

**6.2. var. tuberculatus**

*Fl. & Fr.* Oct. - Feb.

*Distrib.* India: In scrub forests up to 900 m. Uttar Pradesh, Madhya Pradesh and Rajasthan.

Endemic.

*Notes.* It is allied to *Abelmoschus esculentus* (L.) Moench, but differs by its smaller flowers, profuse fruiting, smaller capsules densely covered with bristle bearing tubercles

### 9. *Fioria* Mattei

Herbs or undershrubs, sparsely to densely pubescent. Leaves broadly ovate to orbicular, 3 - 5-lobed or unlobed, subcordate to rounded at base, acute at apex, serrate. Flowers axillary, solitary, or in terminal racemes by reduction of upper leaves. Epicalyx segments 7 - 12, linear, free. Calyx 5-lobed. Corolla yellow with purple centre; petals obovate. Staminal column shorter than petals, antheriferous throughout or nearly so. Ovary ovoid, 5-angular, 5-loculed; stigmas clavate. Capsules globular, shorter than calyx, with strongly 5-veined wings. Seeds 2 - 4 in each locule, reniform, verruculose, glabrous.

Tropical and subtropical regions of the world, ca 4 species; one in India.

*Fioria vitifolia* (L.) Mattei in Bot. Ort. Bot. Palermo n.s. 2: 71. 1916. *Hibiscus vitifolius* L., Sp. pl. 696. 1753; Masters in Fl. Brit. India 1: 338. 1874. *H. obtusifolius* Willd.,

Sp. Pl. 3: 829. 1801. *H. vitifolius* L. var. *genuina* f. *indica* Hochr. in Ann. Cons. Jard. Bot. Geneve 4: 169. 1900. Fig. 87.

Beng.: *Ban-kapas*; Sans.: *Bhar advaji*, *Vankarpasa*; Tel.: *Karu-patti*.

Herbs or undershrubs, 1 - 2 m high. Leaves 2.5 - 15 x 2 - 12 cm, broadly ovate to orbicular, subcordate to rounded at base, acute at apex, crenate-serrate or dentate, 3 - 5-lobed or unlobed; petioles 2 - 13 cm long; stipules 2 - 5 mm long, linear. Flowers axillary, solitary; pedicels 1.5 - 6 cm long, accrescent, articulate. Epicalyx segments 7 - 12, 6 - 12 x ca 0.5 mm, linear, erect, ultimately spreading or reflexed. Calyx campanulate, 5-lobed, lobes 5 - 15 x 6 - 10 mm, ovate to deltoid. Corolla yellow with dark purple centre; petals 2.5 - 5 x 1 - 3 cm, obovate, obtuse or rounded at apex. Staminal column glabrous, antheriferous throughout. Ovary ovoid, obtuse, 5-angular, 5-loculed; style arms up to 4 mm long, glandular hairy; stigmas clavate, hairy. Capsules 1.5 - 2 cm across, shorter than calyx, shortly beaked, beaks ca 3 mm long, 5-winged, wings bristly, splitting laterally on the keels during dehiscence. Seeds 2 - 4 in each locule, 2 - 3 mm across, reniform, verruculose, glabrous, brownish-black.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Throughout in tropical and subtropical areas on roadsides, forest edges, waste lands.

Pakistan, Sri Lanka, Africa, Myanmar, Malesia and Australia.

*Notes.* This species was treated previously by Masters (1874) and Borssum Waalkes (1966) under *Hibiscus*. Mattei (l.c.) transferred it to *Fioria* based mainly on fruit with conspicuous, scarious, strongly veined wings- a unique character absent in the genus *Hibiscus*.

In this species the density of the indumentum and the leaf lobation are variable even on an individual plant. The density of the indumentum depends on the habitat, the indumentum is dense on plants growing in sunny places than in shade.

#### 10. *Gossypium* L.

Annual herbs, undershrubs or perennial shrubs or rarely small trees, all parts irregularly dotted with black oil-glands. Leaves palmately lobed, sometimes entire, palm-nerved, usually with nectaries on the main basal veins beneath. Flowers solitary, axillary, large, showy; Pedicels not jointed, usually with nectaries below insertion of epicalyx segments. Epicalyx segments 3, free or connate at base, foliaceous, entire or dentate to deeply incised. Calyx campanulate, smaller than epicalyx, truncate, undulate to 5-dentate or 5-lobed, usually with 3 nectaries at base, persistent. Corolla yellow or

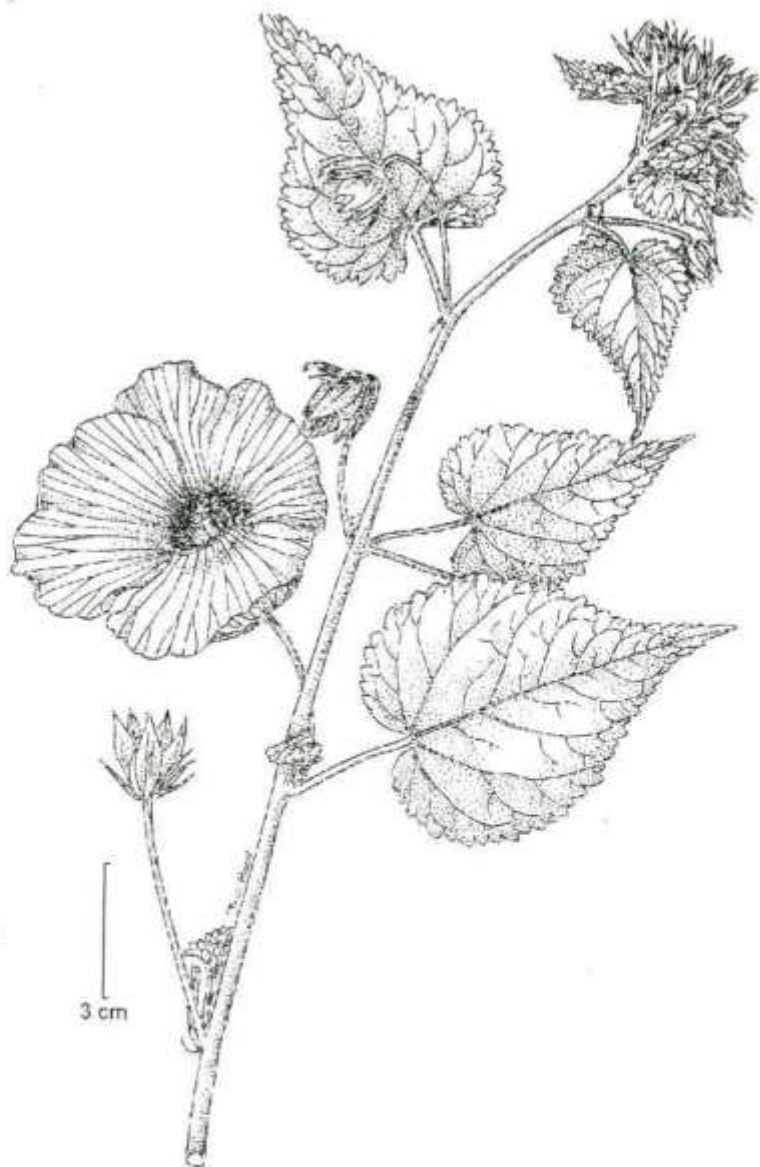


Fig. 87. *Fioria vitifolia* (L.) Mattei



white, sometimes red or purple with a deep purple centre. Staminal column included, antheriferous throughout. Ovary 3 - 5-loculed, ovules many in each locule; style 1, short; stigma clavate, 5-sulcate. Capsules ovoid to globular rarely fusiform, acute or acuminate; 3 - 5-loculed. Seeds ovoid to obovoid, densely covered by unicellular 1 - 6.5 mm long woolly hairs (lint or floss) and with or without short dense hairs (Fuzz).

Throughout tropics and subtropics of the world, ca 35 species; one in India.

*Notes.* India is the earliest country where cotton was first used for making fabrics as evidenced by the discovery of cotton from excavation at Mahenjodaro, the date of which is estimated to be 2750 - 3000 B.C.

Cultivated cottons fall under 4 species of *Gossypium*, viz. *G. arboreum*, *G. herbaceum*, *G. barbadense* and *G. hirsutum*. Each of these species have a large number of races based on geographical distribution and associated genetical features. A number of cotton cultivars belonging to all the above species are cultivated as a commercial crop in India except *G. barbadense* which is only to be found as a homeyard plant in many states. Commercially the cotton belonging to *G. herbaceum* constitutes a larger percentage of medium staple cotton grown in India. *G. stocksii* Masters is the only wild species occurring in India.

#### KEY TO THE SPECIES

- |   |                                   |
|---|-----------------------------------|
| 1a. Seeds with fine short tomentum (fuzz) only  | <b>G. stocksii</b>                |
| b. Seeds with dense long woolly hairs and with fine short tomentum  | 2                                 |
| 2a. Epicalyx segments entire to serrate   | 3                                 |
| b. Epicalyx segments laciniate  | 4                                 |
| 3a. Epicalyx segments connate at base for 1 cm or more, entire or 3 - 4-toothed near apex, closely embracing the flower; capsules ovoid; lobes or segments of leaves linear to lanceolate with an extra tooth in sinuses                                  | <b>G. arboreum</b> (cultivated)   |
| b. Epicalyx segments free or connate at the very base for ca 5 mm, 7 - 9-toothed or lobed at apex, flaring widely from the flower; capsules globose or oblong; lobes or segments of leaves ovate to oblong or elliptic without any extra tooth in sinuses | <b>G. herbaceum</b> (cultivated)  |
| 4a. Leaves palmiparted, segments ovate to oblong; staminal column 3.5 - 4 cm long, with compact stamens on filaments of equal length; seeds with floss and fuzz only at the hilum.  | <b>G. barbadense</b> (cultivated) |
| b. Leaves palmilobed to palmifid, lobes deltoid to ovoid; staminal column 1 - 2 cm long with loosely arranged stamens, filaments longer towards apex; seeds with floss and fuzz all over or only at the hilum   | <b>G. hirsutum</b> (cultivated)   |

**Gossypium stocksii** Masters in Fl. Brit. India 1: 346. 1874; T. Cooke, Fl. Pres. Bombay 1: 115. 1901.

Shrubs or prostrate undershrubs, stellate-pubescent. Leaves 1 - 3.5 x 1.5 - 5 cm, cordate at base, 3 - 5 lobed, palmately nerved, black dotted with oil glands, stellate-pubescent, ultimately glabrescent; petioles 1 - 3 cm long, stellate-tomentose, black gland-dotted; stipules 3 - 6 mm long, linear-lanceolate to ovate, entire or serrate. Flowers solitary, axillary; pedicels up to 1 cm long in fruit, stellate-tomentose, black gland-dotted. Epicalyx segments 1 - 2.5 x 0.5 - 1.5 cm, free, foliaceous, broadly ovate, truncate or rounded at base, lacinate, lobes 8 - 12, linear-lanceolate with rounded sinuses, black gland-dotted, pubescent. Calyx 5 - 8 mm long, cupular, 5-dentate. Corolla yellow with purple base, campanulate, 1.5 - 2 cm across; petals 2 - 3 x 1 - 1.5 cm. Staminal column antheriferous throughout. Capsules 1 - 2 cm long, ca 1 cm across, ovoid, prominently gland-dotted, usually 5 locular. Seeds 2 or 3 in each locule, wedge-shaped, yellowish or brownish tomentose.

*Fl.* Dec.

*Distrib.* India: Gujarat.

Pakistan(Sind), S.E. Arabia and Somaliland.

*Notes.* Ansari(Pakistan cottons 2: 27 - 32, 1958) based on the ecology of this species comments that the wild plants were singularly free of pests and diseases and speculates on the possible genetic potential of this species in producing drought and disease resistant cultivated Asiatic cottons through hybridization.

### 11. *Hibiscus* L., nom. cons.

Annual or perennial herbs, undershrubs, shrubs or trees; branchlets glabrate or sparsely to densely pubescent or tomentose with simple hairs and sometimes scarbid or with stellate hairs (tufted or appressed) and recurved simple hairs decurrent in one or two lines from the base of stipules. Leaves simple, palmilobed to palmiparted, rarely pennilobed, often with obscure nectaries or nectariferous zone on midrib beneath; stipules subulate to linear, ovate or foliaceous. Flowers axillary, solitary, or in terminal, lax racemes or panicles by reduction of upper leaves. Epicalyx segments 3 - many, rarely absent. Calyx 5-lobed or 5-parted, distinctly nerved, sometimes with nectaries, persistent. Corolla generally large and showy, rotate, campanulate or cylindrical, variously coloured. Staminal column shorter or as long as petals, rarely longer, truncate or 5-toothed at apex, antheriferous throughout or only in the upper half. Ovary 5-locular or 10-locular by 5 false septa, ovules 3 or more in each locule; style 1, distally 5-branched, spreading; stigmas usually discoid, sometimes capitate or not distinct. Capsules loculicidally dehiscent, usually 5-loculed or 10-loculed by false dissepiments. Seeds 3 - many in each locule, reniform, subglobose or obovoid, glabrous or hairy.

Throughout tropics and subtropics of the world, a few extend to temperate areas, ca 250 species; 23 in India.

*Notes.* Most of the species grow at low altitudes and found in the areas of comparatively high rainfall; usually grow in waste places and road sides etc; tree species grow in secondary forests in hilly tracts.

*Literature.* RAKSHIT, S.C. & B.C. KUNDU(1970). Revision of the Indian species of *Hibiscus*. Bull. Bot. Surv. India 12: 151 -175.

#### KEY TO THE SECTIONS

- 1a. Capsules often 10-loculed by false dissepiments; trees, treelets, woody climbers or scandent shrubs 2  
 b. Capsules 5-loculed; Herbs, undershrubs or shrubs (not scandent) 3
- 2a. Leaves unlobed or rarely 3-lobed(*H. scandens*); stipules large, foliaceous, sometimes linear-lanceolate (*H. fragrans*) enveloping young sprouts; epicalyx segments connate at base; seeds hairy sect. 1. *Azanza*  
 b. Leaves 3 - 5-palmilobed; stipules linear, lanceolate; epicalyx segments free; seeds glabrous. sect. 7. *Spatula*
- 3a. Epicalyx segments forked at apex, linear or oblanceolate; calyx lobes prominently 3-veined; stems with prickles or bristles or both; herbs or undershrubs sect. 2. *Furcaria*  
 b. Epicalyx segments not forked at apex; calyx lobes without prominent veins; stems without bristles or prickles; undershrubs, shrubs or herbs 4
- 4a. Staminal column longer than corolla, antheriferous towards apex; fruits rarely develop; leaves unlobed; shrubs sect. 5. *Lilibiscus* (cultivated)  
 b. Staminal column shorter than corolla, antheriferous throughout; fruits well developed; leaves lobed or entire; herbs, undershrubs or shrubs 5
- 5a. Segments of epicalyx very short, often caducous sect. 6. *Solandra*  
 b. Segments of epicalyx distinctly long, persistent 6
- 6a. Seeds hairy 7  
 b. Seeds glabrous or tubercled 8
- 7a. Seeds covered with long silky, ferruginous hairs sect. 3. *Hibiscus*  
 b. Seeds tomentose with short hairs sect. 8. *Trichospermum*
- 8a. Calyx more or less inflated particularly in fruit, lobes many-veined; mostly shrubs, sometimes herbs sect. 9. *Trionum*  
 b. Calyx not inflated, lobes 3-veined; herbs or undershrubs sect. 4. *Ketmia*

#### KEY TO THE SPECIES IN SECTIONS

##### Section 1. A Z A N Z A DC.

- 1a. Trees; stipules oblong, foliaceous; epicalyx segments 7 - 14, lanceolate; capsules shorter than calyx 2  
 b. Treelets or climbers; stipules linear-lanceolate; epicalyx segments 5; capsules longer than calyx 4
- 2a. Epicalyx 2 - 3 cm long; leaves densely stellate-hairy, hairs 8 - 10 mm long, tufted from a glandular base; stipules 5 - 10 x 2 - 4 cm 2. *H. macrophyllus*  
 b. Epicalyx 0.5 - 1 cm long; leaves densely stellate-pubescent, hairs ca 0.5 mm long; stipules 2 x 0.5 - 1 cm 3

- |     |  |                        |
|-----|--|------------------------|
| 3a  | Capsules falsely 10-loculed; seeds well developed                          | 5. <i>H. tiliaceus</i> |
| b.  | Capsules 5-loculed; seeds abortive   | 4. <i>H. similis</i>   |
| 4a. | Scandent shrubs; leaves unlobed; flowers fragrant, petals 2 - 4 x 2 - 3 cm | 1. <i>H. fragrans</i>  |
| b.  | Woody climbers; leaves 3-lobed; flowers not fragrant, petals ca 2 x 1.5 cm | 3. <i>H. scandens</i>  |

## Section 2. FURCARIA DC.

- |     |  |                                   |
|-----|--|-----------------------------------|
| 1a. | Epicalyx segments with an appendage on the inner surface towards apex  | 2                                 |
| b.  | Epicalyx segments without any appendage  | 6                                 |
| 2a. | Stems, petioles and pedicels armed with prickles   | 3                                 |
| b.  | Stems, petioles and pedicels without prickles  | 5                                 |
| 3a. | Stipules foliaceous, auriculate at base, semilunar   | 11. <i>H. surattensis</i>         |
| b.  | Stipules not foliaceous  | 4                                 |
| 4a. | Leaves unlobed or 3 - 5-lobed, lobation up to about middle; stipules ovate-lanceolate; pedicels 1.5 - 7 cm long; calyx lobes broadly lanceolate, acute to acuminate at apex; rambling or trailing undershrubs                          | 6. <i>H. aculeatus</i>            |
| b.  | Leaves deeply palmately 3 - 5-lobed, or sometimes 6 - 7-lobed, lobation nearly to the base; stipules linear; pedicels 2 - 4 mm long; calyx lobes ovate to deltoid, long acuminate at apex; erect undershrubs                           | 10. <i>H. radiatus</i>            |
| 5a. | Leaves ovate, shallowly 3-lobed, 5 - 9 x 5 - 10 cm, cordate at base; petioles 2.5 - 5.5 cm long; calyx as long as capsules   | 2. <i>H. beddomei</i>             |
| b.  | Leaves lanceolate, unlobed, 5.5 - 10 x 1 - 4 m, cuneate at base; petiole 0.5 - 2.5 cm; calyx longer than capsules  | 9. <i>H. hoshiarpurensis</i>      |
| 6a. | Leaves deeply palmatilobed to -parted, lobation up to the base of lamina; epicalyx segments spreading or reflexed; calyx lobes with white arachnoid tomentum, never becoming fleshy after anthesis; seeds with scale-like tufted hairs | 8. <i>H. cannabinus</i>           |
| b.  | Leaves palmatifid to -partite, lobation up to 3/4 of lamina; epicalyx segments usually appressed; calyx lobes without arachnoid tomentum, becoming fleshy after anthesis; seeds furfuraceous   | <i>H. sabbariffa</i> (cultivated) |

## Section 3. HIBISCUS

- |     |  |                                    |
|-----|--|------------------------------------|
| 1a. | Shrubs; corolla large, more than 4 cm in diameter; pedicels equal to or shorter than petioles  | <i>H. syriacus</i><br>(cultivated) |
| b.  | Herbs or undershrubs; corolla small, less than 3 cm in diameter; pedicels longer than petioles | 2                                  |
| 2a. | Leaves unlobed; epicalyx segments filiform; calyx divided up to the middle                     | 13. <i>H. micranthus</i>           |
| b.  | Leaves 3-lobed; epicalyx segments lanceolate to linear; calyx divided nearly to the base       | 3                                  |
| 3a. | Leaves with nectaries on veins; petioles 0.5 - 1.5(- 3) cm long; calyx lobes 3 - 10 mm long    | 12. <i>H. hirtus</i>               |
| b.  | Leaves without nectaries on veins; petioles 2 - 6 cm long; calyx lobes 10 - 22 mm long         | 14. <i>H. talbotii</i>             |

## Section 4. K E T M I A DC.

- 1a. Pedicels as long as or longer than petioles, articulate; epicalyx segments 8 - 10 2  
 b. Pedicels much shorter than petioles, inarticulate; epicalyx segments usually 5, sometimes 5 - 10  
 16. *H. lunariifolius*
- 2a. Leaves deeply 3 - 5-lobed, lobation up to the base of lamina; stems covered with bristles and prickles; epicalyx segments 2 - 3.5 cm long 15. *H. caesius*  
 b. Leaves unlobed or shallowly 3-lobed, lobation up to the middle of lamina; stems sparsely covered with stellate hairs or glabrous; epicalyx segments ca 5 mm long 17. *H. obtusilobus*

## Section 5. L I L I B I S C U S Hochr.

- 1a. Petals entire; staminal column slightly longer than the petals *H. rosa-sinensis* (cultivated)  
 b. Petals lacinate; staminal column twice as long as petals *H. schizopetalus* (cultivated)

## Section 6. S O L A N D R A (MURRAY) Hochr.

Flowers solitary or in terminal racemes by reduction of upper leaves; epicalyx segments very small or absent in open flower; seeds glabrous or tubercled 18. *H. lobatus*

## Section 7. S P A T U L A Hochr.

Treelets; leaves palmately 3 - 5-lobed; stipules linear-lanceolate; epicalyx segments free, foliaceous; capsules depressed globose; seeds glabrous 19. *H. platanifolius*

## Section 8. T R I C H O S P E R M U M Hochr.

- 1a. Leaves unlobed or slightly lobed or angled; flowers 3.5 cm or more in diameter 2  
 b. Leaves palmatilobed; flowers ca 2.5 cm in diameter 20. *H. palmatus*
- 2a. Epicalyx segments 6 - 10, spatulate, shorter than the calyx; capsules shorter than calyx; stipules ca 5 mm long 21. *H. panduraeformis*  
 b. Epicalyx segments 5, linear-lanceolate, longer than calyx; capsules twice the length of calyx; stipules 1.3 - 2.5 cm long 22. *H. purpureus*

## Section 9. T R I O N U M DC.

- 1a. Small herbs; calyx lobes broadly ovate, inflated covering the capsule, sparsely stellate-pubescent with dense stiff hairs on nerves; petals 5, 1.5 - 2 cm long; capsules oblong; seeds minutely tubercled or glabrate 23. *H. trionum*  
 b. Shrubs; calyx lobes ovate-lanceolate, enlarged in capsule, densely stellate-pubescent with glandular hairs throughout; petals 5 or multiples of 5, 6 - 8 cm long; capsules subglobose; seeds with long hairs *H. mutabilis* (cultivated)

## Section 1. A Z A N Z A DC.

**1. *Hibiscus fragrans* Roxb.**, [Hort. Beng. 97. 1814, nom. nud.] Fl. Ind. 3: 195. 1832; Masters in Fl. Brit. India 1: 337. 1874. **Fig. 88.**

Scandent shrubs or robust climbers or tall trees; stems ca 20 cm in diam.; branchlets, petioles and pedicels stellate-pubescent. Leaves 5 - 15 x 4 - 12 cm, ovate, unlobed, cordate at base, acute at apex, dentate or repand, 5 - 7-nerved at base, stellate-hairy on both surfaces, densely so on lower surface, ultimately glabrescent, chartaceous; petioles 5 - 7 cm long; stipules ca 10 x 3 mm, linear to lanceolate, stellate-tomentose on both surfaces. Flowers in axillary or in terminal panicles, fragrant; pedicels 3 - 7 cm long, jointed 3 - 5 mm below the epicalyx. Epicalyx segments 5, connate at base, 4 - 14 x 5 - 10 mm, ovate, acuminate, stellate-pubescent. Calyx 5-lobed, lobes connate up to the middle, 1 - 2 x 0.3 - 1 cm, ovate, acuminate, densely stellate-tomentose inside, stellate and club-shaped hairy outside. Corolla white to pinkish with pale yellow centre, fragrant, ca 3 cm across; petals 2 - 4 x 2 - 3 cm, somewhat rounded at apex, veins parallel, sparsely long stellate-hairy outside, glabrous inside. Staminal column ca 1 cm long, purplish. Capsules 3 - 4 x 1.5 - 2 cm, ovoid, dehiscing into five parts, densely stellate-hairy outside, glossy and glabrous inside. Seeds small, reniform covered with long, white or brown hairs.

Fl. Nov. - Jan.; Fr. Feb. - April.

*Distrib.* India: In tropical evergreen and subtropical forests of Eastern Himalayas up to 1350 m. Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Mizoram and Manipur.

Bangladesh, Myanmar and China.

**2. *Hibiscus macrophyllus* Roxb.** [Hort. Beng. 51. 1814, nom. nud.] ex Hornem., Hort. Hafn. Suppl. 149. 1819; Masters in Fl. Brit. India 1: 337. 1874. *H. setosus* Roxb., [Hort. Beng. 97. 1814, nom. nud.] Fl. Ind. 3: 194. 1832. *H. vestitus* Griffith, Not. Pl. Asiat. 4: 519. 1854.

Beng.: *Kashis udal*, *Kashia palla*; Kh.: *Tyllendkhar*; Urdu: *Baiza*, *Raiza*; Mikir.: *Phama*.

Trees, 12 - 22 m tall; trunk 1.2 - 1.5 m in diam., at the base; branches spreading; branchlets tufted with stiff yellowish-brown stellate-pubescent, ultimately glabrescent. Leaves 15 - 30 x 15 - 35 cm, cordate at base, abruptly acuminate at apex, entire or minutely crenulate; petioles 10 - 22 cm long; stipules 5 - 10 x 2 - 4 cm, foliaceous. Flowers axillary, solitary or in terminal racemes; pedicels 2 - 4 cm long, accrescent up to 7 cm. Epicalyx lobes 10 - 12, 2 - 3 x 0.2 - 0.3 cm, linear to lanceolate. Calyx 5-lobed, lobes connate at base, 2.5 - 3 cm long, lanceolate. Corolla yellow with dark purple centre, often turning

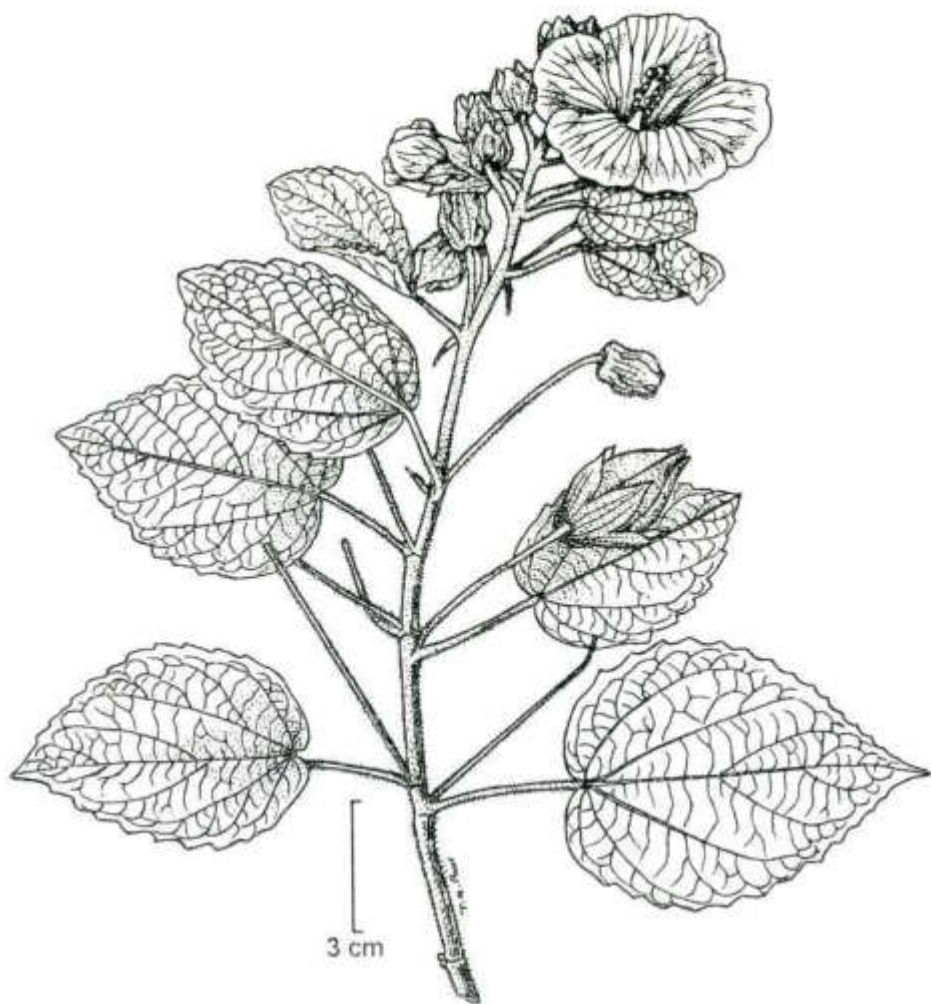


Fig. 88. *Hibiscus fragrans* Roxb.

red; Petals 5 - 7 x 3 - 5 cm, obovoid, rounded at apex. Staminal column ca 4 cm long. Ovary ca 6 x 4 mm, conical; style obovoid, with ca 5 mm long beak. Seeds numerous in each locule, ca 4 mm across, reniform with long fulvous hairs in a line along the edge.

*Fl.* Jan. - April; *Fr.* April - May.

*Distrib.* India: In Eastern Himalayas and N. E. region up to 900 m, Assam, Meghalaya and Nagaland.

Bangladesh, Myanmar, S. China and Malesia.

*Notes.* The heart wood is light and durable, used for house posts, rafters etc. The inner layer of the bark yields strong fibre used for rope making and cordage. Fibre is also used for making of good quality paper.

**3. *Hibiscus scandens* Roxb.**, [Hort. Beng. 51. 1814 nom. nud.] Fl. Ind. 3: 200. 1832; Masters in Fl. Brit. India 1: 337. 1874. **Fig. 89.**

Woody climbers over lofty trees; young stems, petioles and pedicels stellate-tomentose. Leaves 5 - 14 x 4 - 13 cm, ovate-cordate, 5 - 7-nerved at base, 3-lobed or angled, lobes deltoid-lanceolate, acute or acuminate at apex, entire or dentate, stellate-pilose on both surfaces; petioles 2 - 9 cm long; stipules up to 5 cm long, linear-lanceolate, caducous. Flowers in terminal panicles; pedicels 1 - 4 cm long, jointed above the middle. Epicalyx segments 5, connate near the base, segments ca 10 x 3 mm, lanceolate, stellate-pilose, persistent. Calyx equal to or shorter than epicalyx, densely stellate-pilose outside, distinctly long hairy inside, persistent. Corolla white or yellow with crimson centre; petals ca 2.5 cm long, stellate-hairy outside, glabrous inside. Staminal column ca 1.5 cm long. Capsules 1 - 3 x 1 - 1.5 cm, ovoid-cylindric, densely stellate-hairy. Seeds ca 2 mm, reniform, densely brownish-white hairy, hairs up to 1.5 cm long.

*Fl. & Fr.* Oct. - March.

*Distrib.* India: In tropical evergreen and subtropical forests up to 1500m. Sikkim, Assam, Tripura and Andaman & Nicobar Islands.

Bangladesh (Chittagong hill tracts) and Myanmar.

**4. *Hibiscus similis* Blume**, Bijdr. 2: 73, 105. 1825. *H. prainii* Raizada & Chatterjee in Sci. & Cult. 26: 47. 1960. *H. tortuosus* Wallich ex Prain, Bengal Pl. 1: 268. 1903, non Roxb. 1832.

Trees; branchlets glabrous or stellate-tomentose. Leaves 10 - 21 x 9 - 20 cm, orbicular, ovate, cordate and 7 - 9-palminerved at base, with linear, 5 - 30 mm long nectaries on middle nerves beneath, cuspidate at apex, entire; petioles 5 - 15 cm long,



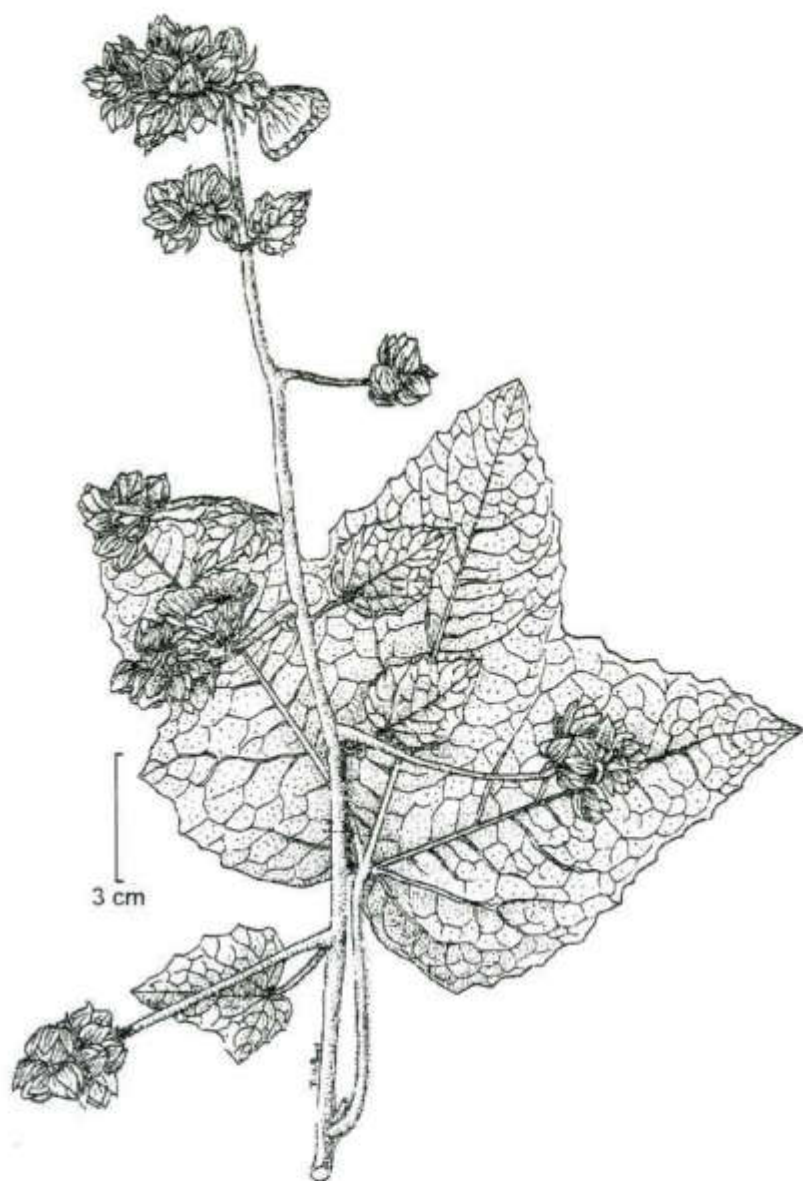


Fig. 89. *Hibiscus scandens* Roxb.

stellate-tomentose, ultimately glabrescent; stipules 3 - 5 x 1.5 - 2 cm, ovate-lanceolate, stellate-tomentose, ultimately glabrescent. Flowers axillary, solitary or in terminal panicles; pedicels 1.5 - 2.0 cm long, accrescent up to 10 cm, densely stellate-tomentose. Epicalyx segments 8 - 11-fid, connate at base, segments 1.5 - 2.0 x 4 - 5 mm, linear-lanceolate, acuminate, stellate-hairy outside, middle portion of inside with long simple hairs, marginal portion with minute stellate hairs. Calyx lobes connate at base, lobes 2 - 2.5 x 0.5 - 0.7 cm, lanceolate, acuminate, distinctly 3-nerved, indumentum as on epicalyx. Petals 6.5 - 7.0 cm long, hairy outside. Capsules ca 2.5 cm long, orbicular with a short beak, 5-loculed, hirsute, inner surface glossy. Seeds abortive.

*Distrib.* India: In estuaries. West Bengal (Sundarbans).

Malesia.

*Notes.* This species exhibit characters that are intermediate between *H. tiliaceus* L. s.s. and *H. macrophyllus* Hornem. and is therefore, considered as a possible hybrid of these 2 species. Borssum Waalkes (l.c.) treated *H. similis* as only a subspecies of *H. tiliaceus*.

**5. *Hibiscus tiliaceus* L., Sp. Pl. 694. 1753; Masters in Fl. Brit. India 1: 343. 1874.**

Trees, up to 15 m tall; bark tough, fibrous. Leaves 3 - 20 x 1.5 - 20 cm, unlobed or 3 - 5-lobed, orbicular, deeply cordate, rounded or truncate at base, acute to acuminate at apex, entire or crenate, chartaceous to coriaceous, nectaries 1 - 5, linear on nerves beneath, petioles 1.5 - 15 cm long; stipules ca 2 x 0.5 - 1 cm, ovate to oblong, caducous. Flowers solitary, axillary or in terminal racemes by reduction of upper leaves; pedicels 1 - 3 cm long. Epicalyx cupular, segments 7 - 10, deltoid, usually shorter than calyx, spreading and often splitting. Calyx campanulate, lobes 2 - 3 x 0.5 - 1 cm, each with 3 prominent veins and a nectary on the midvein outside. Petals obovate rounded, yellow with dark purple and fleshy base, ultimately turning red. Staminal column shorter than petals. Capsules 1 - 2 cm across, globose to ovoid with a short beak, sericeous or tomentose with simple and stellate hairs; pericarp thin; mesocarp fibrous; endocarp pergamentaceous. Seeds 5 - 8 in each locule, reniform, blackish brown, papillose.

#### KEY TO THE SUBSPECIES

- |   |                             |
|---|-----------------------------|
| 1a. Leaves 3 - 5-lobed, rounded or truncate at base | 5.1 subsp. <i>hastatus</i>  |
| b. Leaves unlobed, cordate at base                  | 5.2 subsp. <i>tiliaceus</i> |

**5.1. subsp. *hastatus* (L. f.) Borss. in Blumea 14: 36. 1966. *Hibiscus hastatus* L. f., Suppl. Pl. 310. 1781, non Cav. 1787. *H. tricuspis* Banks ex Cav., Diss. 3: 152, t. 55. f. 2. 1787; Masters in Fl. Brit. India 1: 344. 1874.**

*Distrib.* India: Andaman & Nicobar Islands, sometimes cultivated in gardens.

Pacific Islands and Polynesia.

**5.2. subsp. tiliaceus**

Beng. & Hindi: *Bola*; Mal.: *Nirparathi*; Mar.: *Belapala*; Or.: *Baria*; Tel.: *Etagogu*.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Throughout coastal areas, sometimes planted in interior areas.

Throughout tropics and subtropics of the world.

*Notes.* Bark yields dark fibres which are used locally for ropes and cordages. The fibres are more resistant to water than jute and sunhemp. Bark, roots, leaves and flowers are reported to have medicinal properties.

Section 2. FURCARIA DC.

**6. *Hibiscus aculeatus*** Roxb., *Fl. Ind.* 3: 206. 1832. *H. furcatus* Roxb. [*Hort. Beng.* 51. 1814 nom. nud.] ex DC., *Prod.* 1: 449. 1824, non Willd. 1809; *Masters in Fl. Brit. India* 1: 335. 1874.

Kan.: *Huligowri*, *Gumchi*; Mal.: *Naranam pupuli*, *Paccapuli*; Or.: *Piri-pirika*; Tel.: *Adavi gogu*, *Konda gogu*, *Danasonigogu*.

Undershrubs, trailing or suberect, up to 1.5 m high; stems, petioles and pedicels densely simple hairy and with stiff, sharp, recurved bristles, ca 1 mm long, arising from a glandular base. Leaves 2.5 - 10 x 3 - 8 cm, unlobed or 3 - 5-lobed, cordate at base, acute at apex, crenate, dentate or crenate-serrate, 5 - 7-nerved at base with stiff prickles on the main veins beneath; petioles 2 - 8 cm; stipules 5 - 14 x 2 - 3 mm, ovate-lanceolate, acute, hirsute, long stiff hairs along margins. Flowers 5 - 10 cm across, solitary, axillary, buds with a tuft of hairs at apex; pedicel 1.5 - 7 cm long. Epicalyx segments 8 - 12, 1 - 2 cm long, forked at apex with one ovate leafy lobe, another oval-shaped lobe projecting upwards, hairy. Calyx deeply 5-parted, lobes broadly lanceolate, acute or acuminate, 3-nerved with stiff bristles outside, softly hairy along margin and apical portion of inner accrescent, persistent. Corolla yellow with purple centre. Capsules enclosed by enlarged calyx, ca 1.5 cm long, ovoid, acute, covered with rigid deciduous hairs. Seeds 4 - 5 mm, more or less reniform, sparsely covered with whitish scale-like structures, brownish.

*Fl.* Sept. - Jan.; *Fr.* Nov. - Feb.

*Distrib.* India: In deciduous and scrub forests and also in wastelands. Bihar, West Bengal, Assam, Meghalaya, Orissa, Maharashtra, Andhra Pradesh, Karnataka, Tamil

Nadu and Kerala.

Bangladesh, Myanmar, Sri Lanka, Tropical and S. Africa.

*Notes.* The stem yields strong fibres suitable for cordage and rope. The leaves and roots are medicinal.

7. *Hibiscus beddomei* Rakshit & Kundu in *Sci. & Cult.* 27: 192. 1961.

Herbs; branchlets covered with rigid stellate hairs. Leaves 5 - 9 x 5 - 10 cm, ovate, 3-angled or slightly 3-lobed, cordate at base, acute at apex, serrate, 5 - 7-nerved at base, upper leaves lanceolate or narrowly ovate with a midvein, serrate-dentate, stellate-hairy on both surfaces; petioles 2.3 - 5.5 cm, pubescent with simple and stellate hairs; stipules linear, hairy. Flowers axillary, solitary; pedicels 2 - 4 mm long. Epicalyx segments 9, ca 9 mm long, linear, shorter than calyx, each segment with a ca 3 mm long, linear appendage at the base of spatulate tip, pubescent. Calyx campanulate, ca 1 cm long, lobes triangular, acuminate, 3-nerved, membranous, hairy, persistent. Petals 5, pale purple, stellate-hairy outside towards apex. Staminal column laxly antheriferous throughout. Ovary ovoid-oblong, densely white sericeous; styles 5, spreading above the staminal column. Capsules as long as calyx, ovoid, beaked, hairy, dehiscing into 5 longitudinal valves.

*Fl. & Fr.* Sept. - Nov.

*Distrib.* India: Rajasthan, Uttar Pradesh, Central and South India.

8. *Hibiscus cannabinus* L., *Syst. Nat.* ed. 10, 2: 1149; *Masters in Fl. Brit. India* 1: 339. 1874.

Beng.: *Mestapat*; Hindi: *Ambari*, *Patsan*, *Pitwa*; Guj.: *Ambari*, *Sheria*; Kan.: *Pundi*; Mal.: *Kanjaru*; Mar.: *Ambadi*, *Ambada*, Or.: *Kanuriya*; Sans.: *Nalita*; Tam.: *Pulichhi*, *Pulimanji*; Tel.: *Gogu*, *Gongura*, *Gaynaru*.

Annual or perennial herbs, 2.5 - 4 m high; stems prickly glabrous. Leaves unlobed, upper ones palmatilobed to -parted, 3 - 5 or 7-lobed, lobation up to the base of lamina, lobes 3 - 8 x 0.4 - 2 cm linear, elliptic to lanceolate, acuminate, middle nerve with a nectary beneath, glabrous; petioles 3 - 15 cm; stipules 3 - 5 mm, linear to subulate. Flowers axillary, solitary or in racemes; pedicels 2 - 5 mm long, prickly. Epicalyx segments 7 - 8, spreading or reflexed, up to 1.5 cm long, shorter than calyx, connate or adnate to the base calyx, sparsely covered with upturned, stiff prickles. Calyx lobes free almost to the base, lobes lanceolate to somewhat deltoid, distinctly 3-nerved with a large nectary on midvein outside, prickly and white archnoid tomentose outside, glabrous inside. Corolla yellow with a crimson centre; petals 4 - 6 x 1 - 3 cm, spreading, glabrous. Staminal column 1 - 2.5 cm long, antheriferous throughout. Capsules ca 2 x 1.5 cm, ovoid to

globose, beaked, dehiscent into 5 valves, densely hairy outside, glossy inside. Seeds ca 7 x 4 mm, reniform, dotted with minute brownish scale-like tufted hairs, brownish.

*Fl. & Fr.* Aug. - Nov.

*Distrib.* India: Throughout up to 1500 m.

Tropical and subtropical Africa, cultivated in most tropical countries.

*Notes.* This species is highly variable in its leaf shape, pigmentation of stem and branching. The environmental factors such as soil moisture, temperature and day light can change the stature, branching pattern and maturation time. 5 distinct varieties comprising 8 agricultural types have been isolated at Pusa, Bihar (Anonymous, Wealth of India 5: 78. 1959). These are *simplex* (Type 1), *viridis* (Type 2), *ruber* (Type 3), *purpureus* (Type 4, 5), *vulgaris* (Type 6, 7, 8). Among these type 3 and 6 (renamed N. P. 3 and N. P. 6) are best suited for extraction of fibre.

Fibres extracted from stem are used for making coarse textiles, fishing lines and nets. Leaves, flowers and seeds are medicinal. Leaves are used in making pickles and chutnies.

9. *Hibiscus hoshiarpurensis* T. K. Paul & Nayar in Bull. Bot. Surv. India 25: 188. 1985 & in Fasc. Fl. India 19: 131. 1988.

Perennial herbs, up to 1.5 m high; stems erect, densely covered with both stiff and soft stellate hairs mixed with a few simple hairs, nearly hirsute. Leaves 5.5 - 10 x 1 - 4 cm, lanceolate, unlobed, cuneate at base, acute at apex, irregularly serrate, midvein prominent, stellate-pubescent on both surfaces; petioles 0.5 - 2.5 cm long, densely stellate-pubescent, nearly hirsute; stipules ca 5 mm long, linear, covered with simple and few stellate hairs. Flowers axillary, solitary; pedicels 1 - 4 mm long, hairy. Epicalyx segments 10, free, 0.8 - 1.3 cm long, linear, forked at apex with 3 - 5 mm long linear appendage arising from the base of the oblanceolate tip, stiff hairy throughout. Calyx 1.2 - 1.7 cm long, campanulate, divided up to the middle, lobes 1.2 - 1.7 x 0.3 - 0.5 cm, deltoid, acuminate, with a prominent midvein, stiff simple and stellate-hairy outside, glabrous inside. Corolla bright yellow; petals ca 2.5 cm long, sparsely stellate-hairy outside. Staminal column ca 1.5 cm long, antheriferous throughout. Ovary ovoid-oblong, white silky hairy; styles ca 1.8 cm long; stigmas 5. Capsules ca 1.5 cm long, ca 1 cm across, shorter than calyx, ovoid, shortly beaked, densely hairy, dehiscent longitudinally into 5 valves. Seeds 3 - 4 x 2 mm, ovoid-reniform, dotted with white scaly structures.

*Fl.* Aug. - Sept.; *Fr.* Oct. - Nov.

*Distrib.* India: Punjab.



Fig. 90. *Hibiscus radiatus* Cav.

Endemic.

**10. *Hibiscus radiatus*** Cav., Diss. 3: 150, t. 54 f. 2. 1787; Masters in Fl. Brit. India 1: 335. 1874. *H. lindleyi* Wallich, Pl. Asiat. Rar. 1: 4, t. 4. 1830. *H. heptaphyllus* Dalz. & Gibs., Bombay Fl. 20. 1861. *H. pachmaricus* Haines in Bull. Misc. Inform. 1914: 24. 1914, **syn. nov.** **Fig. 90.**

Undershrubs, up to 1.8 m high; stems tinged red, with some bulbous based retrorse prickles and long simple hairs, ultimately glabrescent. Leaves 2 - 12 x 1.5 - 12 cm, lower leaves broadly ovate to oblong, cuneate at base, acute at apex, entire, upper leaves orbicular, deeply palmately 3 - 5-lobed, sometimes 6 - 7, lobes ovate to oblong, obovate, linear to lanceolate, acute to acuminate at apex, coarsely or sharply serrate, glabrous or with stout hairs on veins beneath, 3 - 5-nerved at base, often tinged red; petioles 2 - 15 cm long, sparsely aculeate or unarmed, with a strip of short hairs above, upper surface coppery red when young; stipules 5 - 8 mm, linear to lanceolate, bristly. Flowers axillary, solitary, large, showy; pedicels 2 - 4 mm long, jointed, pubescent below the joint. Epicalyx segments 8 or 10, 15 - 18 x 1.5 - 2 mm, linear, acute, spreading, forked towards apex, covered with bulbous based bristles of ca 1 - 2 mm long. Calyx ca 2 cm long, ca 1.5 cm across, accrescent up to 2.5 mm, ultimately becoming hard and stiff; lobes ca 10 x 3 - 4 mm, ovate to deltoid, long acuminate at apex, veins prominent without nectaries, beset with bristles outside, glabrous inside. Corolla ca 6 cm across, yellow with dark purple centre; petals obovate, sparsely hairy outside, glabrous inside. Staminal column 1.5 - 2.2 cm long, anthers laxly arranged throughout its length. Ovary 5 - 7 mm long, globose, white hirsute; styles 1.3 - 2.3 cm long, arms purple; stigmas capitellate, dark purple. Capsules 2 - 2.5 x 1.5 cm, ovoid, with a short beak, densely hairy with long simple bristles, dehiscing into 5 loculicidal valves. Seeds 4 mm across, scarious, brown.

*Fl.* Aug. - Feb.; *Fr.* Oct. - Feb.

*Distrib.* India: In deciduous and mixed forests. Bihar, West Bengal, Assam, Meghalaya, Madhya Pradesh, Rajasthan, Maharashtra and Tamil Nadu; often cultivated.

Bangladesh, Myanmar, Malesia and Australia.

**11. *Hibiscus surattensis*** L., Sp. Pl. 1753; Masters in Fl. Brit. India 1: 334. 1874. **Fig. 91.**

Tam.: *Kashlirirai*; Tel.: *Mullugogu*.

Undershrubs or herbs, initially erect, ultimately trailing; stems, petioles, pedicels and main nerves of leaves with soft simple hairs and recurved prickles. Leaves 3 - 7 x 4 - 12 cm, suborbicular or ovate, lower ones 3 - 5-palmilobed, upper ones 5-palmiparted, lobes linear, lanceolate, more or less truncate and 5 - 7-nerved at base, acute at apex, crenate-serrate, simple and stellate-hairy on both surfaces, ultimately becoming gla-



Fig. 91. *Hibiscus surattensis* L.



brous; petioles 3 - 9 cm long; stipules 5 - 25 x 6 - 15 mm, foliaceous, ovate, semilunar, auricled at base, acute at apex, serrate to dentate, pubescent or glabrous, ciliate with long simple hairs. Flowers axillary, solitary; pedicels 3 - 7 cm long, jointed near apex, the portion above the joint densely covered with stiff simple hairs. Epicalyx segments 10, 15 - 20 x 2.5 - 3 mm, spatulate, spreading with an erect filiform to linear appendage near the apex of each segment, sparsely simple hairy. Calyx campanulate, deeply 5-partite, lobes 10 - 25 x 5 - 10 mm, ovate to deltoid, acuminate, 3-nerved, hispid outside with recurved prickles and simple hairs, glabrous or nearly so inside, persistent. Corolla yellow with deep purple centre; petals 3 - 5 x 1.5 - 3 cm, obovate, sparsely stellate-pubescent along margins outside. Staminal column 0.5 - 1.5 cm long, antheriferous throughout; filaments 1.5 - 2 mm long. Ovary 3 - 5 mm long, conical; style arms 2 - 2.5 mm long; stigmas discoid, hairy. Capsules ca 1.2 x 1 cm, ovoid, acute, covered with bristle-like, shiny, white or yellow hairs. Seeds 3 - 4 mm long, downy, blackish brown.

*Fl.* Sep. - Oct.; *Fr.* Dec. - Feb.

*Distrib.* India: Throughout in scrub forests, waste lands, forest edges up to 1200 m.

Paleotropical.

*Notes.* Stem yields a strong fibre of good quality. The leaves are acidic and used as salad. The decoction of leaves and stems are medicinal.

### Section 3. H I B I S C U S

12. *Hibiscus hirtus* L., Sp. Pl. 694. 1753; Masters in Fl. Brit. India 1: 335. 1874. *H. phoeniceus* auct. non Jacq.; Cav., Diss. 3: 157, t. 67 f. 2. 1787; Roxb., Fl. Ind. 3: 195. 1832.

Beng.: *Lal-surgumini*.

Undershrubs, 1 - 1.5 m high; stems pubescent with stiff, minute stellate hairs, densely so on branchlets. Leaves 3.5 - 6 x 1.5 - 3 cm, ovate, unlobed or 3-lobed, upper ones 2 - 3 x 0.5 - 2 cm, ovate-lanceolate, rounded or more or less cuneate at base, acute to acuminate at apex, crenate-serrate or irregularly dentate, 3 - 5-nerved at base, often with an oblong nectary on midrib beneath, minutely stellate-pubescent, densely so on lower surface; petioles 0.5 - 1.5(-3) cm, short stellate and simple hairy; stipules 2 - 8 mm, linear, ciliate. Flowers small, axillary, solitary or in racemes or panicles by reduction of leaves; pedicels longer than petioles, 0.5 - 2 cm long, accrescent up to 5 cm, jointed below or above the middle, pubescent with minute stellate and appressed simple hairs. Epicalyx segments 6 - 9, free, 3 - 8 x 0.5 - 1 mm, lanceolate to linear, acute. Calyx narrowly campanulate, 5-fid or parted, divided nearly to the base, lobes 3 - 10 x 0.5 - 1.5 mm, linear-lanceolate, hairy, persistent. Corolla pink or white, rotate; petals 1 - 1.5 x 0.5 - 0.8 cm, obovate, rounded at apex. Staminal column shorter or as long as petals, pink, antheriferous throughout. Capsules shorter than calyx, 7 - 10 mm across, globose,

puberulous to glabrous outside, glabrous inside, locules 2 - 3-seeded. Seeds ca 3 mm long, reniform, densely covered with long, ferruginous woolly hairs.

*Fl. & Fr.* Nov. - June.

*Distrib.* India: In Scrub forests up to 900 m. Throughout; rarely cultivated as an ornamental.

Malesia.

**13. *Hibiscus micranthus* L. f., Suppl. Pl. 308. 1781; Masters in Fl. Brit. India 1: 335. 1874.**

Undershrubs, up to 2.6 m high; branches slender, terete, scabrid or with scattered stellate hairs. Leaves 1.5 - 4.5 x 0.5 - 1.5 cm, ovate to oblong, acute to obtuse at apex, serrate, scabrid with stellate hairs on both surfaces; petioles 0.3 - 2 cm; stipules 0.3 - 1.3 cm, filiform, hairy. Flowers axillary, solitary; pedicels up to 3.5 cm long, slender, jointed above or below the middle, scabrid with stellate hairs. Calyx divided up to the middle, lobes ca 5 mm long, stellate-hairy outside and on apical portion inside. Corolla 0.6 - 1.2 cm across, purplish-white or pink; petals ca 1.2 x 0.4 cm, oblong-obtuse, often reflexed, stellate-pubescent outside, glabrous inside. Capsules globose, dehisces into 5 valves smooth outside, glossy inside. Seeds reniform, black, hirsute with long white silky hairs, hairs up to 8 mm long.

#### KEY TO THE VARIETIES

- |  |                              |
|--|------------------------------|
| 1a. Pedicels 0.5 - 4 cm long; branches straight; stems, petioles, pedicels and leaves scabrous with appressed stellate hairs                       | 2                            |
| b. Pedicels 0.3 - 1 cm long; branches entangled with each other; stems, petioles, pedicels and leaves with raised stellate hairs, bristly to touch | 13.1. var. <i>alii</i>       |
| 2a. Leaves ovate; petioles 5 - 20 mm long  | 13.2. var. <i>micranthus</i> |
| b. Leaves narrowly to broadly elliptic; petioles 1 - 6 mm long   | 13.3. var. <i>rigidus</i>    |

**13.1. var. *alii*** S.Abedin, Fl. W. Paksitan 130: 18. 1979; T.K. Paul & Nayar in Fasc. Fl. India 19: 140. 1988.

Undershrubs, profusely branched, branches entangled with each other, covered with stiff, bristly stellate hairs. Leaves 8 - 30 x 7 - 24 mm. Flowers axillary, solitary; pedicels 3 - 24 mm long.

*Distrib.* India: Rajasthan.

Pakistan, Arabia and Tropical Africa.

**13.2. var. micranthus**

Fig. 92.

*Distrib.* India: Throughout.

Pakistan, Africa, Sri Lanka and Myanmar.

**13.3. var. rigidus** (L. f.) Cuf. in Ann. Natur. Mus. W. 56: 49. 1948. *H. rigidus* L.f., Suppl. Pl. 310. 1781. *H. suborbiculatus* Wallich [Cat. No. 1906. 1828, nom. nud.] ex T.K. Paul & Nayar in Fasc. Fl. India 19: 138. 1988.

Shrubs, up to 1.5 m tall; branches with appressed stellate hairs. Leaves 0.5 - 2 x 0.2 - 1 cm, narrowly to broadly elliptic. Pedicels 0.5 - 3.5 cm long.

*Distrib.* India: S. Peninsula.

Pakistan, Arabia and Tropical Africa.

**14. Hibiscus talbotii** (Rakshit) T.K. Paul & Nayar in Bull. Bot. Surv. India 22: 197. 1982. *H. hirtus* L. var. *talbotii* Rakshit in Sci. & Cult. 27: 193. 1961.

Undershrubs, 1 - 2 m high; stems with minute stellate hairs and with a line of short simple hairs above each leaf axil extending over node, ultimately glabrescent. Leaves 8 - 14 x 3 - 8 cm, ovate-lanceolate, 3-lobed or deeply 3-parted, upper ones 4 - 12 x 1 - 4 cm, lanceolate, unlobed or slightly cuneate at base, crenate-serrate or irregularly dentate, 3 - 5-nerved at base, minutely stellate-hairy, particular on lower surface; petioles 2 - 6 cm long; stipules up to 1.3 cm long, linear-subulate, hairy. Flowers axillary, solitary or in terminal racemes or panicles by reduction of leaves; pedicels 1 - 2 cm long, accrescent up to 5 cm, jointed above the middle, pubescent with minute stellate and appressed simple hairs. Epicalyx segments 6 - 9, free, erecto-patent to appressed, shorter than calyx, 5 - 10 x 0.5 - 1 mm, lanceolate to linear, acute. Calyx 5-lobed, lobes free nearly to the base, 10 - 22 x 1 - 3 mm, linear to lanceolate, acute, hairy. Petals 1.6 - 2.5 x 0.5 - 0.7 cm, hairy outside. Staminal column shorter or as long as petals. Capsules globose, shorter than calyx. Seeds ca 3 mm long, reniform, densely covered with whitish woolly hairs.

*Distrib.* India: In deciduous forests up to 900 m. Maharashtra and Karnataka.

Endemic.



Fig. 92. *Hibiscus micranthus* L.f. var. *micranthus*

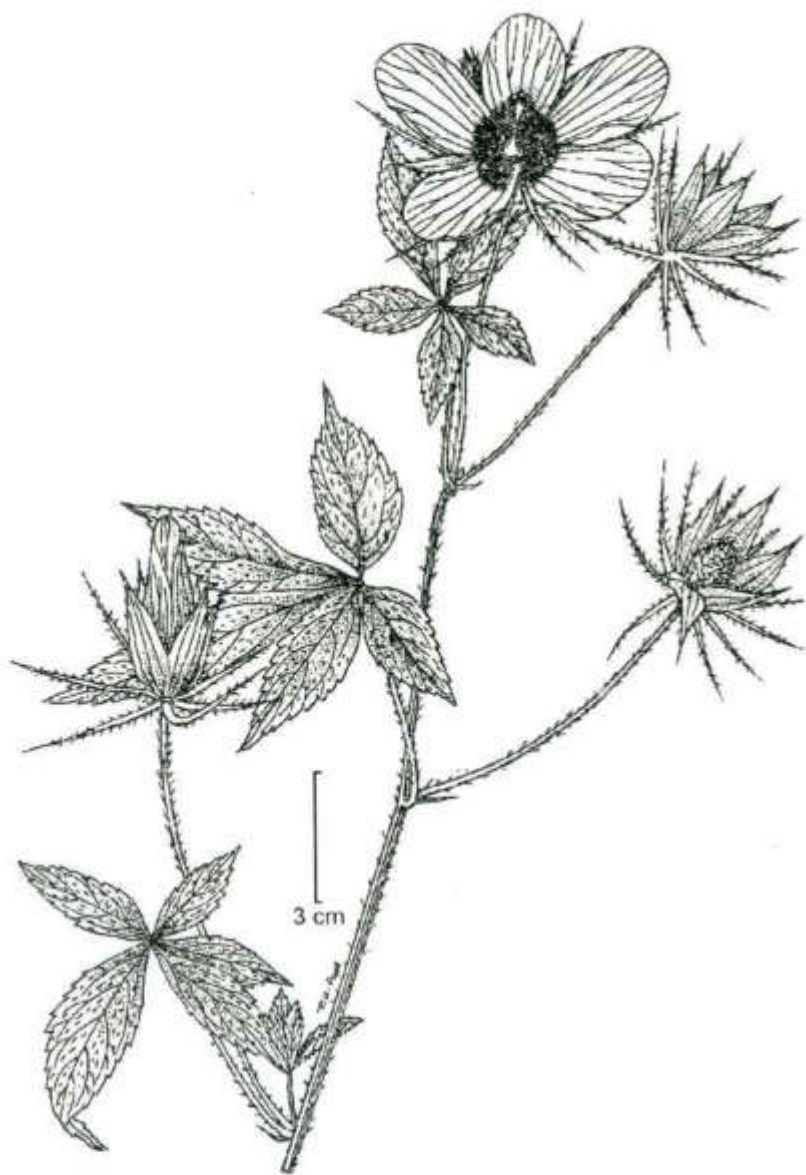


Fig. 93. *Hibiscus caesius* Garcke

## Section 4. K E T M I A DC.

**15. *Hibiscus caesius*** Garcke, Bot. Zeit. 7: 850. 1849. *H. gibsoni* Stocks ex Harvey & Sonder, Fl. Cap. 2: 587. 1862; Masters in Fl. Brit. India 1: 339. 1874. **Fig. 93.**

Herbs, undershrubs or shrubs, 1 - 2 m high; stems erect, sparsely covered with bristles and prickles. Leaves deeply 3 - 5-lobed to the base of lamina, lobes 2 - 7.5 x 1 - 3 cm, oblong, lanceolate, attenuate at both ends, serrate, simple hairy above, stellate-pubescent beneath; petioles 1 - 7 cm long, sparsely covered with stellate bristles; stipules 5 - 10 mm long, linear, subulate, hairy. Flowers axillary, solitary; pedicels up to 12 cm long, slender, jointed towards apex, sparsely covered with prickly hairs, densely so above joint. Epicalyx segments usually 10, number varies even on an individual plant, 2 - 3.5 cm long, linear, hairy, persistent, spreading like rays, become spinescent in fruit. Calyx lobes connate at base, 1.5 - 3 x 0.5 - 1 cm, lanceolate, acute at apex, glabrous or sparsely covered with simple hairs outside, pubescent inside with simple hairs particularly towards apex, persistent. Corolla yellow with purple centre or purple throughout, twice the length of calyx, stellate-hairy outside, glabrous inside. Staminal column ca 2 cm long, antheriferous throughout, purple. Capsules ovoid, enclosed within the calyx, prickly hairy outside, glabrous inside, dehiscent into 5 valves. Seeds ca 3 mm across, reniform, minutely pilose.

*Fl. & Fr.* Sept. - Dec.

*Distrib.* India: In dry deciduous and scrub forests. Punjab, Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat and Maharashtra.

Pakistan, Afghanistan, S. Africa and N. Australia.

**16. *Hibiscus lunariifolius*** Willd., Sp. Pl. 3: 811. 1800; Masters in Fl. Brit. India 1: 338. 1874. *H. pruriens* Roxb. [Hort. Beng. 51. 1814, nom. nud.] ex Hornem., Hort. Hofn. 1: 79. 1815; Roxb., Fl. Ind. 3: 196. 1832. **Fig. 94.**

Mal.: *Malankuru parentthi*

Herbs or undershrubs, 2 - 4 m high; stems sparsely to densely stiff, shiny, tribrachiate, yellow stellate-hairy, ultimately becoming glabrescent. Leaves 1 - 15 x 0.5 - 19 cm, orbicular to ovate, rarely lanceolate, lower leaves 3 - 5-lobed, broadly cordate or rounded at base, acute to acuminate at apex, coarsely serrate to dentate, sparsely or densely simple and tribrachiate stellate-hairy on both surfaces; petioles 1 - 15 cm long, sparsely covered with tribrachiate stellate and soft, simple hairs; stipules 1.5 - 1.7 cm long, subulate, setaceous. Flowers axillary, solitary or in racemes by decrescence of upper leaves; pedicels 5 - 10 mm long, inarticulate, stout, densely stellate-hairy. Epicalyx segments 5 - 10, usually 5, 10 - 20 x 1 - 2 mm, linear to narrowly lanceolate, alternate with calyx lobes, minutely hairy or glabrescent, persistent. Corolla 6 - 10 mm across, yellow

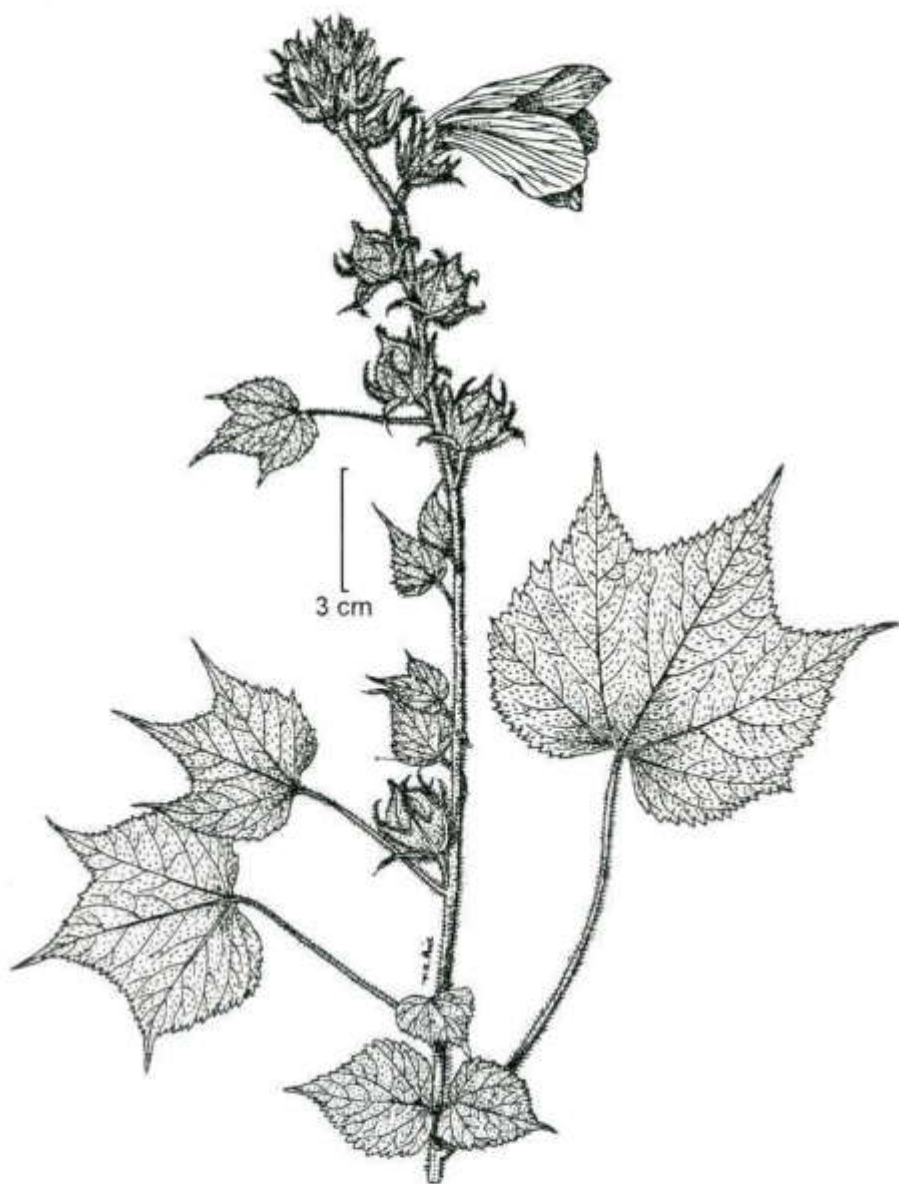


Fig. 94. *Hibiscus lunariifolius* Willd.

with a dark purple centre; petals stellate-pubescent outside, glabrous inside. Staminal column 1.5 - 3 cm long, nearly antheriferous throughout. Ovary 5 - 7 mm long, ovoid, oblong, pubescent. Capsules 2 - 2.5 x 1.5 - 1.8 cm, globose to obovoid with a rostrum of 3 - 5 mm, dehiscent into 5 valves, densely stellate-hairy outside, glabrous inside. Seeds numerous, 2 - 2.5 mm long, reniform, angular, sparsely covered with minute stellate hairs, black.

*Fl. & Fr.* Sept. - Nov.

*Distrib.* India: In dry deciduous, mixed and scrubby forests in open situations along streams. Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Tropical Africa, Myanmar and Malesia.

17. *Hibiscus obtusilobus* Garcke, Bot. Zeit. 7: 837. 1849. *H. punctatus* Dalz. in Dalz. & Gibs., Bombay Fl. 20. 1861; Masters in Fl. Brit. India 1: 340. 1874.

Annual, erect undershrubs, ca 1 m high; stems, petioles and pedicels stellate-hairy, glabrous. Leaves orbicular to ovate, unlobed or unequally 3-lobed to the middle of lamina, cordate and 5 - 7-nerved at base, lobes 2.5 - 10 x 1.5 - 6 cm, middle lobe longer, acute at apex, undulate-crenate, sparsely stellate-hairy on both surfaces; petioles 1 - 7.5 cm; stipules 4 - 8 mm long, linear, lanceolate. Flowers axillary, solitary or in subpanicles; pedicels 1.3 - 6.5 cm, jointed towards apex. Epicalyx segments 8 - 10, ca 5 mm long, linear, acute, connate at base. Calyx campanulate, lobes connate at base, ca 1 x 0.3 mm, deltoid-lanceolate, acuminate, densely stellate-tomentose, persistent. Corolla scarcely exceeding the calyx, white or pale pink. Capsules ca 1 cm long, beaked, dehiscent into 5 valves, densely stellate-pubescent outside, glossy inside. Seeds 2 mm across, reniform, mucicapped, black.

*Fl. & Fr.* Aug. - Dec.

*Distrib.* India: In dry deciduous and scrub forests, Punjab, Rajasthan, Gujarat and Maharashtra.

Pakistan and Tropical Africa.

*Notes.* Leaves eaten as a vegetable in Punjab.

#### Section 6. SOLANDRA (Murray) Hochr.

18. *Hibiscus lobatus* (Murray) O. Kuntze, Rev. Gen. Pl. 3, 2: 19. 1898; *Solandra lobata* Murray, Comm. Soc. Reg. Sc. Goetting 6: 20, t. 1. 1785. *Hibiscus solandra* L' Herit., Stirp. Nov. 1: 103, t. 49. 1788, nom. illeg.; Masters in Fl. Brit. India 1: 336. 1874

Fig. 95.



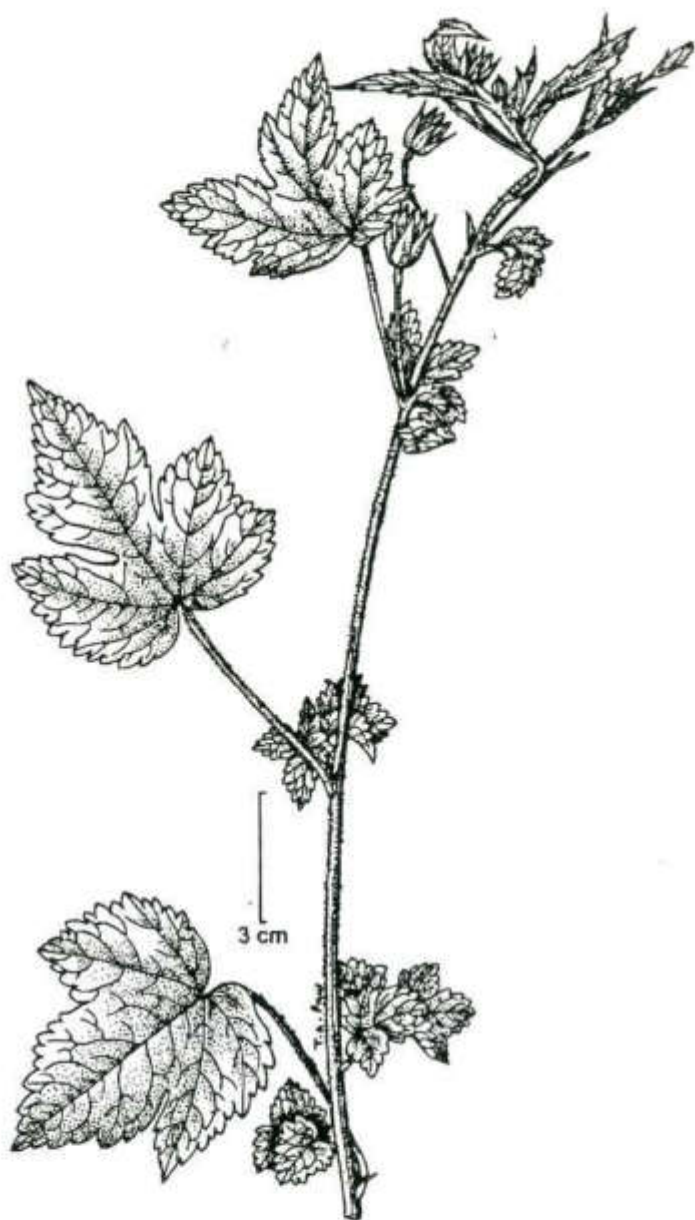


Fig. 95. *Hibiscus lobatus* (Murray) O. Kuntze.

Tel.: *Atakanara*

Annual, erect herbs, 30 - 100 cm high; stems pubescent with short simple hairs and rarely mixed with stellate hairs. Leaves 2 - 9 x 1.5 - 7.5 cm, upper leaves lanceolate to linear occasionally lyrate, cordate, rounded or truncate and 3 - 5-nerved at base, acute to acuminate at apex, lower leaves 3-lobed; lobes linear, lanceolate, ovate, deltoid or obovate, obtuse, acute to acuminate at apex, crenate or coarsely serrate, pubescent with simple and tribrachiate stellate hairs; petioles 2 - 9.5 cm long, adpressed with short simple hairs, rarely with stellate hairs; stipules 4 - 8 mm long, linear to filiform, simple hairy. Flowers axillary, solitary, rarely in terminal racemes by decrescence of upper leaves; pedicels 0.5 - 1 cm, accrescent up to 6 cm long with a joint ca 1 cm below flower. Epicalyx segments 6 - 8, ca 1 mm in bud, caducous before anthesis. Calyx campanulate to rotate, 5 - 8 mm across, 5-fid to 5-parted, lobes 5 - 10 x 1 - 2 mm, accrescent up to 1.2 x 0.3 cm, deltoid to lanceolate, acute, 3-nerved, densely hispid with simple and gland-tipped hairs outside, glabrous or nearly so inside. Corolla white or yellow, 1.3 - 1.8 cm in diam.; petals 10 - 15 x 6 - 10 mm, obovate, glabrous or nearly so. Staminal column ca 6 mm long, antheriferous throughout. Capsules 10 - 15 mm high, with 1 - 2 mm long rostrum, ovoid, simple and tribrachiate stellate-hairy outside, valves smooth inside, locules 3 - 4-seeded. Seeds ca 1.5 x 1.3 mm, tetragonous to globose, tubercled or verrucose, glabrous, black.

*Fl. & Fr.* July - Jan.

*Distrib.* India: Almost throughout up to 1500 m.

Tropical Asia, Tropical Africa, Madagascar and adjacent Islands.

#### Section 7. SPATULA Hochr.

19. *Hibiscus platanifolius* (Willd.) Sweet, Hort. Brit. 2: 51. 1827. *Pavonia platanifolia* Willd. in Ges. Naturf. Freunde Berlin Mag. Neuesten 4: 220. 1810. *Hibiscus collinus* Roxb., Fl. Ind. 3: 199. 1832; Masters in Fl. Brit. India 1: 338. 1874.

Tel.: *Kandagang*.

Small trees or shrubs up to 5 m tall, ascendingly much branched, branchlets pubescent; bark greenish, glabrous. Leaves 8 - 15 cm long and about as much broad, cordate and 5 - 7-nerved at base, palmately 3 - 5-lobed with a semicircular furrow between lobes, lobes elliptical, acute to acuminate at apex, entire or irregularly toothed, densely stellate-pubescent particularly on veins beneath, sparsely stellate-pilose above; petioles 2.5 - 11 cm long, tomentose; stipules 5 - 10 mm long, linear-lanceolate. Flowers axillary, solitary; pedicels 2 - 11 cm long, jointed near apex, hairy. Epicalyx segments 5, 8 or 10, connate at base, 12 - 18 mm long, lanceolate, acuminate, stellate-pubescent. Calyx 5-lobed, lobes connate at base, 2 - 3.2 x 0.6 - 0.9 cm, ovate, oblong or lanceolate,

acute with one prominent vein, pubescent. Corolla pink with deep purple centre, occasionally yellow; petals 4-6 x 3-4 cm, hairy outside, glabrous inside, parallel veined. Staminal column 2-2.5 cm long, antheriferous throughout; filaments 2-4 mm long; styles hairy; stigmas capitate. Capsules 2-3.5 cm long and as much broad, depressed globose, shortly beaked, woody, yellow tomentose and densely setose, valves glossy inside. Seeds 4-5 mm long, subspherical, glabrous, brownish.

*Fl. & Fr.* Aug. - April.

*Distrib.* India: In tropical deciduous and evergreen forests up to 600 m, West Bengal, Orissa, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka and Nepal.

*Notes.* This species can be easily recognised by its bushy tree habit, foliaceous epicalyx and 5-angled capsules with glabrous seeds. Sometimes cultivated as an ornamental for its showy flowers. Bark yields strong fibres used for cordage.

#### Section 8. TRICHOSPERMUM Hochr.

**20. *Hibiscus palmatus*** Forsskal, Fl. Aegypt.-Arab. 126. 1775. *H. intermedius* A. Rich., Tent. Fl. Abyss. 1: 58. 1847; Masters in Fl. Brit. India 1: 336. 1874.

Annual, semierect or prostrate herbs, stems pubescent with retrose simple and stellate hairs along with a line of short whitish shiny hairs. Leaves polymorphic, cordate or truncate at base, 3-7-palmatilobed, lobes 2-5 x 0.3-0.8 cm, narrowly lanceolate to linear, irregularly dentate, glabrescent above, sparsely simple hairy beneath; petioles 1.5-5 cm long, pubescent. Flowers axillary, solitary; pedicels shorter than petioles, jointed near base. Epicalyx segments 10, shorter or slightly longer than calyx, linear to strap-shaped, hairy. Calyx campanulate, lobes connate at base, 8-12 x 3-5 mm, lanceolate, prominently 3-nerved, hispid on nerves and margin. Corolla yellow with purple centre, ca 2.5 cm across. Staminal column ca 5 mm long, antheriferous towards tip. Capsules ca 1 cm long, enclosed within calyx, beak ca 2.5 mm long, hispid, slightly winged along edges. Seeds 2-3 mm, reniform, with adpressed shiny hairs, black.

*Fl. & Fr.* Aug. - Nov.

*Distrib.* India: Rajasthan and Gujarat.

Pakistan, Arabia and Tropical Africa.

**21. *Hibiscus panduraeformis*** Burm. f., Fl. Ind. 151, t. 47, f. 2. 1768; Masters in Fl. Brit. India 1: 338. 1874. *H. tubulosus* Cav., Diss. 3: 161, t. 68 f. 2. 1787, nom. superfl.; Roxb., Fl. Ind. 3: 196. 1832. *H. panduriformis* Burm. f. var. *tubulosus* (Cav.) Hochr. in

Ann. Cons. Jard. Bot. Geneve 4: 96. 1900.

Annual or perennial herbs or undershrubs, 1 - 4 m high; stems stout, stellate-velutinous to tomentose, generally with large, stiff shiny prickly stellate hairs (hairs 3 - 5 mm long) often mixed with short simple hairs. Leaves 2 - 15 x 0.5 - 10 cm, lower ones ovate-cordate, palmilobed with deltoid-acuminate segments, upper leaves oblong-lanceolate, coarsely serrate, 5 - 9-nerved at base, stellate-velutinous above, cinereously stellate-velutinous to tomentose beneath; petioles 1 - 15 cm long, stellate-velutinous with prickly hairs; stipules ca 5 mm long, 2 - 3-parted with filiform segments, deciduous. Flowers axillary, solitary, often in terminal racemes by decrescence of upper leaves; pedicels 5 - 15 mm long, accrescent up to 5 cm, stellate-velutinous to tomentose, jointed near apex. Epicalyx segments 6 - 10, shorter than calyx, segments shortly connate at base, spatulate, obtuse, stellate-velutinous, persistent. Calyx campanulate, 5-lobed, lobes free up to the middle, 15 - 20 x 3 - 5 mm, ovate, obtuse, 3-nerved, stellate-velutinous outside, sericeous inside except for glabrescent basal portion. Corolla yellow with dark purple centre; petals 15 - 30 x 25 mm, obovate, rounded at apex, stellate-tomentose outside, white glandular hairy inside. Staminal column 10 - 15 mm long, dark purple, antheriferous throughout. Ovary 7 - 9 mm long, ovoid, 5-locular, hairy; style arms 3 - 5 mm long, purple; stigmas capitate. Capsules ovoid to globose, acute to acuminate enclosed within persistent calyx, hirsute by simple and stellate hairs, smooth and shiny inside. Seeds 2 - 2.5 mm long, reniform, angular, concentrically ribbed, densely hairy or glabrous, brown.

*Fl. & Fr.* Oct. - Jan.

*Distrib.* India: In deciduous and scrub forests especially near streams and ponds up to 900 m. Throughout.

Sri Lanka, Tropical Africa, Myanmar, Indonesia (Java) and Australia.

**22. *Hibiscus purpureus*** Forsskal, Fl. Aegypt.-Arab. 126. 1775. *H. calyphyllus* Cav., Diss. 5: 283, t. 140, 1788; Rakshit & Kundu in Bull. Bot. Surv. India 12: 172. 1972. *H. canescens* Heyne [in Wallich Cat. No. 2698. 1828, nom. nud.] ex Wight & Arn., Prodr. 49. 1834; Masters in Fl. Brit. India 1: 337. 1874.

Shrubs; stems, glabrous. Leaves 6 - 15 x 4.5 - 11 cm, ovate, cordate at base, acute to acuminate at apex, irregularly dentate, 7-nerved at base, stellate-pubescent on both surfaces, densely so beneath; petioles stellate-pubescent; stipules 7 - 12 mm long, linear, setaceous, sparsely pubescent. Flowers axillary, solitary; pedicels 1 - 1.5 cm long, pubescent. Epicalyx segments 5, 2 - 2.5 cm long, linear-lanceolate, stellate-pubescent on both surfaces. Calyx lobes connate up to the middle, equalling or slightly shorter than epicalyx, ovate to triangular, long acuminate, 3-nerved, stellate-pubescent outside, except along margin, glabrous inside. Corolla yellow with purple centre, 3 - 7 cm across; petals hairy outside, glabrous inside. Capsules 2.5 - 4 cm long, oblong, villous, aristate.

Seeds ca 3 mm long, tomentose.

*Fl. & Fr.* Jan. - Feb.

*Distrib.* India: In deciduous and mixed forests up to 300 m. Karnataka and Tamil Nadu.

Sri Lanka, Madagascar and Africa.

#### Section 9. TRIONUM DC.

**23. *Hibiscus trionum* L., Sp. Pl. 697. 1753; Masters in Fl. Brit. India 1: 334. 1874.**

Annual, erect or decumbent herbs, 30 - 60 cm, high; stems simple hairy mixed with few stellate hairs. Leaves 2.5 - 7.5 cm long, lower ones orbicular, lobed or unlobed, upper ones palmately 3 - 5-lobed, middle lobe longer, oblong, pinnatisect, punctate, sparsely simple and stellate-hairy on both surfaces, densely so on lower surface, upper surface rarely glabrous; petioles 2 - 5 cm long, pubescent by simple and di- or tribrachiate stellate hairs; stipules subulate, covered with long stiff hairs. Flowers axillary, solitary; pedicels 1 - 4 cm long, jointed above middle, pubescent. Epicalyx segments 8 - 12, 10 - 15 x 1 - 1.5 mm, linear, 3-nerved, ciliate with long simple hairs, segments spreading upwards surrounding the capsules. Calyx campanulate, inflated covering capsule, lobes 1 - 2.5 cm long, broadly ovate, acute, membranous, prominently 4 - 6-nerved, nerves hispid outside, simple hairy inside, nerves green initially, ultimately becoming purple. Corolla yellowish pink with dark purple centre; 1 - 2.5 cm across; petals 1.5 - 2 x 0.5 cm, sparsely stellate-hairy outside, glabrous inside. Staminal column 5 - 8 mm long, antheriferous towards tip. Ovary ovate, densely hairy; styles 5, connate up to middle. Capsules 0.5 - 2 x 1 - 1.5 cm, ovoid-oblong, obtuse, dehisces longitudinally from tip, hairy outside, glossy inside. Seeds ca 2 mm across, reniform, minutely tuberculate or glabrate.

*Fl. & Fr.* July - Jan.

*Distrib.* India: Throughout in subtropical and tropical forests up to 3000 m, often as a weed in cultivated fields.

Myanmar, China, Australia, Pakistan, Afghanistan, C.I.S., Europe and Africa.

*Notes.* An infusion of flowers is used for treating itching and some painful skin diseases. The extract of the plant is used as wormicide for round worm in South Africa. It is reported to be poisonous to live stock particularly horses.

## 12. *Julostylis* Thwaites

Trees; branchlets stellate-tomentose. Flowers large, in lax panicles. Epicalyx segments connate at base. Sepals 5, connate at base. Petals 5, slightly connate at base and adnate to staminal column; Staminal column 5-toothed at apex. Ovary 2-locular; styles 2, connate at base. Fruit indehiscent, enclosed in enlarged epicalyx and calyx. Seeds oblong.

Confined to India and Sri Lanka, 2 species, both occur in India.

### KEY TO THE SPECIES

- 1a. Leaves lanceolate; epicalyx segments 4, ovate with rounded base; staminal column with 10 anthers  
**1. *J. angustifolia***
- b. Leaves suborbiculate or ovate; epicalyx segments 4 - 6, triangular-ovate with cordate base; staminal column with 17 - 20 anthers  
**2. *J. polyandra***

**1. *Julostylis angustifolia*** (Arn.) Thwaites, Enum. Pl. Zeyl. 30. 1858; Masters in Fl. Erit. India 1: 333. 1874; K. Ramam. & Rajan in J. Econ. Tax. Bot. 7: 728. 1985. *Kydia angustifolia* Arn. in Nov. Act. 18: 1. 322. 1836.

Small trees; branchlets stellate-pubescent. Leaves 5 - 16 x 1 - 7 cm lanceolate, rounded at base, tapering to obtuse at apex, entire, 3-nerved at base, sparsely stellate-pubescent on both surfaces, densely so on lower surface; petioles 5 - 10 mm, pubescent. Flowers in axillary and terminal panicles; pedicels 3 - 5 mm long, stellate-pubescent. Epicalyx segments 5, connate at base, 4 - 6 x 3 mm, accrescent in fruit up to 10 x 6 mm, ovate, acute, pubescent on both surfaces. Sepals 5, ovate-acute, connate at base, shorter than epicalyx, pubescent. Petals 5, connate at base, oblong, longer than sepals, stellate-hairy outside. Staminal column antheriferous towards base, 5-toothed above; anthers 10 on long filaments. Ovary 2-loculed with 2 ovules in each locule, stellate-hairy; styles 2, connate at base, densely stellate-hairy; stigmas globose, woolly. Fruit 5 - 10 mm across, globular, indehiscent, densely tomentose. Seeds oblong.

*Fl. & Fr.* Oct. - Jan.

*Distrib.* India: Kerala.

Sri Lanka.

**2. *Julostylis polyandra*** Ravi & Anil Kumar in J. Bombay Nat. Hist. Soc. 87: 260. 1990.

Small trees; branchlets rusty stellate-tomentose. Leaves 4 - 21 x 2 - 18 cm, suborbicular to ovate. Often palmately 3-angled or lobed, cordate at base, tapering to obtuse at apex, subentire, palmately 5-nerved at base with elongated nectary on central nerve beneath. sparsely stellate-tomentose on both surfaces; petioles 1 - 8 cm long, terete, tomentose. Flowers in a congested pyramidal panicle; pedicels up to 1.5 cm long; bracts 3 x 1 mm, elliptic-oblong, rusty tomentose outside; bracteoles shorter than bracts, obovate, tomentose outside. Epicalyx 4 - 6, slightly connate at base, ca 15 x 8 mm, segments triangular-ovate, subcordate at base, acute to subacute at apex, pubescent, ultimately spreading. Sepals connate up to the middle, lobes 8 - 10 x 5 - 6 mm, triangular, subacute, 3-nerved. Petals 5, free, 1.5 - 2.0 x 1 cm, narrowly obovate, stellate-pubescent outside. Staminal column 5 - 7 mm long, 5-toothed at apex, acicular; stamens 20, rarely 17 - 19, ovary ca 2 mm long, bilocular with 2 ovules in each locule; styles 1.5 cm long branched or rarely unbranched; stigmas peltate, thickened. Fruits ca 5 x 6 mm, shortly beaked, indehiscent with stellate and simple hairs. Seeds ca 4 mm long, reniform, stellate-hairy.

*Fl. & Fr.* Aug. - Jan.

*Distrib.* India: Tropical evergreen forests of Western Ghats. Kerala.

*Notes.* So far known only by two collections from Quilon and Trivandrum districts of Kerala.

### 13. *Kydia* Roxb.

Trees; bark mucilaginous; branchlets stellate-pubescent. Leaves palminerved, lobed or angled with nectaries on the veins beneath. Flowers polygamous in axillary or terminal panicles. Epicalyx segments 4 - 6, foliaceous, connate at base, accrescent and spreading in fruit, persistent. Calyx 5-fid. Petals 5, obcordate, adnate to staminal tube at base. Staminal column branched distally into 5 arms, each tipped by a cluster of 4 - 6 connate, reniform anthers. Ovary abortive with a short style in male flowers. In female flowers branches of staminal column short with imperfect anthers. Ovary trilocular with 2 - 3 ovules in each locule; styles 3 with peltate stigmas. Capsules subglobose, depressed, mucous; loculicidally 3-valved. Seeds reniform, furrowed, ascending.

Predominantly in tropical and subtropical regions of India, Pakistan, Nepal, Bhutan, China, Myanmar and Brazil, 4 species; 2 in India.

#### KEY TO THE SPECIES

- 1a. Leaves stellate-pubescent beneath; epicalyx segments oblong or obovate, stellate-pubescent on both surfaces

**1. *K. calycina***

b. Leaves glabrate; epicalyx segments oblanceolate, glabrous

2. *K. glabrescens*

1. *Kydia calycina* Roxb., [Hort. Beng. 50. 1814, nom. nud.] Pl. Corom. 3: 11, t. 215. 1819 & Fl. Ind. 3: 188. 1832; Masters in Fl. Brit. India 1: 348. 1874. *K. fraterna* Roxb., Pl. Corom. 3: 12, t. 216. 1819. *K. roxburghiana* Wight, Icon. Pl. Ind. Orient. 3: t. 881. 1844.

Beng.: *Pola*, *Bonkopas*; Guj.: *Mhotihirwani*; Mal.: *Velukku*; Mar.: *Warung*, *Bhoti*, *Potari*; Or.: *Bankopasia*; Tam.: *Vendai*; Tel.: *Potri*;

Trees, 15 - 20 m tall; young stems and branches densely pubescent with minute greyish stellate hairs. Leaves 4-12 x 3.5-15 cm, suborbicular or ovate-rounded, rounded or subcordate at base, acute or obtuse at apex, entire or irregularly serrate, more or less tri- or penta-cuspidate, uniformly stellate-hispid above, greyish stellate-pubescent beneath, 5-9-nerved at base; petioles 2-7 cm long, densely stellate-pubescent; stipules subulate. Flowers polygamous, in axillary or terminal panicles; pedicels 0.5-1.5 cm long, densely stellate-pubescent. Epicalyx segments 4-6, connate at base, 4-15 x 5-7 mm, oblong-spathulate or obovate, ultimately spreading, minutely stellate-pubescent on both surfaces, persistent. Calyx cup-shaped, connate at base, lobes 5 x 4 mm, ovate acute, stellate-pubescent on both surfaces, persistent. Corolla white or pink, ca 1.7 cm across; petals longer than calyx but shorter than epicalyx, obcordate, obliquely adnate at base to staminal column, hairy at base. Staminal column ca 3 mm long, pistilode absent in male flower. Ovary ovoid, trilobular with 2-3 ovules in each locule. Capsule 5 mm across, subglobose, hard, depressed. Seeds ca 3 x 2 mm, more or less reniform-ellipsoid, glabrous, glandular striate, brown.

Fl. Sept. - Nov.; Fr. Nov. - Feb.

*Distrib.* India: In subtropical evergreen forests from 600 to 1200 m. Throughout.

Pakistan, Nepal, Bhutan, Myanmar and China.

*Notes.* Wood used in building construction, making of match boxes, splints and light packing cases. Inner bark yields a fibre used locally for making coarse ropes.

2. *Kydia glabrescens* Masters in Fl. Brit. India 1: 348. 1874.

Asm.: *Kukuha*.

Trees, ca 30 m tall with short spreading branches; trunk ca 1.5 m in diam.; branchlets sparsely stellate-pubescent initially, ultimately becoming glabrescent. Leaves 5-12 x 4-10 cm, suborbicular, ovate or obovate, cuneate, obtuse, rounded or shallowly cordate at base, rounded or slightly acute to acuminate at apex, semicrenate, sparsely stellate-pubescent above, glabrous beneath, 7-9-nerved at base with elliptical nectaries on



central 1 - 3 nerves; petioles 2 - 6 cm long, stellate-pubescent; stipules 6 - 10 x 5 - 7 mm, foliaceous, deciduous, stellate-pilose on both surfaces. Flowers in axillary or terminal panicles; pedicels 0.5 - 1.5 cm long, stellate-pubescent. Epicalyx segments 4, 5 - 7 x 1.5 - 2 mm, spreading and accrescent up to 15 x 5 mm in fruit, oblanceolate, glabrous, persistent. Calyx cup-shaped, lobes ovate, acute, connate up to middle with a distinct midvein in each lobe, glabrous outside, densely appressed stellate-hairy inside. Corolla white, ca 1 cm across, deciduous; petals ca 6 x 5 mm, ovate, glabrous, ciliate. Capsules ca 6 mm across, globose, 3-loculed with 2 seeds in each locule; seeds ca 3 x 2 mm, reniform, glabrous, striated, brownish.

*Fl.* Sept. - Oct.; *Fr.* Oct. - Jan.

*Distrib.* India: In subtropical evergreen forests 600 to 1200 m. Assam, Meghalaya, Arunachal Pradesh and Tripura.

Bhutan and China.

#### 14. *Nayariophyton* T.K. Paul

Trees; indumentum stellate. Leaves ovate or suborbicular, entire or shallowly 3-lobed. Flowers axillary, solitary or in short panicles. Epicalyx segments 4 - 6, lanceolate-oblong, shortly connate at base, spreading. Calyx 5-lobed, connate up to the middle. Petals 5, oblong. Staminal column 8 - 10 mm long, stamens numerous. Ovary globose, bilocular; styles 2-branched; stigmas rugose-capitate. Fruit subglobose, indehiscent, hairy. Seed one in each locule.

Monotypic genus distributed in India, Bhutan, Myanmar and China (Yunnan).

*Nayariophyton zizyphifolium* (Griffith) Long & A. G. Miller in *Edinburgh J. Bot.* 47: 357. 1990. *Kydia zizyphifolium* Griffith, *Itin. Notes* 108. 1848. *K. jujubifolia* Griffith, *Not. Pl. Asiat.* 4: 534. 1854; *Dicellostyles jujubifolia* (Griffith) Benth. in Benth. & Hook. f., *Gen. Pl.* 1: 207. 1862; Masters in *Fl. Brit. India* 1: 333. 1874. *Nayariophyton jujubifolium* (Griffith) T. K. Paul in *Fasc. Fl. India* 19: 185. 1988, ortho. Fig. 96.

Trees, ca 5 - 8 m high; branchlets greyish pubescent with stellate hairs. Leaves 7 - 15 x 4 - 9 cm, ovate or suborbicular, subcordate or rounded at base, acute to acuminate at apex, entire or shallowly 3-lobed, sparsely pubescent or glabrous above, densely pilose beneath, 5 - 7-nerved at base; petioles 1 - 3 cm long, pubescent; stipules subulate. Flowers axillary, solitary or 2 - 5 in short panicles; pedicels 5 - 15 mm long, pubescent. Epicalyx segments 4 - 6, 10 - 15 x 5 mm accrescent, oblong-lanceolate, rounded at apex conspicuously striate and reticulate, sparsely pubescent above, velutinous beneath, persistent. Calyx lobes 10 - 15 x 5 mm, triangular, connate up to the middle, hairy. Corolla white, ca 2.5 cm across; petals 5, 1 - 2.5 x 1 - 1.5 cm, oblong, densely pubescent outside, simple and stellate-hairy at base inside. Staminal column 8 - 10 mm long, hairy;

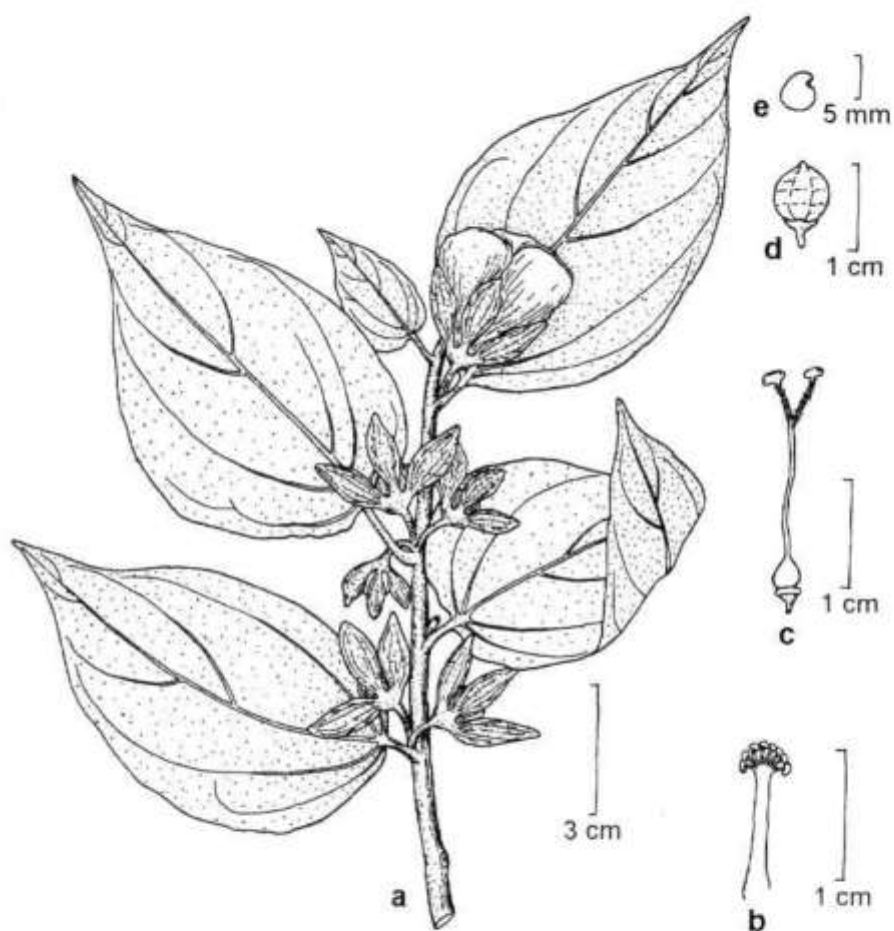


Fig. 96. *Nayariophyton ziziphifolium* (Griffith) Long & A.G. Miller: a. flowering part of branch; b. androecium; c. pistil; d. fruit; e. seed.

stamens numerous; anthers reniform. Ovary globose, 2-locular; styles ca 2.5 cm long, 2-branched, each branch ca 0.5 cm long, densely hairy; stigmas rugose-capitate. Capsules ca 8 mm across, subglobose, shortly rostellate, densely hairy, 2-loculed with one seed in each locule, indehiscent. Seeds ca 4 x 3 mm, reniform, glabrous.

*Fl. & Fr.* May - Oct.

*Distrib.* India: Eastern Himalayas and North eastern region in tropical and subtropical forests between 300 and 2200 m. West Bengal (Darjeeling) Sikkim, Meghalaya, Manipur and Mizoram.

Bhutan, Myanmar and China(Yunnan).

### 15. *Senra* Cav.

Undershrubs or shrubs, soft brownish pubescent. Leaves orbicular, cordate at base. Flowers axillary, solitary, shortly pedicelled. Epicalyx segments 3, free, large, cordate, membranous at maturity. Calyx 5-fid. Corolla deep purple, violet or rarely yellow; petals 5. Staminal column 5-toothed at apex, antheriferous just below the apex. Ovary 5-locular, ovule 2 in each locule; styles 5. Capsules 5-valved, loculicidally dehiscent, wrinkled, pubescent or villous. Seed one in each locule, reniform, ascending, pubescent or villous.

Africa, Arabia, and S. Asia, 3 species; one in India.

*Senra incana* Cav., Diss. 2: 83, t. 35, f. 3. 1786; Masters in Fl. Brit. India 1: 334. 1874

**Fig. 97.**

Erect or climbing herbs or undershrubs, pubescent. Leaves 1.5 - 3.5 x 2 - 3 cm, orbicular or more or less deeply 3-lobed, lobes deltoid, deeply cordate at base, acute at apex, entire, stellate-pubescent on both surfaces; petioles 1.5 - 3.5 cm long; stipules ca 2 mm long, filiform. Flowers axillary, solitary or rarely clustered towards tips of branches; pedicels 0.5 - 1.5 cm long. Epicalyx segments 1.5 - 2.5 x 1.5 - 2.5 cm, reticulately veined. Calyx ca 5 mm across, campanulate, lobes 1.5 - 2 mm long, triangular, acute. Petals violet or rarely yellow, 1.5 - 3 x 1 - 1.5 cm, obovate. Staminal column 8 - 15 mm long. Capsules ca 5.5 x 4.5 mm, ovoid, reticulate, ribbed, valves slightly winged, papery. Seeds ca 2 x 1 mm, reniform, pubescent, brown.

*Fl. & Fr.* Nov. - April.

*Distrib.* India: Coastal areas of Gujarat(Kutch district).

Pakistan, Arabia and E. Africa.

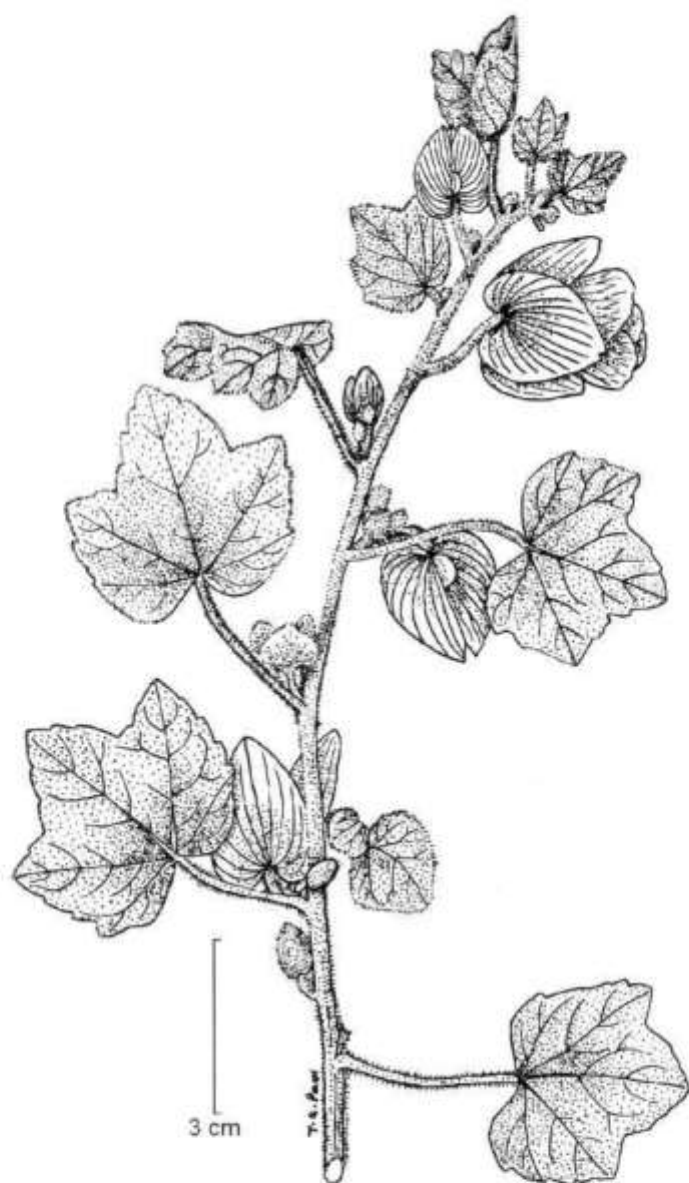


Fig. 97. *Senra incana* Cav.

### 16. *Thespesia* Sol. ex Correa, nom. cons.

Trees or shrubs; branchlets with an indumentum of scales or stellate hairs. Leaves simple, entire or palmilobed, often with extrafloral nectaries, palmately veined; stipules early caducous. Flowers solitary, axillary or in racemes by reduction of upper leaves; pedicels generally articulate, thickened at apex into a hypanthium. Epicalyx segments 3 or 6, free, caducous. Calyx cyathiform, nearly truncate, remotely denticulate, persistent. Corolla large, showy, mostly yellow with a dark purple centre. Staminal column shorter than petals, cylindrical, antheriferous throughout. Ovary 5-loculed or 10 by 5 false dissepiments; style unbranched; stigma clavate, 5-sulcate or rarely 5-lobed. Capsules globose or pyriform, indehiscent or partly dehiscent or loculicidal; pericarp woody. Seeds 3-many in each locule, obovoid, glabrous, pubescent or tomentose.

In tropical and subtropical regions of the World, ca 18 species; 4 in India.

#### KEY TO THE SPECIES

- |   |                                  |
|---|----------------------------------|
| 1a. Leaves with a linear nectary on midrib beneath, 3 - 5-lobed, densely stellate-hairy; seeds 8 - 15 in each locule; shrubs up to 2.5 m high   | <b>2. <i>T. lampas</i></b>       |
| b. Leaves without nectaries on midrib beneath, not lobed, lepidote; seeds 2 - 4 in each locule; shrubs or trees, 3 - 10 m high  | 2                                |
| 2a. Epicalyx segments early caducous; capsules without any acumen   | 3                                |
| b. Epicalyx segments persistent; capsules with a short acumen   | <b>1. <i>T. danis</i></b>        |
| 3a. Leaves deeply cordate, green; pedicels 2 - 5 cm long; jointed near base; capsules indehiscent; seeds covered with simple hairs  | <b>3. <i>T. populnea</i></b>     |
| b. Leaves shallowly cordate or subtruncate; copper coloured; pedicels 8 - 12 cm long, not jointed; outer layer of capsules dehiscent; seeds covered with short clavate or bulbous hairs | <b>4. <i>T. populneoides</i></b> |

**1. *Thespesia danis*** Oliver in Hook., Icon. Pl. t. 1336. 1881; T.K. Paul & Nayar in J. Econ. Tax. Bot. 3: 655. 1982.

Large shrubs or trees; young stems and branchlets densely lepidote. Leaves 3 - 5 x 4.5 - 7 cm, almost roundish or ovate, obtuse or subacute at apex, broadly cordate at base, entire, sparsely lepidote on both surfaces; 5 - 7-nerved at base; petioles 3 - 5 cm long, densely lepidote. Flowers solitary, axillary; pedicels 1.5 - 2 cm long, slightly thickened at base, densely lepidote. Epicalyx segments 3, 3 - 7 x 1.5 - 2 mm, lanceolate, lepidote, persistent. Calyx 6 - 10 x 8 - 10 mm, cupular, with 5 minute teeth or entire, lepidote outside. Corolla campanulate; petals 5, ca 2 x 1.5 cm, obliquely obovate, cuneate at base, rounded at apex, lepidote outside, glabrous inside. Staminal column included, antheriferous throughout. Ovary globose to ovoid; stigma clavate. Capsules ca 1.5 x 1.2 cm, globose with a short acumen at tip.

*Fl. & Fr.* May - June.

*Distrib.* India: Tamil Nadu.

Tropical Africa.

**2. *Thespesia lampas* (Cav.) Dalz. & Gibs.** Bombay Fl. 19. 1861; Masters in Fl. Brit. India 1: 345. 1874. *Hibiscus lampas* Cav. Diss. 3: 154, t. 56, f. 2. 1787. *Azanza lampas* (Cav.) Alef. in Bot. Zeit. 19: 298. 1861. *Pariti gangeticum* G. Don, Gen. Hist. 1: 485. 1831. *Hibiscus tetralocularis* Roxb., Fl. Ind. 3: 198. 1832. **Fig. 98.**

*Asm.:* *Bon kapas*; *Beng.:* *Bankapas*; *Guj.:* *Jangliparaspiplo*; *Kan.:* *Turuve*; *Mal.:* *Kattuparatti, Katupa varasu*; *Mar.:* *Ranbhendi*; *Tel.:* *Adavipratti, Kondapratti*.

Arborescent shrubs, 0.5 - 2.5 m high; twigs densely tomentose with stellate-hairs, ultimately glabrescent. Leaves 6 - 12 cm across, orbicular, 3 - 5-lobed, lobes deltoid, cordate at base, acuminate, acute or rarely obtuse at apex; upper leaves 5 - 12 x 2 - 22 cm, ovate to oblong, shallowly cordate to rounded at base, entire, membranous to subcoriaceous, 5 - 7-nerved at base with a 3 - 5 mm long, linear nectary at base on midrib beneath, densely stellate-tomentose beneath, sparsely covered with stellate and short simple hairs above; petioles 1 - 12 cm long, densely hairy; stipules 5 - 8 mm, lanceolate to subulate, stellate-hairy. Flowers solitary, axillary or 1 - 5 in long stalked racemes by reduction of upper leaves; pedicels 3 - 7 mm, slightly accrescent, sulcate, jointed above middle; hypanthium 2 - 6.5 x 4 - 6 mm, obconical. Epicalyx segments 5, free, 2 - 3 x 0.5 mm, usually subulate, minutely hairy, caducous. Calyx ca 5 mm long, cupular, with 5 small subulate to deltoid segments, densely stellate-hairy outside, ultimately glabrescent, stellate hairy on segments inside and with a ring of short hairs at base. Corolla yellow with dark purple centre, campanulate; petals ca 6 x 4 cm, obovate, rounded at apex, with scattered stellate and gland-tipped hairs outside, glabrous, inside. Staminal column 1 - 2 cm long, glabrous. Ovary ca 8 mm in diam., conical, acuminate, densely hairy. Capsules 2 - 3 x 1.5 - 2 cm, ovoid to globose, minutely stellate-hairy becoming glabrescent, dehiscent into 5 valves, valves thick, woody, stellate-hairy on nerves inside. Seeds 8 - 15 in each locule, 5 mm long, obovoid, angular, more or less densely appressed, short, simple hairy, glabrescent, black.

*Fl. & Fr.* Aug. - Dec.

*Notes.* It can easily be distinguished from *T. populnea* (L.) Sol. ex Correa by its shrubby habit, 3-lobed leaves with nectary on midrib beneath and dehiscent capsule.

The roots and fruits are reported to be used for treating gonorrhoea and Syphilis.

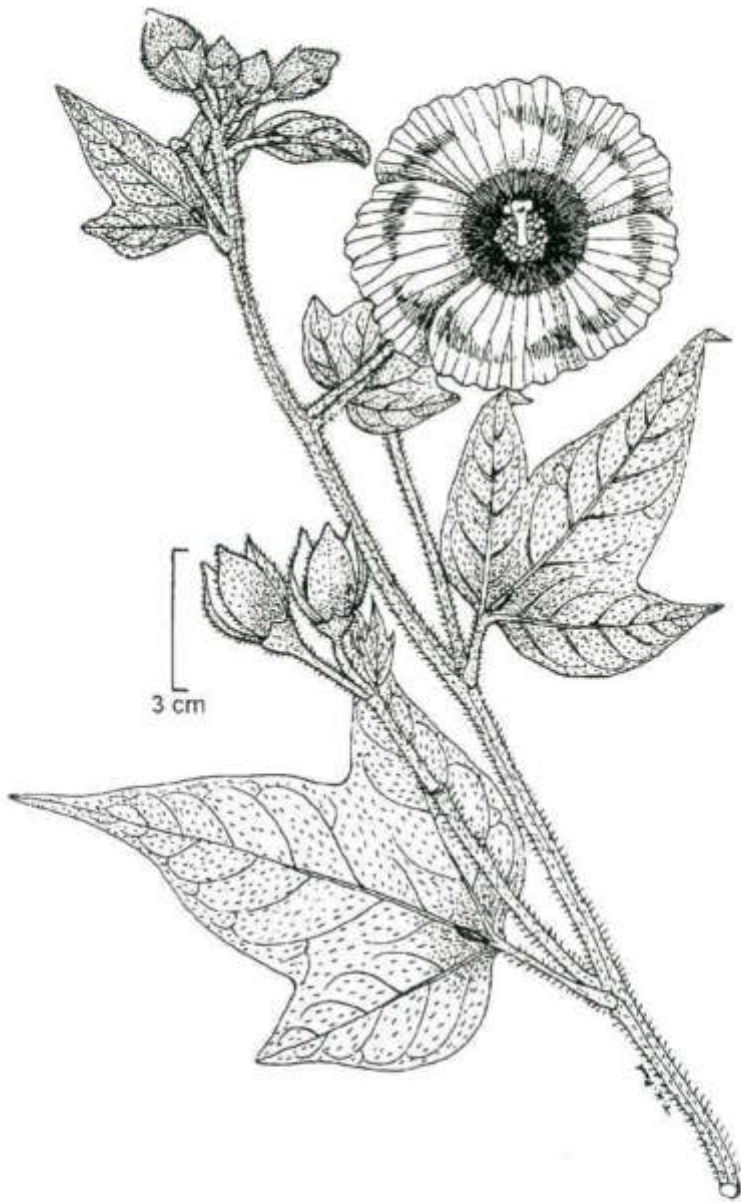


Fig. 98. *Thespesia lampas* (Cav.) Dalz. & Gibs.

## KEY TO THE VARIETIES

- 1a. Calyx lobes 1 - 3 mm long, subulate to triangular 2.1. var. *lampas*  
 b. Calyx lobes 8 - 15 mm long, triangular to linear-triangular 2.2. var. *longisepala*

**2.1. var. *lampas***

*Distrib.* India: Throughout in evergreen forests particularly on edges.

Tropical E. Africa and S. & S.E. Asia.

**2.2. var. *longisepala*** Borss. in Blume 14: 118. 1966; Anand Kumar in J. Econ. Tax. Bot. 7: 665. 1985.

*Distrib.* India: Uttar Pradesh, Orissa, Assam and Meghalaya.

Malesia.

**3. *Thespesia populnea*** (L.) Sol. ex Correa in Ann. Mus. Herb. Paris 9: 290, t. 8 f. 1. 1807; Masters in Fl. Brit. India 1: 345. 1874. *Hibiscus populneus* L., Sp. Pl. 694. 1753. *Thespesia macrophylla* Blume, Bijdr. 2: 73. 1825.

Beng.: *Dumbila, Parespipal, Palaopipal, Gajashuni*; Guj.: *Parasapupala*; Kan.: *Hoovarase, Kandarola, Adavibendi, Jogiyarala*; Mal.: *Poovarasu*; Mar.: *Paravhahada, Bendika Jhar*; Or.: *Gunjausto, Porosopipoli*; Punj.: *Paraspipal*; Sans.: *Gardha-bhanda*; Tam.: *Poovarasam kallaql, Cheelanthi*; Tel.: *Gangaraavi, Muni gangaraavi, Gangareenu*.

Trees, 5 - 10 m tall; twigs densely covered with minute scales, glabrescent. Leaves 5 - 20 x 5.5 - 15 cm, orbicular, deltoid, ovate or oblong, deeply cordate at base, acute to acuminate at apex, entire, 7-nerved at base, domatia present, in between the bases of main veins beneath, when young brown or bronze green by densely covered scales, glabrescent; petioles 5 - 15 cm long, scaly; stipules 4 - 10 mm long, lanceolate to linear, acute, caducous. Flowers solitary, axillary; pedicels 2 - 5 cm long, slightly accrescent, erect or ascending, jointed near base, glabrescent. Epicalyx segments 3, 5 - 15 x 2 - 3 mm, oblong to lanceolate, acute, subcoriaceous, densely scaly, caducous. Calyx 8 - 12 mm high and ca 1.8 cm in diam., cupular, coriaceous, accrescent and flattened in fruit, scaly outside, densely sericeous by simple hairs inside. Corolla light yellow with dark purple centre, ultimately reddish, broadly campanulate; petals 5 - 7.5 x 4 - 6 cm, obliquely obovate, narrowed and fleshy at base, rounded at apex, densely scaly, outside, glabrous inside, ciliate at base. Staminal column 1.5 - 2.5 cm long. Ovary 6 - 8 mm in diam., globose to ovoid, scaly, 10-locular, ovules 4 in each locule; styles ca 3 cm long; stigmas



connate to a clavate 5-sulcate body. Capsules 2 - 3.5 cm across, globose, obtuse or slightly depressed often with a short mucro at apex, at first scaly becoming glabrescent, irregularly crumpled at maturity, indehiscent. Seeds 6 - 10 x 5 - 8 mm, obovoid, angular, acute to shortly acuminate at base, rounded at apex, covered with yellowish-brown, long, simple hairs, densely so on angles, veined.

*Fl. & Fr.* Aug. - Jan.

*Distrib.* India: Throughout in coastal regions; often cultivated in interior areas.

**4. *Thespesia populneoides* (Roxb.) Kostel., Allg. Med. Pharm. Fl. 5: 1861. 1836; Voigt, Hort. Sub. Calc. 120. 1845. *Hibiscus populneoides* Roxb., [Hort. Beng. 51. 1814, nom. nud.] Fl. Ind. 3: 190. 1832.**

Trees, 3 - 8 m tall; twigs densely brownish lepidote giving coppery appearance. Leaves 5 - 20 x 5.5 - 15 cm, deltoid to subcordate, shallowly cordate or subtruncate with a broad sinus at base, acute to acuminate at apex, entire, 7-nerved at base, prominent with domatia in axils of main veins beneath, densely brownish lepidote; petioles 5 - 8 cm, brownish lepidote; stipules subulate to lanceolate, early caducous. Flowers solitary, axillary; pedicels 8 - 12 cm long, curving downwards, densely brownish lepidote. Epicalyx segments 3, 1 - 2 mm long, triangular-ovate, very early caducous. Calyx 8 - 10 mm high, ca 15 mm across, cupular, truncate or with 5 minute teeth, densely brownish lepidote outside, densely adpressed simple hairy inside, accrescent and flattened in fruit. Corolla light yellow with dark purple centre, 5 - 6 cm long, campanulate; petals obliquely obovate, rounded at apex, densely lepidote outside, glabrous inside. Staminal column included. Capsules globose, obtuse or slightly depressed at apex, exocarp smooth separated from the tough endocarp by loose fibrous-spongy mesocarp, dehiscing into 5 valves. Seeds ca 10 x 6 mm, obovoid, angular, densely covered with a short clavate or bulbous hairs.

*Fl. & Fr.* May - Jan.

*Distrib.* India: Coasts of Andaman & Nicobar Islands.

Myanmar, Indo-China, Malesia, Australia and Africa.

#### Tribe 4. MALVEAE A. Gray

#### 17. *Althaea* L.

Annual or perennial herbs, erect or decumbent, pubescent or villous. Leaves suborbicular, deeply lobed or partite or rarely entire. Flowers axillary, solitary or in fascicles or in long terminal racemes towards the end of branches. Epicalyx cupular, segments 6 - 9, connate at base, deltoid, densely lanate and bristly. Calyx campanulate,

5-lobed, densely hairy. Corolla infundibular; petals obovate-cuneate. Staminal column antheriferous almost up to base, hairy. Carpels numerous, many-loculed, one ovule in each locule; style-branches as many as carpels, filiform; stigmas adaxial. Schizocarp with mericarps arranged in a circle around axis, indehiscent, ultimately separating at maturity.

Subtropical and temperate regions of Europe and Asia, ca 20 species; 2 in India.

#### KEY TO THE SPECIES

- 1a. Prostrate or ascending herbs; leaves 5 - 7-lobed; Petals white; schizocarps with 8 - 9 mericarps, glabrous 1. *A. ludwigii*  
 b. Erect herbs or undershrubs; leaves entire or slightly 3-lobed; Petals pinkish; schizocarps with 10 - 15 mericarps, stellate-pillose 2. *A. officinalis*

1. *Althaea ludwigii* L., Mant. Pl. 98. 1767; Masters in Fl. Brit. India 1: 319. 1874.

Raj.: *Golio*

Prostrate or ascending herbs, branched from the base. Leaves 0.5 - 1.5 x 0.8 - 1.8 cm, orbicular, 5 - 7-lobed, lobes wedge shaped, cuneate, each lobe 3 - 5-fid; petioles 2 - 10 cm long; stipules 3 - 5 x 2 - 3 mm, ovate. Pedicels 3 - 10 mm long. Epicalyx segments 7 - 9, 3 - 5 x 1 mm. Calyx lobes lanceolate, accrescent. Petals whitish, longer than sepals. Schizocarps 4 - 6 mm across; mericarps 8 - 9, wrinkled at sides. Seeds 1 mm in diam., brownish black.

*Fl. & Fr.* Jan. - March.

*Distrib.* India: In tropical dry deciduous forests up to 300 m. Punjab, Rajasthan and Maharashtra.

Pakistan, W. Asia, Mediterranean region and S. Africa

2. *Althaea officinalis* L., Sp. Pl. 686. 1753; Masters in Fl. Brit. India 1: 319. 1874.

Hindi: *Khitmi - ka - jhar*; Tam.: *Shemai - tutti*.

Erect herbs or undershrubs, 50 - 100 cm high; branched throughout, uniformly downy. Leaves 2.5 - 7 x 1.5 - 6 cm, ovate, entire or slightly 3-lobed, scarcely cordate at base, acute at apex, irregularly dentate; petioles 1 - 4 cm long; stipules 5 - 10 x 1 - 2 mm. Pedicels 0.5 - 1.5 cm long. Epicalyx segments 6 - 8, 2 - 3 x 1 mm. Calyx longer than epicalyx, lobes 4 - 6 x 3 - 4 mm. Petals 1.5 - 2.5 x 0.4 - 1 cm, pinkish. Staminal column 0.5 - 1 cm long. Schizocarps 5 - 7 mm across, partly covered with persistent calyx,

mericarps 10 - 15, wrinkled at sides. Seeds 1.5 - 2.5 mm in diam., brownish black.

*Fl. & Fr.* Aug. - July.

*Distrib.* India: N.W. Himalyas between 900 and 1800 m. Jammu & Kashmir (Kashmir) and Himachal Pradesh.

Afghanistan, Europe and N. Africa.

*Notes.* This species is believed to have a great healing property and is esteemed by Greeks. The leaves and flowers mixed with an oil are applied for burns and venomous bites. A decoction of root with sugar is given to treat cough and irritation of intestine and bladder.

Seeds dissolved in vinegar are employed generally to remove toothache. The plant is also eaten as green vegetable.

Masters (l.c.) described a variety (*A. officinalis* var. *tauriensis* Masters) but no specimen of this variety could be examined and is yet to be collected in India.

### 18. *Lavatera* L.

Annual or perennial herbs or large shrubs, simple or stellate-hairy. Leaves palmately lobed or angular; stipules usually foliaceous, persistent. Flowers solitary, axillary or in terminal racemes. Epicalyx segments 3 - 6, connate at base. Calyx 5-lobed. Petals 5, usually emarginate. Staminal column branched at apex. Carpels 6 - many; ovary many-loculed, ovules 1 in each locule; styles filiform, as many as carpels. Schizocarp with mericarps arranged in a depressed circle around a conical or dilated axis, finally separating, indehiscent. Seeds reniform, ascending.

Mediterranean region, Canary Islands, C. Asia, Russia, N.W. America, N.W. Himalayas and Australia, ca 45 species; one in India.

*Lavatera cachemiriana* Cambess. in Jacquem., Voy. Ind. 4: 29, t. 32. 1844; Masters in Fl. Brit. India 1: 319. 1874.

Perennial herbs, 1.5 - 2.5 m high; branchlets densely stellate-pubescent, ultimately glabrescent. Leaves 4 - 9 x 3 - 8 cm, orbicular-cordate, 5 - 7-nerved at base, lower leaves 5-lobed, upper ones 3 - 5-lobed, lobes ovate to deltoid, acute, crenate, sparsely stellate-hairy above, densely so beneath; stipules 2 - 5 x 1 mm, linear-lanceolate, stellate-hairy. Flowers axillary, solitary. Epicalyx segments 3, connate below middle, segments 1 - 1.5 x 0.8 - 1.2 cm, ovate or rounded acute, stellate-hairy on both surfaces. Calyx divided to the middle; lobes 1.5 - 1.8 x 0.8 - 1.2 cm, extending beyond epicalyx segments, lanceolate, densely stellate-hairy outside, stellate-pubescent along margin and glabres-

cent in the centre inside. Corolla bright pink with dark coloured veins, 3 - 7 cm across; petals free, 3 - 5 x 2 - 3 cm, obovate or oblong-obovate, deeply notched, hairy at base. Staminal column 1 - 1.5 cm long, villous, antheriferous towards tip. Carpels glabrous; styles filiform, as many as carpels. Schizocarps 1 - 1.5 cm in diam., discoid; mericarps more than 20, ca 3 mm in diam., reniform, globose, shorter than projecting torus. Seeds ca 2.5 mm in diam., reniform, glabrous, brownish-black.

*Fl. & Fr.* July - Oct.

*Distrib.* India: N.W. Himalayas in temperate forests between 2000 and 3300 m. Jammu & Kashmir and Himachal Pradesh.

Nepal, Pakistan and C.I.S.

### 19. *Malva* L.

Annual, biennial or perennial herbs or undershrubs, erect or procumbent, glabrous or hairy. Leaves reniform to suborbicular cordate, entire, lobed or dissected. Flowers axillary, solitary or fascicled, rarely in terminal racemes. Epicalyx segments 3, free, small. Calyx cupular to rotate, 5-lobed, lobes deltoid, acute. Corolla longer than calyx or scarcely exceeding, rotate to infundibular, mostly red, pink, violet, purple or white, rarely blue; petals obtriangular, cuneate, notched at apex. Staminal column antheriferous towards apex. Ovary 10 - 14 carpellate, carpels arranged in a ring around a central axis, ovules one in each carpel; styles as many as carpels, obliquely calvate, united to about half their length; stigmas decurrent on adaxial sides of styles. Schizocarps enclosed in persistent calyx, discoid, with a depressed centre; mericarps reniform, flattened, awnless, usually dorsally and laterally prominently veined, sometimes muricate, indehiscent but separating at maturity. Seeds reniform, ascending.

Temperate and subtropical regions of the Old World, some species are naturalized in the New World, ca 30 species; 7 in India.

#### KEY TO THE SPECIES

- |  |                         |
|--|-------------------------|
| 1a. Epicalyx segments ovate or ovate-oblong  | 2                       |
| b. Epicalyx segments linear to lanceolate  | 4                       |
| 2a. Schizocarps glabrous; petals 3 - 5 times longer than calyx   | 3                       |
| b. Schizocarps hairy; petals less than 3 times longer than calyx   | 1. <i>M. ambigua</i>    |
| 3a. Flowers more than 5 in each fascicle, rarely less; petals 3 - 5 times longer than calyx; retuse; stems glabrescent, stout                  | 2. <i>M. mauritiana</i> |
| b. Flowers 1 - 4 in each fascicle; petals usually 3 times longer than calyx, emarginate; stems pubescent to glabrescent, comparatively slender | 6. <i>M. sylvestris</i> |
| 4a. Dorsal surface of mericarps distinctly reticulate with keeled angles   | 5. <i>M. parviflora</i> |
| b. Dorsal surface of mericarps smooth or finely ridged, with angles not keeled   | 5                       |

- 5a. Flowers lax in fascicles; pedicels 1 - 3 cm long; petals 9 - 15 mm long; calyx slightly accrescent  
4. *M. neglecta*
- b. Flowers compact in fascicles; pedicels 3 - 10 mm long; petals 7 - 10 mm long; calyx distinctly accrescent 6
- 6a. Plants glabrescent; staminal column glabrous or simple hairy towards tips; fruiting calyx 10 - 15 mm long  
7. *M. verticillata*
- b. Plants pubescent; staminal column retrorse hairy throughout; fruiting calyx less than 10 mm long  
3. *M. mohileviensis*

1. *Malva ambigua* Guss., Fl. Orient. Prodr. 2: 331. 1828. *M. sylvestris* L. var. *eriocarpa* Boiss., Fl. Orient. 1: 819. 1869; Masters in Fl. Brit. India 1: 320. 1874.

Small, weak herbs; young parts stellate-hairy. Leaves 1.5 - 3 x 2.5 - 4 cm, somewhat semicircular, upper ones 3-lobed, truncate at base, obtuse at apex, serrate; petioles 2 - 7 cm long, pubescent with both stellate and simple hairs; stipules 2 - 8 mm long, ovate-lanceolate, glabrous. Flowers 1 - 5 (- 7) in axillary fascicles; pedicels 0.5 - 1.5 cm long. Epicalyx segments 2 - 5 x 1 - 3 mm, ovate to oblong, stellate-hairy. Calyx ca 5 mm across, slightly accrescent, lobes 3 - 6 x 2 - 3 mm broadly ovate to deltoid, stellate-pubescent, free to the middle. Petals dark pink, 7 - 15 x 5 - 7 mm, oblong-obovate, claw hairy. Staminal column 4 - 7 mm long, stellate-hairy. Schizocarps ca 5 mm across, hairy; mericarps 10 - 12, ca 2 x 2 mm, dorsally reticulated. Seeds ca 1.5 mm across, brown.

*Fl. & Fr.* May - Aug.

*Distrib.* India: N.W. Himalayas in subtropical to temperate forests between 1200 and 3000 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan, W. & E. Mediterranean region and C.I.S.

*Notes.* *M. ambigua* readily differs from *M. sylvestris* L. by its pubescent fruit and petals being more or less 3 times the length of the calyx.

2. *Malva mauritiana* L., Sp. Pl. 689. 1753. *M. sylvestris* L. var. *mauritiana* (L.) Boiss., Fl. Orient. 1: 819. 1867; Masters in Fl. Brit. India 1: 320. 1874. Fig. 99.

Erect herbs or undershrubs, ca 2 m tall; stems stout, glabrescent. Leaves 3 - 8.5 x 2 - 6 cm, orbicular, shallowly 3 - 5-lobed, truncate or shallowly cordate at base, obtuse or rounded at apex, coarsely crenate; petioles 3.5 - 12 cm long; stipules 3 - 6 x 2 - 3 mm, ovate-lanceolate. Flowers 5 - 15 in axillary fascicles; pedicels 1 - 2 cm long, up to 2.5 cm long in fruit. Epicalyx segments 3 - 4 x 2 mm, ovate to ovate-oblong. Calyx lobes 5 - 6 x 3 mm, ovate-lanceolate to ovate or oblong, free up to the middle, accrescent in fruit. Petals dark pink to purple, 1.5 - 2.5 x 1.5 - 2 cm, retuse, claw hairy. Schizocarps 5 - 7 mm across, glabrous; mericarps 10 - 14, 1.5 - 2 mm across, reticulate. Seeds ca 1.5 mm across, reniform, blackish-brown.



Fig. 99. *Malva mauritiana* L.

*Fl. & Fr.* Oct. - May.

*Distrib.* India: Occasionally cultivated or running wild as an escape.

W. Europe, Mediterranean region and C.I.S.

3. *Malva mohileviensis* Downar in Bull. Soc. Imp. Nat. Mosc. 1: 177. 1861; T. K. Paul in Bull. Bot. Surv. India 27: 241. 1987.

Annual, weak herbs, up to 1.5 m high; stems purplish, younger parts pubescent. Leaves 1.5 - 4.5 x 2 - 7 cm, suborbicular, 5 - 7 lobed, cordate at base, rounded at apex, crenate, sparsely hairy, ultimately glabrescent; petioles 1.5 - 14 cm long, stellate and simple hairy, ultimately glabrescent; stipules 3 - 5 x 2 - 3 mm, ovate-lanceolate. Flowers 3 - 8 in axillary fascicles; pedicels 3 - 10 mm long. Epicalyx segments 3 - 4 x 1 mm, linear; ciliate. Calyx 5 x 3 - 4 mm, lobes deltoid. Corolla pinkish; petals about twice as long as calyx, obovate, retuse. Staminal column 3 - 4 mm long, retrorse hairy. Schizocarps 5 - 7 mm across, glabrous; mericarps 11 - 12, ca 2 mm long, dorsally faintly reticulate. Seeds ca 1 mm long, brown.

*Fl. & Fr.* Jan. - March.

*Distrib.* India: Rajasthan.

Pakistan, C.I.S., Europe and Japan.

4. *Malva neglecta* Wallr., Syll. Pl. Nov. Ratisbon 1: 140. 1824. *M. rotundifolia* L., Sp. Pl. 689. 1753, p.p.; Masters in Fl. Brit. India 1: 320. 1874. **Fig. 100.**

Erect or prostrate herbs, 15 - 60 cm high. Leaves 0.6 - 2.2 x 1.5 - 5 cm, reniform to suborbicular-cordate, shallowly 5 - 7-lobed, more or less rounded at apex, crenate, 5 - 7-nerved at base, pubescent with stellate and simple hairs on both surfaces, petioles 2 - 11 cm long, stellate and simple hairy; stipules 4 - 6 x 2 - 3 mm, obliquely triangular, simple hairy outside, glabrous inside. Flowers 2 - 5 in axillary, lax fascicles; pedicels 1 - 3 cm long, unequal in each fascicle, densely pubescent with stellate and simple hairs. Epicalyx segments 2 - 4 x 1 - 1.5 mm, linear to lanceolate, pubescent with simple and stellate hairs, persistent. Calyx divided to the middle, lobes 4 - 6 x 2 - 3 mm, deltoid, pubescent outside with simple and stellate hairs, glabrous inside, persistent. Corolla pale lilac to whitish, ca 1 cm across; petals 9 - 15 x 3 - 5 mm, with 1 - 1.5 mm, deep notch at apex, hairy. Staminal column 4 - 6 mm long, upper two-third portion antheriferous, stellate-pubescent throughout. Mericarps 12 - 14, each ca 2 mm in diam., reniform, fairly ridged, pubescent. Seeds ca 1.5 mm across, reniform, glabrous, brownish black.

*Fl. & Fr.* April - Sept.



Fig. 100. *Malva neglecta* Wallr.



*Distrib.* India: Throughout Himalyas in temperate forests between 2000 and 3000 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal (Darjeeling).

Pakistan, Afghanistan, Europe, Nepal, Bhutan Myanmar and Australia.

**5. *Malva parviflora*** L. in Hoejer, *Demostr. Pl. Hort. Ups.* 18. 1753 & *Amoen. Acad.* 3: 146. 1756 & *Sp. Pl. ed. 2*, 969. 1763; *Masters in Fl. Brit. India* 1: 321. 1874.

Hindi: *Panirak*; Punj.: *Geogisag, Nanna, Sonchal*.

Annual herbs, ascending or prostrate, spreading, 15 - 45 cm high; stems branched at base, pubescent with scattered patent simple and stellate hairs, ultimately glabrescent. Leaves 1.5 - 7 cm across, suborbicular, often slightly 3 - 7-lobed, cordate at base, rounded to obtuse at apex, crenate-serrate, 5 - 7-nerved at base, with scattered stellate hairs on both surfaces; petioles 1 - 25 cm long with a line of stellate and simple hairs on upper side; stipules 1 - 3 mm long, lanceolate to deltoid, acuminate, hairy. Flowers 2 - 6 in axillary fascicles; pedicels 3 - 8 mm long, accrescent up to 10 mm, stellate-hairy or glabrous. Epicalyx segments up to 5 mm long, linear, simple hairy, caducous. Calyx cupular, ca 5 x 3 mm, divided to the middle, lobes ca 5 x 2 mm, ovate, acute, outside with minute stellate and simple hairs, glabrous inside. Corolla bluish-white; Petals 3 - 7 x 2 - 3 mm, obovate, glabrous or occasionally with minute stellate and simple hairs, glabrous inside. Staminal column ca 3 mm long, antheriferous towards apex, glabrous. Schizocarps 5 - 8 mm in diam., 2 - 3 mm long; mericarps 10, reniform, trigonous with sharp angles, margins keeled on the back, rarely slightly winged, dorsally prominently reticulate veined, glabrous, indehiscent. Seeds 1.8 - 2 mm in diam. reniform, glabrous, brownish black.

#### KEY TO THE VARIETIES

- 1a. Plants ascending, branched from the base; flowers solitary or paired or rarely more in fascicles  
5.1. var. *microcarpa*
- b. Plants prostrate or procumbent, branched throughout; flowers many in compact fascicles  
5.2. var. *parviflora*

**5.1. var. *microcarpa*** (Pers.) Loscos, *Trat. Pl. Aragon* 2: 203. 1877; T. K. Paul in *Bull. Bot. Surv. India* 27: 242. 1987. *M. microcarpa* Pers., *Syn. Pl.* 2: 251. 1806.

*Fl. & Fr.* Dec. - Feb.

*Distrib.* India: Rajasthan.

Pakistan and Malesia, native of Mediterranean region.



Fig. 101. *Malva parviflora* L. var. *parviflora*

5.2. var. *parviflora*

Fig. 101.

*Fl. & Fr.* Oct. - March.

*Distrib.* India: In subtropical and temperate forests between 1200 and 2400 m. Jammu & Kashmir, Punjab, Uttar Pradesh, Sikkim, Madhya Pradesh, Karnataka and Tamil Nadu.

Pakistan, W. Asia, N. Africa, Europe, Nepal and Bhutan.

6. *Malva sylvestris* L., Sp. Pl. 689. 1753; Masters in Fl. Brit. India 1: 320. 1874.

Fig. 102.

Biennial or perennial herbs, up to 2 m high; stems erect to decumbent, younger parts pubescent with simple or stellate hairs, ultimately glabrescent. Leaves 1.5 - 8 x 1 - 11 cm, reniform to suborbicular, cordate, 3 - 7-lobed, 3 - 7-nerved at base, lobes semicircular to oblong, obtuse at apex, crenate, glabrous or sparsely simple hairy beneath; petioles 1.5 - 7 cm long, stellate-hairy with a line of simple hairs; stipules 4 - 6 x 2 - 3 mm, ovate, acute, hairy, mostly deciduous. Flowers 1 - 4 in axillary fascicles; pedicels 0.5 - 2.5 cm, unequal in a fascicle, pubescent with simple and stellate hairs, ultimately glabrous. Epicalyx segments 3 - 5 x 1.5 - 2 mm, ovate, ciliate by simple hairs, glabrous. Calyx divided to the middle, lobes 3 - 7 x 2 - 4 mm, broadly triangular, acute, densely hirsute outside with stellate and a few simple hairs, ciliate along margins with short, slender and stiff, simple hairs, densely hairy along margins and sometimes in the centre but glabrous at base inside, persistent. Corolla dark purple or violet; petals 1.5 - 2.5 x 0.5 - 1 cm, obovate, emarginate, glabrous, basal margins tufted with simple hairs. Staminal column ca 4 mm long, densely stellate-hairy, antheriferous towards apex; filaments ca 2 mm long. Schizocarps 4 - 10 mm in diam., 2 - 3 mm high, discoid, glabrous; mericarps 10, 2 mm in diam., dorsally reticulate veined, laterally and radially prominently veined, hairy or glabrous. Seeds 1.5 - 2 mm long, reniform, glabrous, brownish black.

*Fl. & Fr.* Aug. - March.

*Distrib.* India: Tropical to temperate forests between 600 and 3000 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Delhi, Uttar Pradesh, Assam, Madhya Pradesh, Maharashtra, Karnataka and Tamil Nadu.

Tropical and temperate regions of Asia and Europe.

*Notes.* The leaves and seeds are eaten as a vegetable. Young stems, leaves, flowers and immature fruits are medicinal.

7. *Malva verticillata* L., Sp. Pl. 689. 1753; Masters in Fl. Brit. India 1: 320. 1874. *M. neilgherrensis* Wight, Icon. Pl. Ind. Orient. t. 950. 1845.

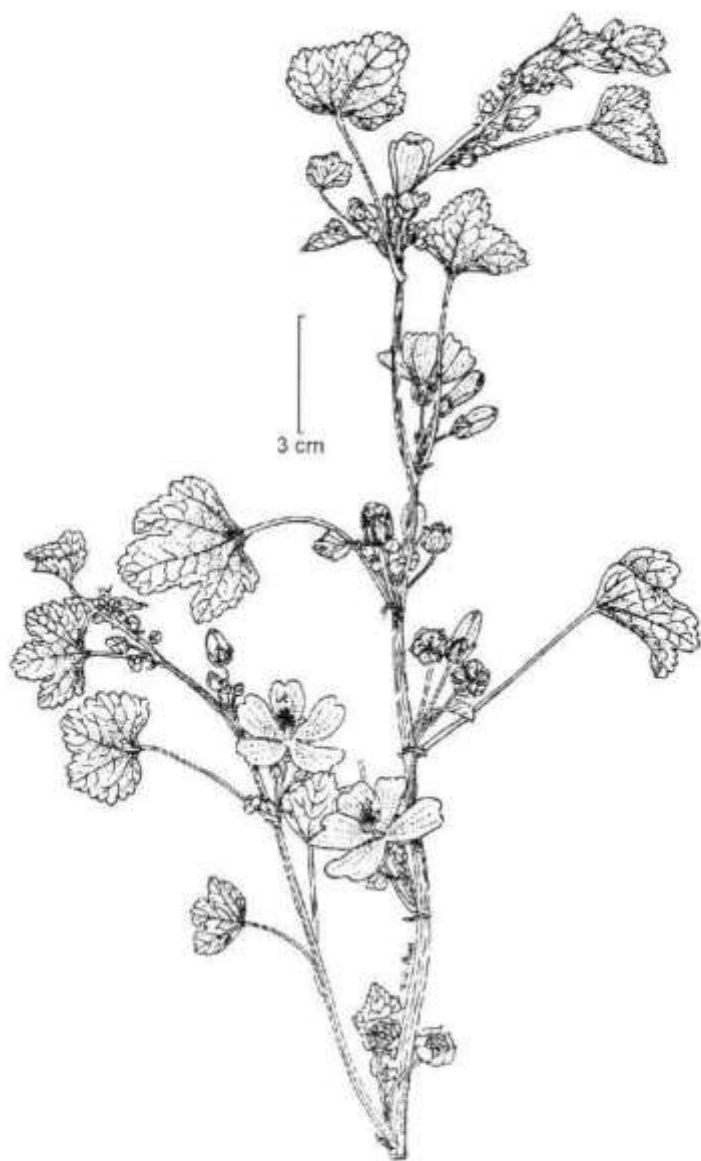


Fig. 102. *Malva sylvestris* L.

Asm.: *Laffa*; Beng.: *Lopha*, *Napha*.

Annual or perennial herbs, 30 - 120 cm high; stems slender with simple and stellate hairs, ultimately glabrescent. Leaves 3 - 12 x 2 - 10 cm, suborbicular, cordate at base, 5 - 6-lobed, lobes roundish, acute or rounded at apex, crenate-serrate, 5 - 7-nerved at base, sparsely to densely simple and stellate-hairy on both surfaces, ultimately glabrescent; petioles 2 - 15 cm long, hairy becoming glabrescent; stipules 3 - 5 x 2 - 4 mm, lanceolate to deltoid, acuminate, hairy. Flowers compact or lax in axillary fascicles, subsessile; pedicels 2 - 15 mm long, stellate-pubescent, all hidden by flowers and fruits. Epicalyx segments 3 - 4 mm long, linear, simple hairy. Calyx 6 - 8 mm long, accrescent up to 15 mm, lobes deltoid-lanceolate, acute at apex, slightly inflated, sparsely stellate and simple hairy outside, hairy or glabrous inside. Corolla purplish; petals 7 - 8 mm long, oblong, lobed at apex; lobes rounded, glabrous or occasionally with few simple hairs. Staminal column 3 - 4 mm long, antheriferous towards apex, glabrous or simple hairy towards tip. Ovary discoid, carpels 10 - 12; styles free; stigmas decumbent on adaxial side of styles. Schizocarps ca 5 mm across, discoid; mericarps 10 - 12, ca 2 mm across, reniform, laterally and radially veined, glabrous, indehiscent. Seeds 1.5 mm across, reniform, glabrous, brownish black.

#### KEY TO THE VARIETIES

- 1a. Flowers 2 - 4, lax in fascicles; pedicels 6 - 15 mm long, unequal in each fascicles 7.1. var. *rafiqii*  
 b. Flowers more than 5, compact in fascicles; pedicels 2 - 3 mm long, all equal in each fascicles 7.2. var. *verticillata*

7.1. var. *rafiqii* S. Abedin in Fl. W. Pakistan 130: 45. 1979; T.K. Paul in Bull. Bot. Surv. India 27: 242. 1987.

*Distrib.* India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh;

Pakistan and China.

7.2. var. *verticillata*

Fig. 103.

*Fl. & Fr.* Aug. - Feb.

*Distrib.* India: Cultivated, occasionally running wild as an escape in Tamil Nadu (Nilgiris).

Asia, Europe, Egypt and S. Africa.

*Notes.* Leaves and young stems are eaten as vegetable. The ash of dried leaves and roots are medicinal.

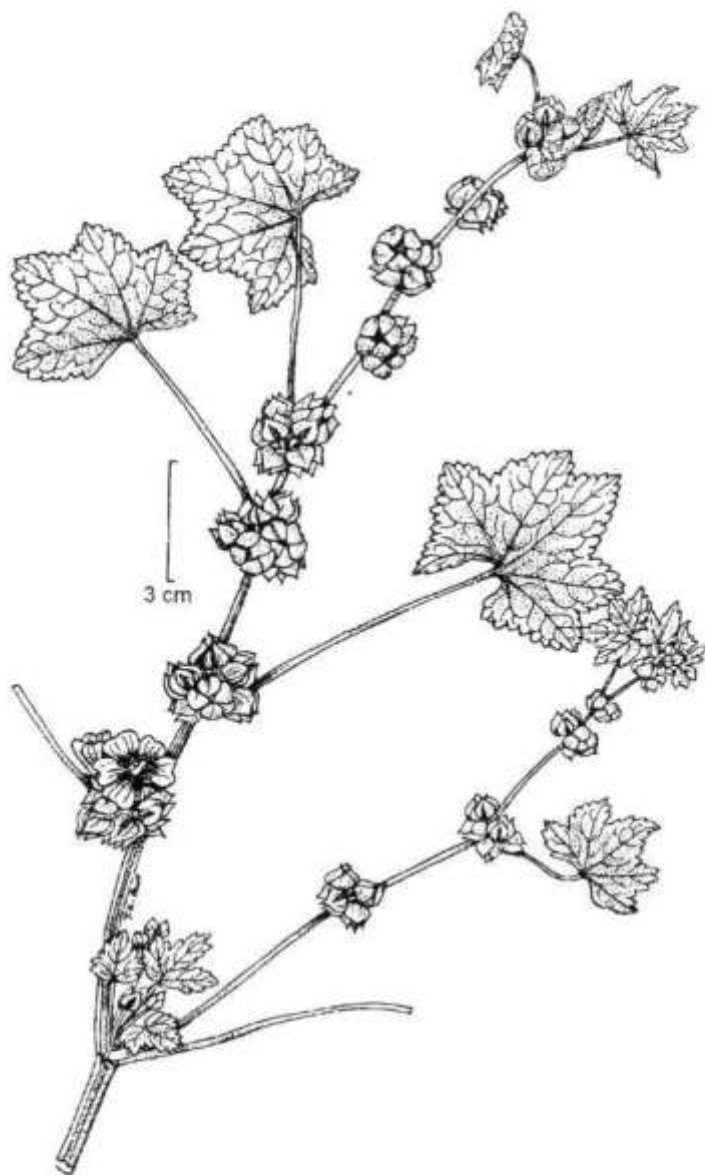


Fig. 103. *Malva verticillata* L. var. *verticillata*

## DOUBTFUL SPECIES

**Malva pusilla** Smith in Sowerby, Eng. Bot. 4. t. 241. 1795. *M. rotundifolia* L. var. *borealis* (Wallm. ex Boiss.) Masters in Fl. Brit. India 1: 320. 1874. *M. borealis* Wallm. ex Boiss. Fl. Orient. 1: 820. 1867.

Masters (l.c.) mentioned the occurrence of this taxon in Bengal and Mysore, but so far it has not been collected from these localities.

## Tribe 5. U R E N E A E Benth. &amp; Hook. f.

20. **Malachra** L.

Annual or perennial herbs or undershrubs, hirsute or prickly. Leaves undivided to angular, palmilobed to palmiparted. Flowers axillary or terminal, in large, condensed racemes surrounded by large mostly broadly triangular or ovate, deeply cordate leafy bracts; pedicels very short. Epicalyx absent, rarely present. Calyx cupular, 5-dentate. Petals 5, red, yellow or white. Staminal column as long as or shorter than petals, 5-toothed, antheriferous throughout. Carpels 5; style-branches 10, connate at base; stigmas capitate, papillose. Schizocarps globular; mericarps 5, isodiametric to ovoid-trigonal with converse dorsal side, 1-seeded, prominently reticulate veined, indehiscent.

Indigenous to tropical America, ca 10 species; 2 or 3 species introduced as weeds in old World; one in India.

**Malachra capitata** (L.) L., Syst. Nat. ed. 12, 2: 458. 1767. Masters in Fl. Brit. India 1: 329. 1874. *Sida capitata* L., Sp. Pl. 685. 1753. **Fig. 104.**

Annual or perennial, erect herbs or undershrubs, up to 1.5 m high; stems, petioles and floral axes minutely stellate-hairy, intermixed with simple and long prickly stellate hairs. Leaves 3 - 14 x 4 - 20 cm, orbicular to suborbicular or ovate, angular or lobed, cordate at base, obtuse or rounded at apex, crenate to serrate, 5-nerved at base, velutinous with minute stellate hairs on both surfaces, ultimately glabrescent; petioles 2 - 8 cm long; stipules 1 - 2 cm long, filiform, hispid. Heads 3 - 7 per axil with 2 - 5 flowers in each head, main axis 5 - 15 mm long; bracts 3 - 4 per head, 0.5 - 2 cm across, broadly ovate to orbicular, cordate to rounded at base, acute at apex with slightly recurved tip, entire or crenate-serrate, folded along midrib, stellate-pubescent and also with stiff bristles along margins and on the nerves beneath, usually with white patches on the interveinium accompanied by filiform stipule-like structures. Calyx cupular, lobes ca 6 x 1.5 mm, oblong to deltoid, acuminate, 3-nerved, glabrous except for a few stiff, simple hairs at apex. Corolla bright yellow, ca 1.5 - 2.5 cm across; petals 1 - 1.5 cm obovate, densely stellate-hairy outside, glabrous inside, ciliate at base. Staminal column ca 1 mm long, antheriferous throughout with both stellate and simple hairs intermixed with a few

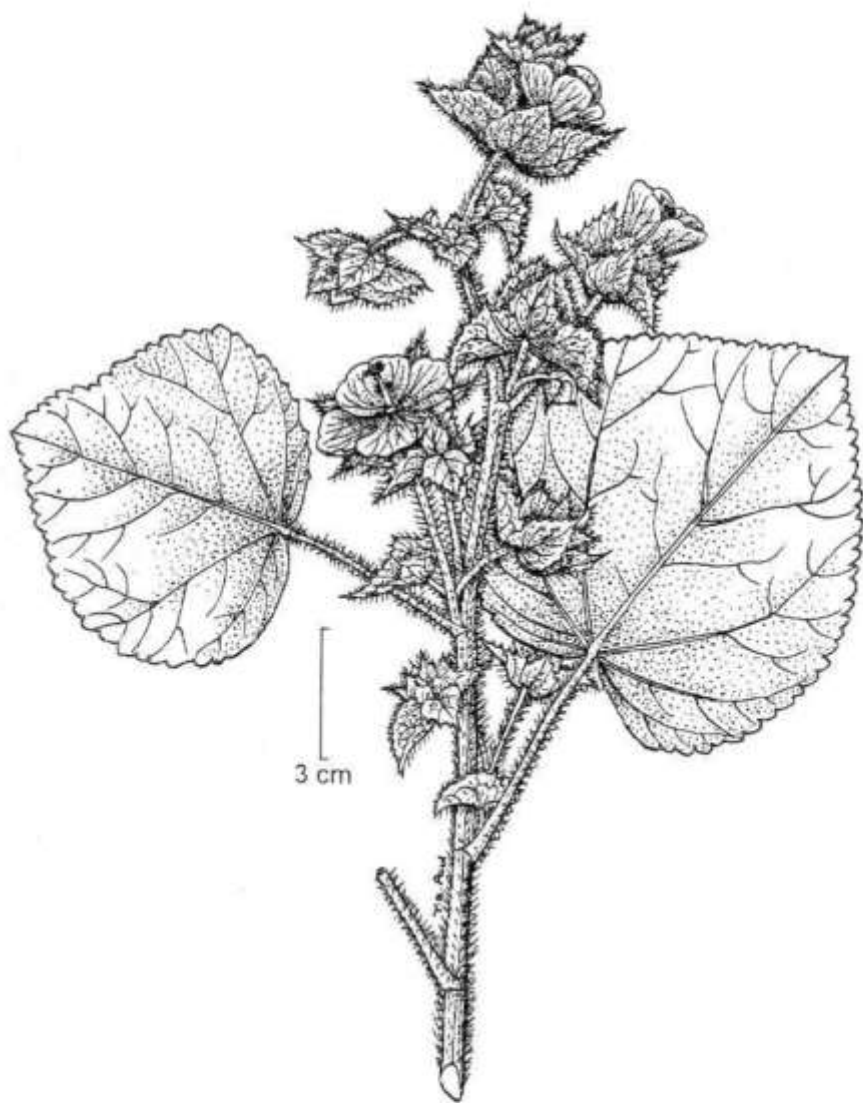


Fig. 104. *Malachra capitata* (L.) L.



gland-tipped hairs. Schizocarps 5 - 6 mm across, obpyriform; mericarps 5, whitish, glabrous, ca 3 x 2 mm, obovoid, trigonous, acute at base, rounded at apex, reticulated with brownish veins. Seeds ca 2.5 mm long, trigonous, minutely stellate-hairy, brownish-black.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Common on roadsides, waste places. Throughout.

Introduced in the Old World, native of tropical America.

### 21. *Pavonia* Cav., nom. cons.

Annual or perennial herbs, undershrubs or shrubs. Leaves entire or lobed to-parted, palminerved, rarely penninerved, rarely with nectaries on midvein beneath. Flowers usually axillary, solitary, sometimes in axillary or terminal fascicles, racemes or panicles by reduction of leaves; pedicels jointed above the middle. Epicalyx segments 5 - 12, free or sometimes connate at base. Calyx campanulate or tubiform, 5-lobed or toothed. Corolla rotate, yellow, pink or pinkish-white. Staminal column as long as or shorter than corolla, antheriferous throughout. Carpels 5, 5-locular, ovules one in each locule; styles 10; stigmas capitate, papillose. Schizocarps discoid to globose; mericarps 5, 1-seeded, indehiscent, echinate or not, with or without wings, glabrous or pubescent, prominently reticulate veined. Seeds reniform, pubescent or glabrous.

Throughout tropics, ca 200 species; 7 in India.

#### KEY TO THE SPECIES

- |  |                            |
|--|----------------------------|
| 1a. Leaves with nectaries on veins beneath; flowers in axillary or terminal clusters; pedicels 1 - 5 mm long         | 6. <i>P. repanda</i>       |
| b. Leaves without nectaries; flowers axillary, solitary; pedicels 10 - 60 mm long                                    | 2                          |
| 2a. Epicalyx segments 5, shortly connate at base   | 3                          |
| b. Epicalyx segments 8 - 14, free  | 4                          |
| 3a. Mericarps with distinct serrulate crest and 3 - 4 prickles on each side; epicalyx segments 5 - 20 mm long, ovate | 5. <i>P. procumbens</i>    |
| b. Mericarps echinate all over; epicalyx segments 16 - 18 mm long, lanceolate  | 2. <i>P. glechomifolia</i> |
| 4a. Mericarps with 3 stout horns and 4 basal protuberances   | 3. <i>P. grewioides</i>    |
| b. Mericarps without horns   | 5                          |
| 5a. Mericarps winged at angles   | 7. <i>P. zeylanica</i>     |
| b. Mericarps wingless  | 6                          |
| 6a. Leaves lobed or angular; mericarps glabrous  | 4. <i>P. odorata</i>       |
| b. Leaves unlobed; mericarps villous   | 1. <i>P. arabica</i>       |

**1. *Pavonia arabica*** Hochst. & Steudel ex Boiss., *Fl. Orient.* 1: 837. 1867; Masters in *Fl. Brit. India* 1: 331. 1874.

Undershrubs, perennial; stems, petioles and pedicels densely stellate-hairy or viscid pubescent. Leaves 2 - 3.5 x 1 - 2.5 cm, ovate or oblong, rounded or truncate at base, obtuse or apiculate at apex, entire or denticulate, 5 - 7-nerved from base, stellate-pubescent on both surfaces; petioles 1 - 2.5 cm long; stipules 4 mm long, linear, stellate-hairy. Flowers axillary, solitary; pedicels 1.5 - 2 cm long, jointed near apex. Epicalyx segments 10 - 12, free to the base, 10 - 14 mm long, linear with stellate and long simple hairs, enclosing schizocarp, persistent. Calyx lobes connate at base or sometimes up to middle, lobes 3 - 6 x 2 mm, ovate-lanceolate, stellate hairy on both surfaces, densely so outside. Petals pink, entire or bilobed to the base, 7 - 12 x 5 - 7 mm, hairy at base. Staminal column ca 6 mm long, antheriferous throughout. Schizocarps 4 - 5 mm across, globose, obtuse; mericarps 5, 5 x 3 mm, trigonous, villous. Seeds ca 2 mm long, globose, pubescent with spirally coiled hairs and with short tubercles in longitudinal rows, brown.

#### KEY TO THE VARIETIES

- |  |                               |
|--|-------------------------------|
| 1a. Petals unlobed                       | 2                             |
| b. Petals deeply bilobed to the base     | 1.3. var. <i>massuriensis</i> |
| 2a. Plants densely pubescent, not viscid | 1.1. var. <i>arabica</i>      |
| b. Plants densely viscid pubescent       | 1.2. var. <i>glutinosa</i>    |

#### 1.1. var. *arabica*

Fig. 105.

*Fl. & Fr.* Aug. - Oct.

*Distrib.* India: In western India and Western Ghats in dry, deciduous forests up to 610 m. Rajasthan, Gujarat and Karantaka.

Pakistan, Arabia and Ethiopia.

1.2. var. *glutinosa* Blatt. & Hallb. in *J. Bombay Nat. Hist. Soc.* 26: 227. 1918.

*Fl. & Fr.* Sept. - Nov.

*Distrib.* India: Rajasthan.

Endemic.

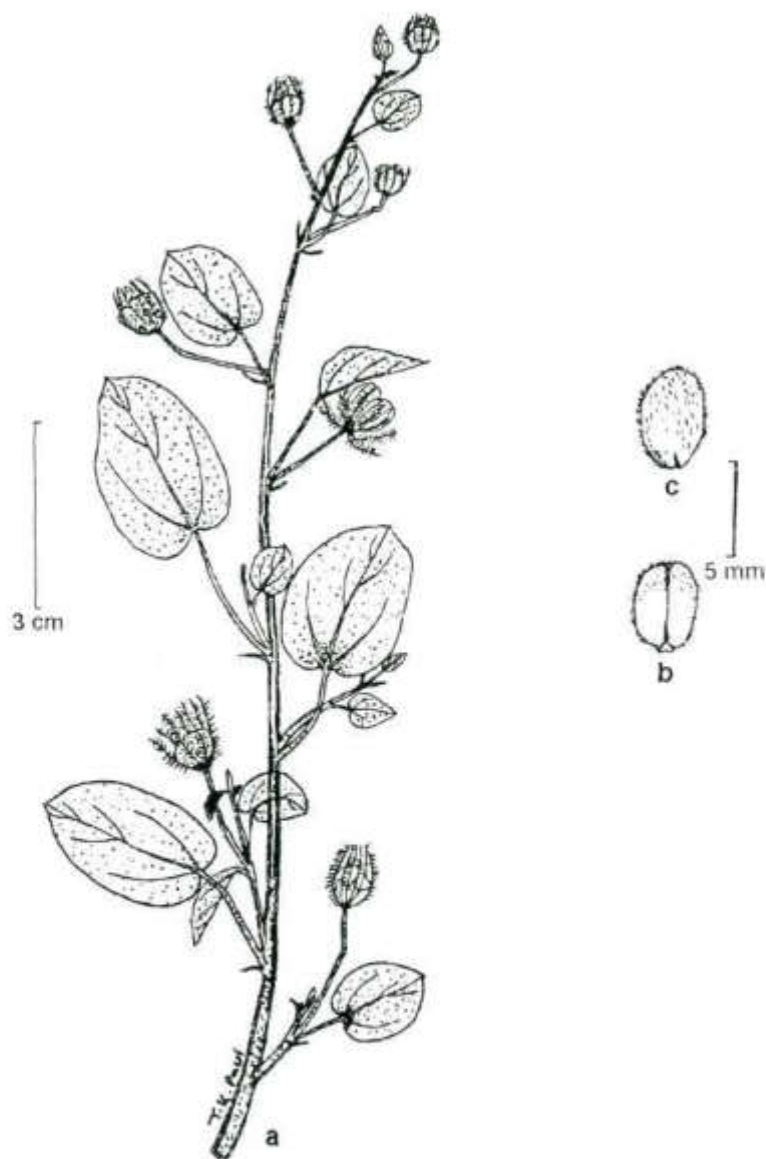


Fig. 105. *Pavonia arabica* Hochst. & Steudel ex Boiss. var. *arabica* : a. flowering part of branch; b. ventral view of mericarp; c. dorsal view of mericarp.

1.3. var. *massuriensis* Bhandari, Fl. Ind. Desert 69. 1978.

*Distrib.* India: Rajasthan.

Endemic.

2. *Pavonia glechomifolia* (A. Rich.) Garcke ex Schewin. f., Beitr. Fl. Aethiop. 1: 54. 1867; Masters in Fl. Brit. India 1: 330. 1874. p.p. *Lebretonia glechomifolia* A. Rich., Tent. Fl. Abyss. 1: 54. 1874. *Pavonia coxii* Tadulingam & Jacob in J. Ind. Bot. Soc. 5: 11. 1926.

Fig. 106 c-d.

Undershrubs, erect, up to 1.5 m high; stems purple with scattered minute simple and stellate hairs. Leaves 1.2 - 3.5 x 1.4 - 3 cm, ovate-cordate, entire or 3-angled, acute at apex, irregularly dentate, 7-nerved at base, stellate-hairy on both surfaces; petioles 0.8 - 2.5 cm, stellate-hairy; stipules 1.5 - 6 mm long, linear, hairy. Flowers axillary, solitary; pedicels 1.5 - 4 cm, jointed towards tip, stellate-hairy. Epicalyx segments 5, connate at base, spreading, 16 - 18 x 3 - 4 mm, lanceolate, stellate-hairy outside, sparsely simple and rarely stellate-hairy inside, margins with stellate and simple hairs. Calyx 6 - 10 mm long, 5-lobed, lobes connate at base, 6 - 10 x 4 - 5 mm, deltoid-ovoid, acute, stellate hairs intermingled with gland-tipped hairs on outside, sparsely pubescent inside. Corolla yellow with dark purple centre, 1 - 2 cm across; petals 12 - 15 x 7 - 10 mm, rhomboid-obovate, more or less rounded at apex, ciliate at base, scattered with stellate hairs and a few gland-tipped hairs outside, margins sparsely with few simple hairs. Staminal column ca 1 cm long, antheriferous mainly towards apex, 5-toothed at apex. Ovary ca 1 x 1.5 mm, obovate; style to the branching ca 10 mm long; stigmas 10, capitate, densely pubescent. Schizocarps 5 - 6 mm across; mericarps ca 4 mm long, pyriform, echinate all over, dorsally longitudinally carinate. Seeds ca 3 x 2 mm, pyriform, sparsely hairy towards base and hilum, brown.

*Fl. & Fr.* Sept. - Feb.

*Distrib.* India: In dry deciduous forests up to 600 m. Rajasthan, Gujarat, Maharashtra, Tamil Nadu and Kerala.

Pakistan and Ethiopia.

*Notes.* Most botanists consider this species to be conspecific with *Pavonia procumbens* (Wight & Arn.) Walp., but can be readily distinguished from it by purple coloured stem, longer epicalyx segments, yellow corolla with dark purple centre and echinate mericarps.

3. *Pavonia grewoides* Hochst. ex Boiss., Fl. Orient. 1: 837. 1867. *P. ceratocarpa* Dalz. ex Masters in Fl. Brit. India 1: 331. 1874.

Fig. 106 e-g.

Guj.: *Karandiya, Khati-chhas.*

Undershrubs, up to 45 cm high, with woody stems and purplish branches; stems, petioles and pedicels densely stellate-pubescent, ultimately glabrescent. Leaves 2 - 6 x 1 - 2 cm, oblong, truncate or shallowly cordate at base, obtuse at apex, coarsely serrate, 5-nerved at base, stellate-pubescent on both surfaces, densely so beneath; petioles 1 - 2.5 cm long; stipules ca 4 mm long, linear with stellate and few simple hairs. Flowers axillary, solitary or in clusters at the apices of stems; pedicels 5 - 7 mm long, accrescent up to 2.5 cm, jointed towards tip. Epicalyx segments 8 - 10, free, 8 - 10 x 1 mm, linear, stellate-hairy outside, glabrous inside. Calyx campanulate, 5-lobed, lobes more or less connate up to the middle, ca 8 x 5 mm, ovate-acute, prominently 5-nerved, densely stellate-hairy outside, densely appressed with simple and stellate hairs towards apex and margin inside. Corolla yellow, turning red; petals ca 15 x 13 mm, more or less obovate, obtuse or truncate, sparsely stellate-hairy towards apex outside, glabrous inside. Staminal column ca 10 mm long, glabrous, antheriferous throughout, 5-toothed at apex; filaments of basal stamens as long as staminal column. Ovary ca 1.5 mm long, obovoid; styles to the branching 10 mm long; stigmas capitate. Schizocarps 10 - 15 mm across, depressed globose; mericarps ca 5 mm high, pyriform, woody, muricated with 3 stout horns and 4 basal wing-like appendages, glabrous, splitting through the back. Seeds ca 1.5 mm across, reniform, glabrous, brownish.

*Fl. & Fr.* Aug. - Nov.

*Distrib.* India: In dry deciduous forests up to 608 m. Maharashtra and Gujarat; rare.

Pakistan and Ethiopia.

*Notes.* This species apparently resembles *Malvastrum coromandelianum* (L.) Garcke.

**4. *Pavonia odorata* Willd., Sp. Pl. 3: 837. 1800; Masters in Fl. Brit. India 1: 331. 1874. *Hibiscus odoratus* Roxb. [Hort. Ben. 50. 1814. nom. nud.] ex Wight & Arn., Prodr. 47. 1934.** **Fig. 108b.**

Erect, odorous herbs, up to 40 cm high; stems, petioles and pedicels covered with simple glandular hairs. Leaves 2 - 10 x 1.5 - 4 cm, orbicular-ovate, occasionally upper ones lanceolate, cordate or more or less truncate at base, obscurely 3 - 5-lobed, middle lobe longer, acute or slightly acuminate at apex irregularly dentate, 3 - 7-nerved at base, scattered stellate-hairy on both surfaces, densely so beneath; petioles 1 - 8 cm long; stipules ca 2 mm long, linear, hairy, deciduous. Flowers axillary, solitary; pedicels 1.5 - 4 cm, accrescent up to 6 cm long, jointed above the middle. Epicalyx segments 10 - 12, free, 0.5 - 1.5 cm long, linear, ciliate, persistent. Calyx ca 3 mm across, 5-lobed, lobes connate at base, ca 4 x 1.5 mm, ovate-lanceolate, scattered simple hairy on both surfaces.

Petals pink, 1 - 2 cm long, glabrous. Staminal column shorter than petals, glabrous. Ovary globose; stigmas capitate. Mericarps 5, ca 4 x 2 mm, more or less reniform, unarmed, wingless, glabrous. Seeds 2 mm long, reniform, minutely papillose, brownish-black.

*Fl. & Fr.* Aug. - Feb.

*Distrib.* India: Punjab, Uttar Pradesh, West Bengal, Orissa, Bihar, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan, Sri Lanka, Africa and Myanmar.

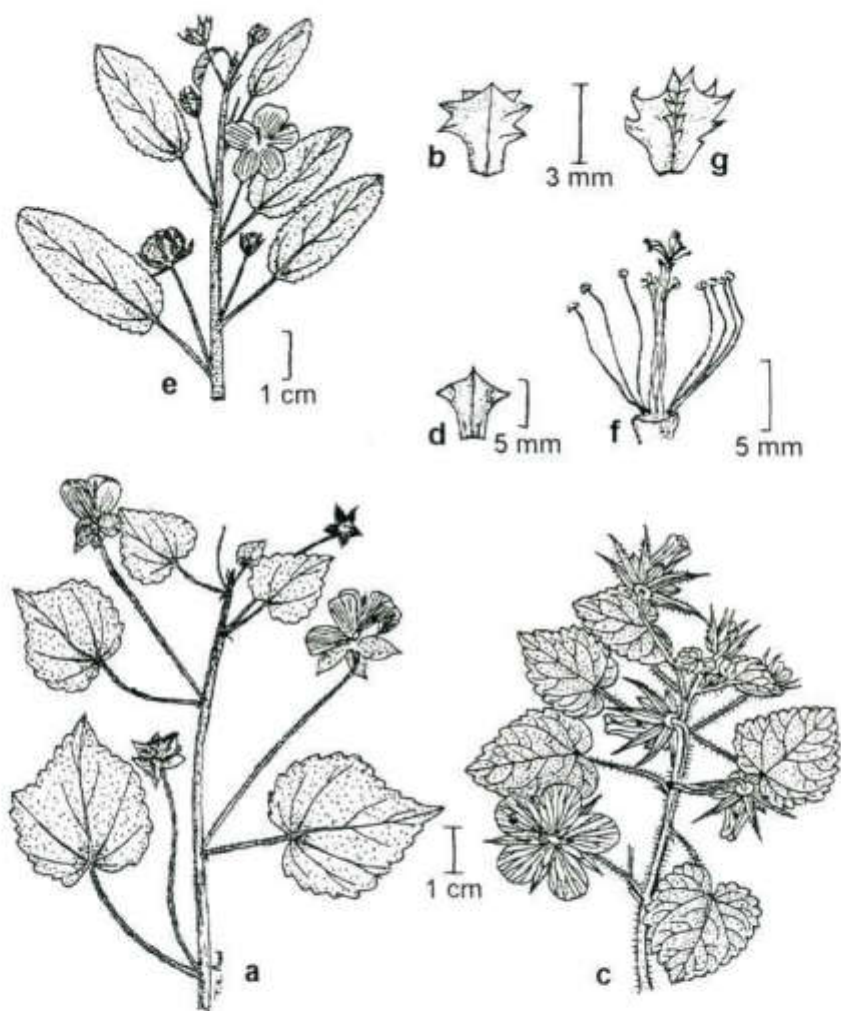
*Notes.* Occasionally cultivated in gardens for its scented flowers. Leaves are edible. Roots are reported to be used for making a perfume called 'Hina'.

**5. *Pavonia procumbens*** (Wallich ex Wight & Arn.) Walp., Rep. Bot. Syst. 1: 301. 1842, non Casaretto, 1842; *Lebertonia procumbens* Wallich [Cat. No. 2688. 1831, nom. nud.] ex Wight & Arn., Prodr. 47. 1834. **Fig. 106 a-b.**

Undershrubs or herbs, procumbent or spreading; stems, petioles and pedicels more or less covered with minute stellate, simple and some scattered gland-tipped. Leaves 2 - 10 x 1.5 - 9 cm, orbicular to ovate, often 3-lobed, cordate at base, obtusely acuminate at apex, coarsely crenate to serrate, 5 - 7-nerved at base, sparsely minute stellate and simple hairy above, densely pubescent with minute stellate hairs beneath, ultimately glabrescent; petioles 0.5 - 9 cm; stipules 3 - 5 mm long, linear to filiform, hairy. Flowers axillary, solitary; pedicels 1.5 - 6 cm, jointed above the middle, usually geniculate at joint and densely hairy above the joint. Epicalyx rotate, segments 5, shortly connate at base, 5 - 10 x 3 - 6 mm, ovate, acuminate at base, acute to acuminate at apex, usually 3-nerved, stellate-hairy on both surfaces, margins with dense, minute stellate hairs intermixed with some long, patent, simple hairs. Calyx 9 - 12 mm across, campanulate, connate up to middle, lobes 5 - 8 x 3 - 4 mm, ovate to lanceolate, acute to acuminate, densely stellate-hairy outside, glabrous inside. Corolla yellow, 1.5 - 2 cm across; petals ca 14 x 10 mm, obovate, rounded at apex, ciliate at base, scattered stellate-hairy outside, glabrous inside. Staminal column ca 5 mm long, sparsely stellate-hairy, antheriferous towards apex. Mericarps 5, ca 5 mm long and ca 3 mm across, obliquely triquetrous, obovoid, obtuse, each with a median, dorsal serrulate crest and 3 - 4 lateral stout ridges on either side, sparsely ferruginous stellate-hairy or glabrous; indehiscent. Seeds ca 2 mm across, reniform, angular, glabrous, brownish-black.

*Fl. & Fr.* Aug. - Dec.

*Distrib.* India: In dry deciduous forests and arid areas. Punjab, Rajasthan, Gujarat, Maharashtra, Tamil Nadu and Kerala.



**Fig. 106.** a-b. *Pavonia procumbens* (Wallich ex Wight & Arn.) Walp.: a. flowering part of branch; b. mericarp. c-d. *Pavonia glechomifolia* (A. Rich.) Garcke ex Schweinf.: c. flowering part of a branch; d. mericarp. e-g. *Pavonia grewoides* Hochst. ex Boiss.: e. flowering part of branch; f. flower with sepals and petals removed; g. mericarp.



**Fig. 107.** *Pavonia repanda* (Smith) Sprengel.



Pakistan, Arabia, Africa, Sri Lanka, Myanmar and Malesia.

**6. Pavonia repanda** (Roxb. ex Smith) Sprengel, Syst. Veg. 3: 98. 1826. *Urena repanda* Roxb. [Hort. Beng. 51. 1814, nom. nud.] ex Smith in Rees, Cyclop. 37. no. 6. 1819; Masters in Fl. Brit. India 1: 330. 1874. *U. palmata* Roxb., Fl. Ind. 3: 182. 1832. **Fig. 107.**

Perennial, erect, much branched herbs; stems, petioles and pedicels densely stellate-hairy. Leaves 3 - 8 x 2.5 - 10 cm, ovate to ovate-rounded, rarely 3 - 5 or 7-lobed, upper leaves sometimes lanceolate, cordate at base, acute at apex, repand-serrate, 5 - 7-nerved at base, midveins with nectaries at base beneath, stellate-pubescent on both surfaces; petioles 1 - 6 cm long; stipules ca 5 mm long, linear, stellate-hairy. Flowers axillary, solitary, ultimately in terminal clusters; pedicels 1 - 5 mm long. Epicalyx cup-shaped, subcoriaceous, segments 5, connate up to middle, 10 - 15 x 5 - 10 mm, strongly nerved and densely stellate-hairy outside, sparsely stellate-hairy inside. Calyx campanulate; lobes connate up to middle, shorter than epicalyx, teeth more or less deltoid, acute to acuminate, densely stellate-hairy outside, sparsely towards apex inside. Petals pink with darker centre, 2 - 3 cm long, oblong-ovoid, densely stellate-hairy towards apical portion outside, glabrous inside. Staminal column 1.5 - 2 cm long. Mericarps ca 4 x 2.5 mm, oblong-ovoid, appressed on two sides, unarmed, glabrous. Seeds ca 3 x 2 mm, oblong-ovoid, glabrous, brownish-black.

*Fl. & Fr.* Sept. - Dec.

*Distrib.* India: In scrub forests. Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Kerala.

S.E. Asia.

*Notes.* Guerke (*Bot. Jahrb.* 6: 368. 1892) placed this species under the genus *Urena* L. based on the presence of nectaries on nerves of leaves. While, Hochreutiner (*Ann. Cons. Jard. Bot. Genev.* 5: 131. 1901) placed it under the genus *Pavonia* Cav. as this species lacks glochidia on mericarps. A critical study of all the specimens of this species represented in Indian herbaria showed that it is somewhat allied to *Urena lobata* L. in having short flowers in axillary or terminal clusters with short pedicels and in shape and size of leaves, but differs from it in having epicalyx segments connate up to the middle and smooth mericarps.

**7. Pavonia zeylanica** (L.) Cav., Diss. 3: 134, t. 48 f. 2. 1787; Masters in Fl. Brit. India 1: 331. 1874. *Hibiscus zeylanicus* L., Sp. Pl. 699. 1753. **Fig. 108. a.**

Perennial undershrubs or herbs, up to 1 m high; stems stout and woody at base, profusely branching towards tip, branches decumbent; stems, petioles and pedicels pubescent with stellate and some long, patent, simple hairs. Leaves 1 - 4 x 0.8 - 3.5 cm, orbicular to obovoid-rounded, deeply 3 - 5-lobed, cordate at base, acute or rounded at

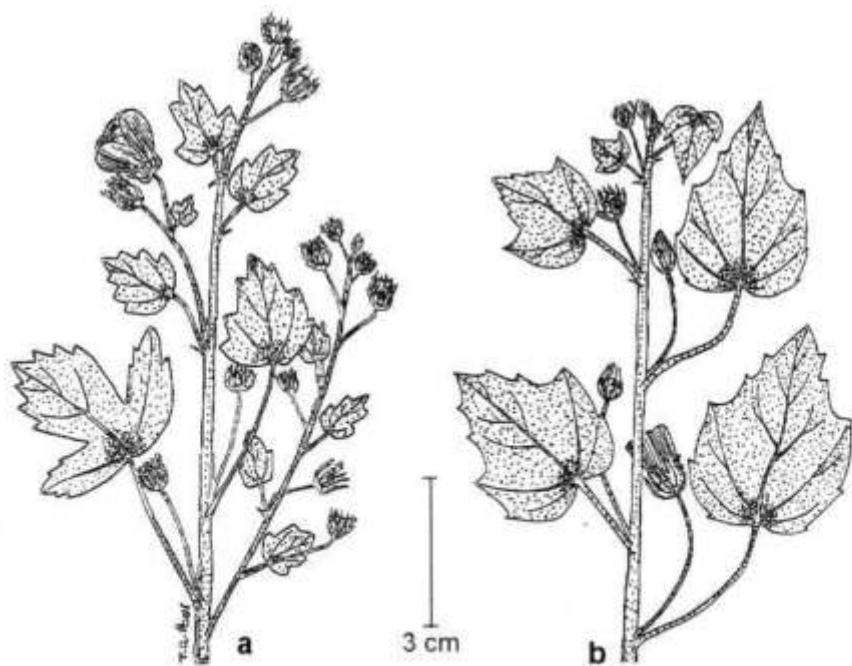


Fig. 108. a. *Pavonia zeylanica* (L.) Cav.: b. *Pavonia odorata* Willd.

apex, dentate, sparsely stellate-hairy on both surfaces; petioles 0.5 - 8 cm; stipules ca 2 mm long, linear, hairy, deciduous. Flowers axillary, solitary; pedicels 1 - 4 cm, jointed towards apex. Epicalyx segments 10, 6 - 10 mm long, linear, ciliate, persistent. Calyx campanulate, 5-lobed, lobes free to the middle, 2 - 4 x 1.5 mm, ovate, lanceolate or deltoid, sparsely simple hairy outside, glabrous inside. Corolla pale pink or pinkish-white; petals 10 x 5 mm, glabrous. Staminal column 8 mm long, antheriferous throughout. Ovary 1.5 mm across, more or less ovoid, glabrous; style-branches 10; stigmas capitate. Schizocarps globular, pubescent; mericarps 5, 4 x 3 mm, oblong, obtuse, slightly winged at angles, awnless, glabrous, dehisces from top. Seeds ca 3 x 1.5 mm, reniform, minutely pubescent.

*Fl. & Fr.* July - Dec.

*Distrib.* India; In arid areas and dry deciduous forests up to 600 m. Uttar Pradesh, Rajasthan, Orissa, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan, Sri Lanka, Arabia, Mauritius and Africa.

## 22. *Urena* L.

Annual or perennial undershrubs or shrubs; young parts densely minute stellate-hairy. Leaves palmi-lobed to-parted or undivided, angular, palminerved with nectaries on nerves beneath. Flowers axillary, solitary or in clusters. Epicalyx campanulate, 5-lobed, lobes connate at base. Calyx campanulate, 5-lobed, lobes ovate or ovate-lanceolate, connate at base with 1-nerved nectaries. Corolla rotate, pink, purplish-red, stellate-pilose outside; petals 5. Staminal column as long as petals, truncate or denticulate at apex; antheriferous towards tip; anthers sessile. Ovary depressed globose, 5-loculed, locules uniovulate; styles divided from about middle into 10 arms, reflexed; stigmas discoid or capitate, papillose. Schizocarps subglobose; mericarps 5, separating at maturity, triangularly obovoid, dorsally convex and covered with glochidiate spines, indehiscent. Seeds obovoid-trigonal, glabrous, ascending.

Monotypic, pantropical.

*Notes.* Linnaeus (1753) in his *Species Plantarum* described 3 species under *Urena*, viz. *U. lobata*, *U. sinuata* and *U. procumbens*. Subsequently several botanists described many other species and varieties. Guerke (*Fl. Brasiliensis* 12, 3: 457 - 596. 1892) maintained 2 Linnaean species, viz. *U. lobata* and *U. sinuata* with 9 and 2 varieties respectively. Hochreutiner (*Ann. Cons. Jard. Bot. Geneve* 5: 131 - 145. 1901) retained only one species (*U. lobata*) with 14 varieties, subsequently adding 3 more. Most botanists (Masters 1874, Cooke 1901, Gamble 1915, etc.) dealing with Indian species of *Urena* maintained 2 species viz., *U. lobata* L. and *U. sinuata* L. Borssum Waalkes (1966) maintained only *U. lobata* with 2 subspecies, viz. *lobata* and *sinuata* based mainly on

epicalyx characters and in each subspecies he included 2 varieties. All taxa recognised by Borssum Waalkes occur in India. After studying these taxa in field and herbarium, Borssum Waalkes's view is followed in this flora.

***Urena lobata* L., Sp. Pl. 692. 1753, s.l.; Masters in Fl. Brit. India 1: 329. 1874.**

Undershurbs, annual or perennial, erect, 0.5 - 2 m high; stems, petioles and pedicels densely minute stellate-hairy intermixed simple hairs, ultimately glabrescent. Leaves extremely variable in size and shape, 1 - 12 x 0.5 - 12.5 cm, usually ovate to orbicular, unlobed to shallowly lobed or deeply irregularly incised towards base, lobes 3 - 5 or more, dilated upwards with rounded sinuses, shallowly cordate, rounded, obtuse to acute at base, obtuse to acute or rounded at apex, serrate to crenate or entire, densely stellate-hairy on both surfaces, ultimately glabrescent; 3 - 9-nerved at base, midrib and sometimes 2 adjacent nerves with linear nectaries beneath; petioles 0.5 - 12 cm long; stipules 2 - 4 mm long, linear to lanceolate, acute. Flowers axillary, solitary or 2 - 3 in clusters; pedicels 1 - 5 mm long. Epicalyx segments closely enveloping calyx and shortly adnate to it, 3 - 10 x 1 - 3 mm, linear to lanceolate, acute, minute stellate-hairy outside, often fimbriate sericeous by appressed, simple and stellate hairs towards apex inside. Calyx tubular to campanulate, lobes 4 - 6 x 1.5 - 2 mm, ovate to deltoid, acute to acuminate, nerves somewhat prominent with nectaries at base, hairs similar to epicalyx. Corolla pink with a purple centre, 2 - 3 cm across; petals 1 - 1.5 x 0.5 cm, obovate, rounded at apex, ciliate or glabrous. Schizocarps 5 - 8 mm across, globose, glochidiate, spines with 4 - 5 retrorse, short, sharp hooks at the top; mericarps 4 - 5 mm, radially ca 4 mm, tangentially ca 3 mm, dorsally and laterally stellate-hairy and reticulate veined. Seeds 2 - 3 mm across, reniform, minutely hairy or glabrous, brown.

#### KEY TO THE SUBSPECIES

- 1a. Leaves angled or shallowly lobed; epicalyx cupular in fruit, appressed to mericarps; segments narrowly triangular 1. subsp. **lobata**  
 b. Leaves palmatilobed or palmatifid; epicalyx spreading or reflexed in fruit, segments linear to lanceolate 2. subsp. **sinuata**

#### 1. subsp. **lobata**

#### KEY TO THE VARIETIES

- 1a. Stems and leaves more or less densely tomentose 1.1. var. **lobata**  
 b. Stems and leaves more or less pubescent, often slightly scabrous 1.2. var. **viminea**

#### 1.1. var. **lobata**

**Fig. 109.**

*Fl. & Fr.* Aug. - Dec.

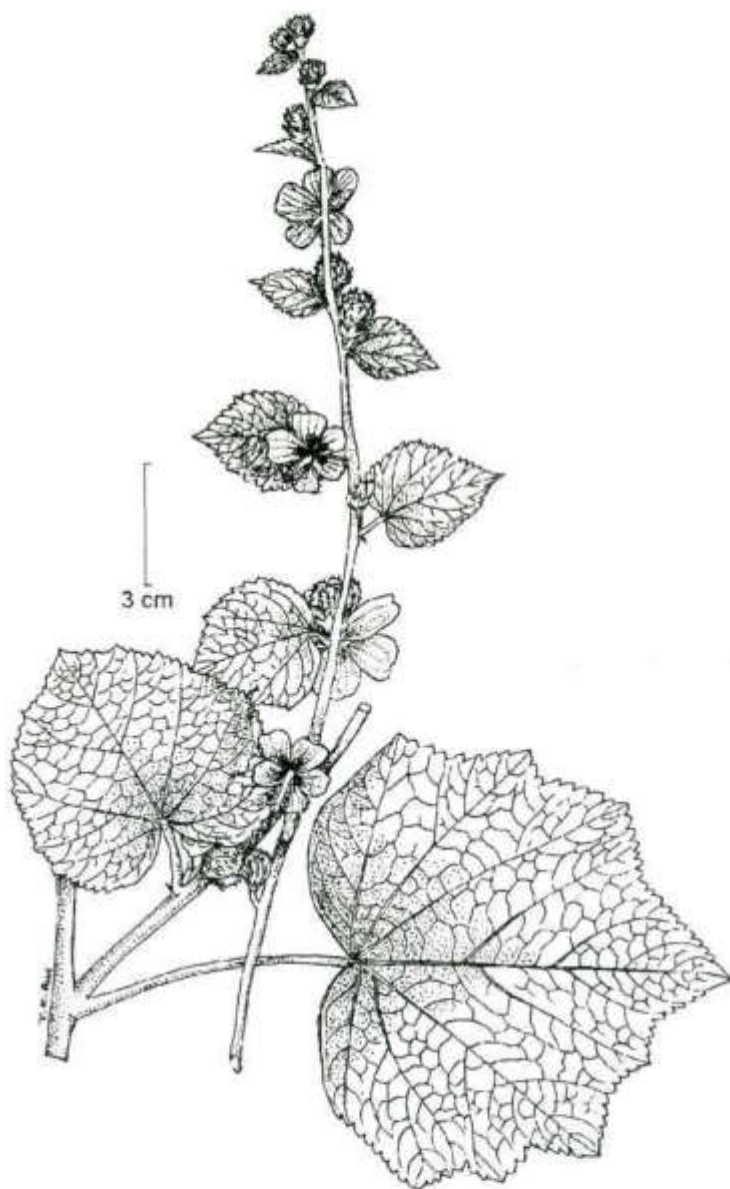


Fig. 109. *Urena lobata* L. subsp. *lobata* var. *lobata*

*Distrib.* India: Throughout.

**1.2. var. *viminea*** (Cav.) Guerke in Bot. Jahrb. 16: 375. 1892. *Urena viminea* Cav., Diss. 6: 335, t. 184 f. 1. 1788. *U. scabriuscula* Wight & Arn., Prodr. 46. 1834, non DC. 1824.

*Fl. & Fr.* Aug. - Dec.

*Distrib.* India: Throughout.

**2. subsp. *sinuata*** (L.) Borss. in Blumea 14: 142, 1966. *Urena sinuata* L., Sp. Pl. 692. 1753.

#### KEY TO THE VARIETIES

- |                                       |                                 |
|---------------------------------------|---------------------------------|
| 1a. Leaves angular to palmilobed      | <b>2.1. var. <i>glauca</i></b>  |
| b. Leaves palmatifid to palmatiparted | <b>2.2. var. <i>sinuata</i></b> |

**2.1. var. *glauca*** (Blume) Borss. in Blumea 14: 144. 1966. *Urena lappago* Smith var. *glauca* Blume, Bijdr. 2: 65. 1825. *U. scabriuscula* DC., Prodr. 1: 441. 1824. *U. lobata* L. var. *scabriuscula* (DC.) Masters in Fl. Brit. India 1: 329. 1874.

*Fl. & Fr.* Sept. - Dec.

*Distrib.* India: Throughout except temperate Himalayas.

**2.2. var. *sinuata***

**Fig. 110.**

*Fl. & Fr.* Aug. - Dec.

*Distrib.* as var. *glauca*.

#### 6. *Wissadula* Medikus

Annual or perennial herbs, undershrubs or shrubs. Leaves ovate, ovate-oblong to narrowly triangular or lanceolate, entire, palminerved. Flowers solitary, axillary or in lax or condensed terminal panicles. Epicalyx absent. Calyx cupular, 5-fid. Corolla small, rotate, yellow, rarely white. Staminal column very short. Ovary 5-carpellate, each carpel 2 - 3 or rarely 1-ovulate; styles 5, capitate-stigmatose at apex. Schizocarps globular to obconical; mericarps beaked, dehiscent, usually with a transverse constriction, thus seemingly bilocular, 3-seeded, 2 in upper part in collateral position and 1 in lower part, sometimes 2 or 1 by abortion. Seeds globular to reniform.

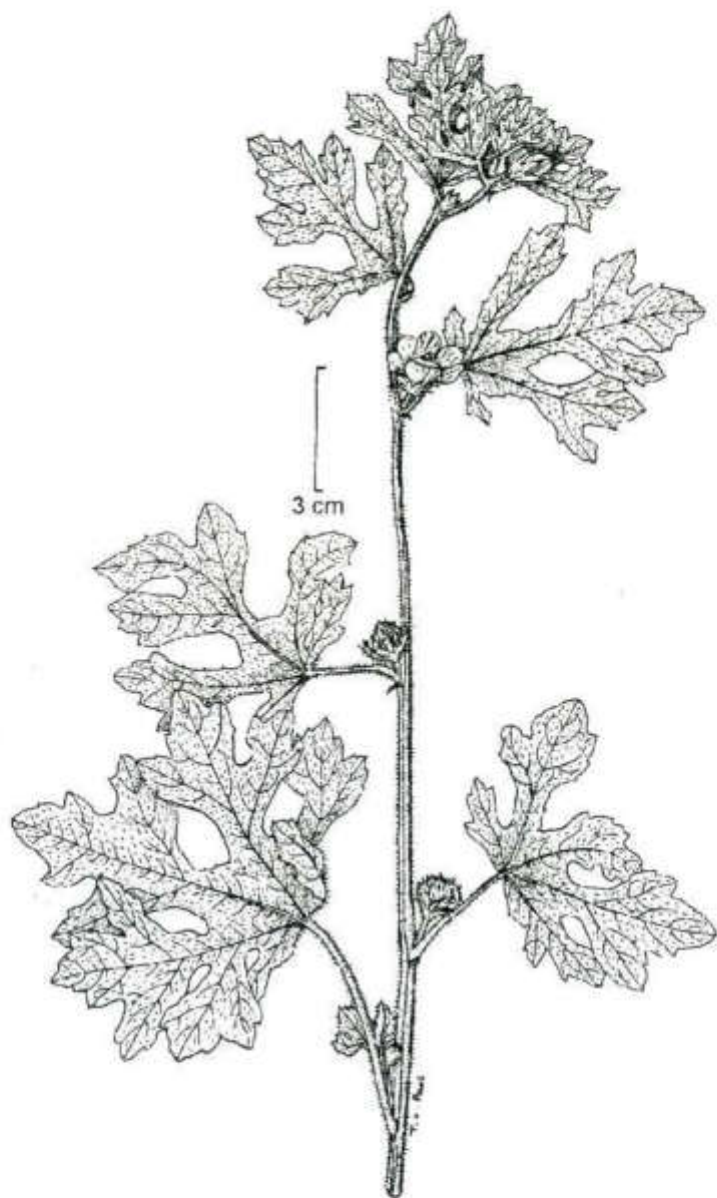


Fig. 110. *Urena lobata* L. subsp. *sinuata* (L.) Borss. var. *sinuata*

Tropical America, ca 40 species; 2 in India (one in naturalised and another cultivated.)

#### KEY TO THE SPECIES

- 1a. Leaves ovate to narrowly triangular, gradually acute or acuminate at apex, subcordate or truncate at base; flowers solitary or in lax panicles; corolla pale yellow; mericarps with a distinct transverse constriction  
**W. periplocifolia**
- b. Leaves orbicular to broadly ovate, deeply cordate at base, abruptly acuminate at apex; flowers in dense panicles; corolla white; mericarps with a faint or without a transverse constriction  
**W. contracta** (cultivated)

**Wissadula periplocifolia** (L.) Pers. ex Thwaites, Enum. Pl. Zeyl. 27. 1858. *Sida periplocifolia* L., Sp. Pl. 684. 1753; Roxb., Fl. Ind. 3: 172. 1832. *Abutilon periplocifolium* (L.) Sweet, Hort. Brit. 53. 1826; Wight & Arn., Prodr. 55. 1834. *Wissadula zeylanica* Medikus, Malv. 25. 1787. *W. rostrata* var. *zeylanica* (Medikus) Masters in Fl. Brit. India 1: 325. 1874.

Beng.: *Banvasma*, *Sahasravedi*.

Undershrubs, annual or perennial, stout, 1.5 - 2 m high; stems, petioles, pedicels and rachises velutinous to tomentose by minute and larger ferruginous stellate and simple hairs. Leaves 4 - 11 x 1 - 4.5 cm, narrowly triangular, ovate or lanceolate, shallowly cordate to truncate at base, long acuminate or acute at apex, entire, 5 - 7-nerved from base, sparsely stellate-hairy to glabrous beneath; petioles 5 cm long; stipules 1.5 - 4 cm long, filiform. Lower flowers axillary, solitary, mostly accompanied by a bud finally sprouting into a side branch; upper flowers in long terminal, lax, panicles; pedicels 1 - 4 cm long, accrescent up to 10 cm. Calyx lobes ca 2 x 1.5 mm, ovate to triangular, acute, densely short, simple hairy mixed with stellate hairs outside, glabrous inside. Corolla pale yellow with dark yellow lines, rarely white, 8 - 12 mm across; petals obovate, rounded to emarginate at apex, ciliate at base. Staminal column very short, glabrous. Schizocarps 6 - 10 mm across, obconic; mericarps ca 0.5 mm long, mucronate, dorsally rounded, sparsely hairy. Seeds 2.5 - 3 mm across, obconic to globular, rounded at apex, pointed at base, densely long, simple hairy especially on hilum.

*Fl. & Fr.* Nov. - March.

*Distrib.* India: Throughout as a weed.

Pantropical weed, native of tropical America.



## CULTIVATED SPECIES

1. **Abelmoschus esculentus** (L.) Moench, Meth. Pl. 617. 1794. *Hibiscus esculentus* L., Sp. Pl. 696. 1753; Masters in Fl. Brit. India 1: 343. 1874. *H. longifolius* Willd., Sp. Pl. 3: 827. 1800; Roxb., Fl. Ind. 3: 210. 1832.

Beng.: *Dehras, Bhindi*; Hindi: *Bhindi, Bhidi tori, Ram turai*; Guj.: *Binda*; Kan.: *Bhende*; Mar.: *Bhendi*; Mal.: *Bandai, Venda*; Tel.: *Venda, Bendakai*; Tam.: *Vendai, Vendakai*.

Herbs or undershrubs, ca 0.5 - 2 m high, stems and branches scattered with short stiff simple hairs, ultimately glabrescent. Leaves 4 - 20 x 4 - 25 cm, cordate at base, lamina variuosly dissected, usually 5 - 7-lobed, lobes acute, subacuminate at apex; petioles 4 - 30 cm long, accrescent up to 5 cm. Epicalyx segments 7 - 10, 5 - 10 x 1 - 2.5 mm. Calyx 2 - 3 cm long. Petals up to 5 cm long, yellow or whitish-yellow with dark purple centre. Capsules 5 - 20 (- 25) cm long. Seeds 3 - 5 mm, minutely warty, glabrous, dark brown.

*Fl. & Fr.* Throughout the year.

Cultivated in most tropical countries including India.

*Notes.* Numerous cultivars of this species are under cultivation. Some of the best known are 'clemson', 'spineless', 'American long green' and 'white velvet'. A new type 'Pusa Makhmali', isolated by the Indian Agricultural Research Institute, New Delhi bears green pods 15 - 20 cm long, straight, 5-ribbed and smooth. (Ambedkar, *Bull. Dep. Agric. Bombay*, No. 146. 1927; Venkataram, *Madras Agric. J.* 1945.)

Unripe fruits are used as vegetable throughout India. The bland mucilage from the fruits and seeds are medicinal.

2. **Abutilon grandifolium** (Willd.) Sweet, Hort. Brit. ed. 1, 53. 1826. *Sida grandifolia* Willd., Enum. Hort. Berol. 2: 724. 1809.

Shrubs, 1 - 3 m high, densely covered with long spreading patent simple hairs. Leaves 3 - 15 x 2 - 12 cm, ovate or lanceolate, somewhat orbicular, rarely 3-angled, cordate at base, acuminate to obtuse at apex, coarsely serrate; petioles 2 - 10 cm long; stipules 8 - 14 mm long, linear-lanceolate. Flowers axillary, 1 - 3 on a common peduncle; pedicels equal to or longer than petioles. Calyx lobes 1 - 2.5 x 1.5 cm, ovate, connate at base. Petals yellow, 1 - 1.5 cm long, obovate. Staminal column shorter than petals, stellate hairy. Schizocarps 1 - 1.5 cm across, ovoid; mericarps 10, 5 - 7 mm across, shortly beaked. Seeds 2 - 3 in each mericarp, ca 2 mm across.

*Fl. & Fr.* Oct. - April.

Tropical America and Africa, cultivated as an ornamental elsewhere in tropics including India.

**3. *Abutilon megapotamicum*** (A. Sprengel) St. Hill. & Naud. in Ann. Sci. Nat. Bot. Ser. 2, 18: 49. 1842; Matthew in Rec. Bot. Surv. India 20: 50. 1969. *Sida megapotamica* A. Sprengel, Tent. Suppl. 19. 1828.

Shrubs.

Cultivated in the hills of Tamil Nadu.

Native of Tropical America.

**4. *Alcea rosea*** L., Sp. Pl. 687. 1753. *Althaea rosea* (L.) Cav. Diss. 2: 91., t. 28. f. 1. 1786; Masters in Fl. Brit. India 1: 319. 1874. *A. coromandeliana* Cav., Diss. 2: 93. 1786.

Hindi: *Gulphaira*; Kash.: *Sudooposh*.

Annual, erect herbs, 1.5 - 2 m high, stellate-hairy, ultimately glabrescent. Leaves 3 - 13 x 3.5 - 12 cm, orbicular-cordate, deeply 3 - 7-lobed, lobes subrotundate or triangular, acute at apex, crenate to dentate; petioles 2 - 18 cm. Flowers solitary, axillary or in terminal racemes by reduction of upper leaves; pedicels 5 - 10 mm long, accrescent up to 15 mm in fruit. Epicalyx segments 6 - 7, 1 - 1.5 x 0.3 - 0.5 cm, ovate-lanceolate. Calyx lobes 15 - 20 x 5 - 10 mm, ovate to ovate-lanceolate. Petals 4 - 7 cm long, variously coloured, usually red. Staminal column 10 - 15 mm long. Schizocarps ca 2 cm across, depressed globose, pubescent, enclosed by calyx; mericarps 20 - 40, ca 4 mm across, longitudinally sulcate.

*Fl. & Fr.* March - Sept.

*Distrib.* Cultivated throughout India for its showy flowers.

*Notes.* According to Zohary (Bull. Res. Coun. Israel 11: 210. 1963), "Wild *A. rosea* L. seems to be indigenous almost exclusively on the Aegean Islands and the adjacent Balkan peninsula. The areas of its origin are no doubt the north-eastern Mediterranean countries, but not China which is beyond the natural range of the genus".

Flowers and seeds are medicinal. The flowers yield a red dye (anthocyanin) and is used as indicator in acidimetry and alkalimetry (Sobyanin and Soakov, *Chem. & abstr.*, 1930, 24, 1962).

**5. *Anoda hastata*** Cav., Diss. 1: 38, t. 11, f. 2. 1785; Masters in Fl. Brit. India 1: 321. 1874.

Herbs, hispid or glabrescent. Leaves hastate, rarely dissected or entire; stipules filiform. Flowers axillary or in terminal racemes. Epicalyx absent. Calyx 5-lobed, spreading. Corolla violet or yellow; petals 5. Ovary many-loculed; styles as many as carpels, ovule one in each carpel. Fruit schizocarp, mericarps separating from the axis, 1-seeded.

Rarely cultivated in North-western and Peninsular India. Native of tropical America.

**6. *Gossypium arboreum* L., Sp. Pl. 693. 1753; Masters in Fl. Brit. India 1: 347. 1874.**

Beng., Hindi, Guj., Mar. and Punj.: *Kapas, Rui, Tula*; Kan.: *Hathi*; Or.: *Karpaso, Kopa*; Tel.: *Patti, Karpassmu*.

Annual or perennial shrubs, 1 - 2 m high; branchlets densely covered with stellate and few simple hairs, ultimately glabrescent or glabrous, purple. Leaves ovate to orbicular, cordate at base, 3, 5 - or 7-lobed or parted with an extra tooth in the sinuses; petioles 1.5 - 12 cm long; stipules 0.5 - 1.5 cm long, linear to lanceolate, often falcate. Flowers axillary, solitary, pedicels 0.5 - 1.5 cm long. Epicalyx segments 1.5 - 3 x 1 - 2.5 cm, ovate, cordate at base, acute at apex, entire or dentate, accrescent. Calyx ca 5 mm long, cupular, 5-dentate at tip. Corolla pale yellow, with or without purple centre or occasionally completely red or purple; petals 3 - 4 cm long, obovate. Staminal column 1.5 - 2 cm long. Capsules 1.5 - 3 cm across, more or less rounded to ovoid or globular with 3 - 4 mm long beak, 3 - 4-loculed, locules 5 - 17-seeded. Seeds 5 - 7 mm across with floss and fuzz, floss white or rusty.

Cultivated in India.

*Notes.* Hutchinson and Ghose (*Ind. J. Agri. Sci.* 7: 233. 1957) maintained 3 varieties of this species, viz. i) var. *typicum* includes wild and primitive cultivated perennial types (ii) var. *neglectum* to include cultivated annual types (iii) var. *cecum* comprising annual ecotypes of Assam and Bangladesh hill tracts. Again, based on distribution they divided each of the first two varieties into 4 forms viz. *bengalense*, *indica*, *burmanica* and *sudanense*.

Borssum Waalkes (l.c.) maintained 2 varieties under this species, viz. *arboreum* and *obtusifolium* (Roxb.) Roberty, the first variety is only cultivated for experimental and ornamental purposes and the latter as a commercial crop.

#### KEY TO THE VARIETIES

- |   |                               |
|---|-------------------------------|
| 1a. Leaves palmatiparted with linear to lanceolate segments                 | 6.1. var. <i>arboreum</i>     |
| b. Leaves palmatilobed to palmatifid with obovate, ovate or oblong segments | 6.2. var. <i>obtusifolium</i> |

**6.1. var. arboreum**

*Gossypium arboreum* L., Sp. Pl. 693. 1753. *G. cernuum* Todaro, Oss. Sp. Cot. 31. 1863. *G. arboreum* L. var. *cernuum* (Todaro) J.B. Hutchinson & Ghose in Ind. J. Agric. Sci. 7: 248. 1937.

Cultivated in Assam, Meghalaya, Nagaland and also in gardens in most parts of India.

**6.2. var. obtusifolium** (Roxb.) Roberty in Candollea 13: 38. 1950, ampl.; Borss. in Blumea 14: 122. 1966. *Gossypium obtusifolium* Roxb., [Hort. Beng. 51. 1814. nom. nud.] Fl. Ind. 3: 183. 1832. *G. herbaceum* L. var. *obtusifolium* (Roxb.) Masters in Fl. Brit. India 1: 437. 1874.

Cultivated in all cotton growing areas of India.

**7. *Gossypium barbadense* L., Sp. Pl. 693. 1753; Masters in Fl. Brit. India 1: 347. 1874.**

Annual or perennial undershrubs, shrubs or small trees; branchlets minutely stellate-hairy, ultimately glabrescent. Leaves orbicular to ovate, cordate at base, deeply 3-5-lobed, lobes ovate-oblong, acuminate, sinuses usually thrown into folds; petioles as long as or slightly longer than lamina; stipules linear to lanceolate or ovate. Flowers axillary, solitary; pedicels shorter than petioles. Epicalyx segments almost as long as broad, orbicular to ovate, cordate at base, lacinate, teeth 10-15, triangular to linear. Calyx cupular, truncate or with 5, obtuse teeth. Corolla pale yellow with a purple tinge; petals obovate. Staminal column shorter than petals. Capsules ovoid, beaked. Seeds ovoid with long, white floss and fuzz.

Occasionally cultivated in India. Sometimes cultivated in gardens and homeyards.

*Notes.* The lint is used for spinning the sacred thread used by some Hindus.

## KEY TO THE VARIETIES

- |   |                             |
|---|-----------------------------|
| 1a. Capsules 5-8 cm long; seeds adhering to each other firmly in a solid column; corolla yellow with crimson centre | 7.1. var. <b>acuminatum</b> |
| b. Capsules 3-5 cm long; seeds free; corolla yellow with purple centre  | 7.2. var. <b>barbadense</b> |

**7.1. var. acuminatum** (Roxb.) Masters in Fl. Brit. India 1: 347. 1874. *G. acuminatum* Roxb., [Hort. Beng. 51. 1814. nom. num.] Fl. Ind. 3: 186. 1832.

Sporadically cultivated in India and Africa, while it is mainly cultivated in tropical S. America.

## 7.2. var. *barbadense*

In India attempts had been made to grow the cultivars of this variety (Sea Island types) in Punjab without success, however, 2 cultivars, viz. St. Vincent and Montserrat in Malabar (Kerala) and South Kanara (Karnataka) were reported to be successful. Cultivated in most tropical countries.

## 8. *Gossypium herbaceum* L., Sp. Pl. 693. 1753; Masters in Fl. Brit. India 1: 346. 1874.

Annual herbs or undershrubs, 1 - 1.5 m high; branchlets sparsely stellate-tomentose, glabrescent or glabrous. Leaves ovate-rounded, cordate at base, palmately 3, 5 or 7-lobed, lobes ovate-rounded or oblong-elliptic, acute or apiculate at apex; petioles 1.5 - 3.5 cm long; stipules 0.5 - 1 cm long, linear to lanceolate. Flowers axillary, solitary; pedicels 0.6 - 1.5 cm long. Epicalyx segments 1 - 2 cm long, ovate-cordate, slightly connate at base, gashed across the top into 7 - 9 fairly long lanceolate, teeth. Calyx 7 - 10 mm long, cup-shaped, undulate or truncate. Corolla yellow with purple centre; petals 2.5 - 3.5 x 2.5 - 4 cm, obovate. Staminal column ca 1 cm long. Capsules 3 - 4 cm long, ca 2.5 cm across, oblong-obtuse, 4-loculed. Seeds 5 - 7 in each locule, 5 - 8 x 3 - 6 mm, ovoid with floss and fuzz; floss greyish-white, fuzz grey.

Cultivated throughout in Cotton growing areas of India and throughout Tropical and subtropical regions of the Old World.

*Notes.* Hutchinson (Emp. Cott. Gr. Rev. 27: 123. 1950) recognized 5 land races of this species based on geographical distribution. These land races are *persicum* (in South Central Asia), *kuljianum* (in Chinese Central Asia), *acerifolium* (in N. Africa and Arabia), *wightianum* (in Western India) and *africanum* (in S. Africa). The land race *wightianum* includes nearly all the types of *G. herbaceum* grown in India.

## 9. *Gossypium hirsutum* L., Sp. Pl. ed. 2. 975. 1753. *G. herbaceum* L. var. *hirsutum* L., Sp. Pl. ed. 2. 975. 1753; Masters in Fl. Brit. India 1: 347. 1874.

Annual herbs or large, perennial undershrubs, 1 - 3.5 m high; stems much branched, greenish red, densely hairy or glabrous. Leaves 3 - 10 x 3 - 15 cm, more or less orbicular cordate at base, mostly 3-lobed, sometimes partially 5-lobed, lobes ovate to broadly triangular, acuminate at apex, sinuses acute, obtuse or rounded, slightly thrown up in a fold or not, upper leaves sometimes ovate and entire; petioles 2 - 10 cm long; stipules 6 - 12 x 2 - 5 mm, lanceolate to ovate-lanceolate, often falcate. Flowers axillary, solitary; pedicels 1 - 2 cm long. Epicalyx segments 2 - 4 x 1 - 3 cm, broadly ovate, cordate at base, lacinate, teeth 7 - 12, linear to lanceolate. Calyx cupular, 5 - 6 mm high, 4.5 - 5.5 mm across, with 5 rounded acuminate segments, nectaries distinct on veins. Corolla yellow to yellowish-white, rarely with purple centre; petals 4 - 6 x 3.5 - 4.5 mm, obovate. Staminal column 1 - 2 cm long. Capsules 3 - 4 x 2 - 3 cm, ovoid or rarely globular, 3 - 5-loculed. Seeds 3 - 5 mm long, ovoid, with copious floss and fuzz.

In India large scale cultivation of this species (American Cottons) is mainly in Punjab, Madhya Pradesh, Maharashtra and Tamil Nadu. Introduced from tropical America in most tropical countries of the old world including India.

*Notes.* Hutchinson (1951) recognized 7 geographical races under this species. These are *mourilli*, *richmondii*, *palmeri*, *punctatum*, *yucatenense*, *marie-galante* and *latifolium*. In India the land races *latifolium* and *marie-galante* are extensively cultivated, the former is agriculturally most important as it includes upland cottons grown in America, Asia and Africa.

**10. *Hibiscus mutabilis* L., Sp. Pl. 694. 1753; Masters in Fl. Brit, India 1: 344. 1874.**

Beng.: *Sthal padma*; Hindi: *Sthalkamal*; Kan.: *Suryakanti*; Mal.: *Chinappratti*; Or.: *Sthalpodmo*; Punj.: *Gul-i-jaib*; Tam.: *Sembarattai*.

Shrubs, up to 6 m high, bushy, rarely treelets; young portion densely stellate-hairy intermixed with copious simple glandular hairs. Leaves 10 - 22 cm in diam., suborbicular, cordate, palmately 3 - 7-lobed, lobes triangular, acute or long acuminate at apex, coarsely dentate or irregularly crenate, densely stellate-pubescent beneath, glabrate or sparsely stellate-pubescent above, 7 - 11-nerved at base; petioles 5 - 15 cm long; stipules linear, lanceolate, tomentose. Flowers axillary, solitary or subcorymbose at tip; pedicels 6 - 12 cm long, jointed 1 - 2 cm below flower. Epicalyx segments 8 - 12, 2 - 2.5 x 1 - 2 mm, linear-lanceolate, bend downwards initially, ultimately spreading. Calyx lobes connate up to middle, lobes 3 - 4 x 1 cm, accrescent, ovate-lanceolate, acuminate, densely stellate-pubescent with glandular hairs outside, densely stellate-hairy along margins inside, central and basal portion of inner surface long simple hairy, 5-nerved, yellowish-green. Petals 5 or multiples of 5, 6 - 8 cm long, suborbicular, shortly clawed, sparsely stellate-hairy outside, glabrous inside with long stellate hairs at base. Staminal column shorter than corolla, white or yellowish white, antheriferous throughout. Ovary ca 6 mm long, roundish-truncate with white silky hairs, 5-locular, ovules many in each locule. Capsules 2.5 cm long, subglobose, more or less emarginate, densely stellate-pubescent intermixed with simple glandular and long setose hairs. Seeds 2 mm long, reniform, dorsal and dorsolateral wall with radiating simple to 6-armed, long hairs, up to 2 mm, brownish.

*Fl. & Fr.* Sept. - Dec.

Cultivated in gardens throughout India up to 600 m.

Native of China.

*Notes.* The stem yields a fibre of inferior quality. Leaves and flowers are reported to be of medicinal value.

**11. *Hibiscus rosa-sinensis* L., Sp. Pl. 694; Masters in Fl. Brit. India 1: 334. 1874.**

Asm.: *Joba*; Beng.: *Joba*; Guj.: *Jasuva*; Hindi: *Jasut, Jasum*; Kan.: *Dasavala*; Mal.: *Chembarathi*; Or.: *Moondaro*; Punj.: *Jasum*; Sans.: *Japa, Java, Rudra pushpam*; Tel.: *Java pushpamu, Desans*.

Shrubs, up to ca 4 m high; stems woody, glabrous. Leaves 5 - 11 x 3 - 6 cm, ovate to ovate-lanceolate, somewhat tapering at base, acuminate at apex, serrate to dentate, crenate or entire and somewhat dentate towards apex, 3 - 5-palmately nerved at base, glabrous to sparsely stellate-hairy on nerves beneath; petioles 1.5 - 4 cm long, sparsely simple hairy; stipules 3 - 11 mm long, lanceolate, subulate, glabrous. Flowers axillary, solitary; pedicels mostly longer than petioles, jointed above the middle, pubescent. Epicalyx segments 5 - 8, about half as long as calyx, segments lanceolate, connate at base, sparsely stellate-pubescent. Calyx campanulate, lobes 1.5 - 2 cm long, lanceolate, stellate and glandular-pilose outside. Corolla 6 - 12 cm across, infundibular, blood red; petals obovate, entire. Staminal column 4 - 9 cm long, slightly exerted beyond corolla, antheriferous towards tip. Capsules globose, rarely formed.

KEY TO THE VARIETIES

- |   |                                 |
|---|---------------------------------|
| 1a. Leaves membranous, serrate to dentate or crenate throughout | 11.1. var. <i>rosa-sinensis</i> |
| b. Leaves coriaceous, entire excepting for dentate apex         | 11.2. var. <i>liliflorus</i>    |

**11.1. var. *liliflorus* Hochr. in Ann. Cons. Jard. Bot. Geneve 4: 134. 1900.**

Note. According to Roxburgh (Fl. Ind. 1832) it is wild in India, but so far it has not been collected in wild.

**11.2. var. *rosa-sinensis***

*Fl. & Fr.* Throughout the year.

Cultivated in gardens throughout India and other tropical and subtropical countries. Origin uncertain.

*Notes.* Leaves, flowers and seeds are reported to be of medicinal value. The flowers are reported to possess contraceptive property and their antifertility efficacy in rats has been confirmed. Ethanol and benzene extracts of flowers have also been reported to have significant antiestrogenic activity (Anand & Prakash in *Curr. Sci.* 48: 501. 1979).

**12. *Hibiscus sabdariffa* L., Sp. Pl. 695. 1753; Masters in Fl. Brit. India 1: 340. 1874.**

Asm.: *Chukiar*; Beng.: *Lalmista*, *Patwa*, *Chukar*; Hindi: *Lal Ambori*; Kan.: *Pulachakiri*, *Pundibija*; Mal.: *Polechi*, *Puichchai*; Mar.: *Lal-Ambadi*, *Patwa*; Tam.: *Pulich-chai*, *Kerai*, *Gogu*; Tel.: *Yerragogu*.

Erect herb, 1 - 2 m high; profusely or sparsely branched; stems unarmed green or reddish-purple, glabrous or somewhat pubescent. Leaves 4 - 11 x 0.5 - 1.8 cm, polymorphic, entire or palmately 3 - 5-fid or -partite or lobed, cuneate at base, lobation up to three-fourth of lamina, middle lobe longer, lobes lanceolate, ovate or oblong, acute at apex, serrate, glabrous, midrib reddish-purple or green with a nectary beneath; petioles 2 - 8 cm, green or reddish-purple; stipules ca 1.3 cm long, linear. Flowers axillary, solitary or in racemose panicles by decrescence of upper leaves; pedicels 1.5 - 2 cm long, jointed. Epicalyx segments 8 - 12, adnate to the base of calyx, lanceolate to oblong-elliptic, green or purple, persistent, usually finally appressed. Calyx campanulate, 1.5 - 4 cm long, becoming fleshy after anthesis, lobes 3-nerved, usually smooth or with few bristles, green or purple, persistent. Corolla yellow with a purple centre; petals 4 - 5 cm long. Staminal column shorter than petals. Capsules 1.5 cm across, ovoid, densely strigose. Seeds reniform, furfuraceous.

Cultivated throughout India and subtropical countries.

*Notes.* The Stem yields 'the Rozella hemp' of commerce which is strong and silky. The fibre is used as a substitute for jute. The fleshy calyces are edible as vegetable and also used for the preparation of jelly and soft drinks.

In India this species is cultivated under two varieties viz. var. *sabdariffa* and var. *altissima* Wester. The var. *sabdariffa* has a much branched stem, without hairs and prickles and anthocyanins pigments. There are four races of this variety i.e. *ruber*, *albus*, *intermedius* and *bhagalpuriensis* (Howard & Howard, 1911). The var. *altissima* differs from the var. *sabdariffa* by its height (3 - 4.5 m), stem with less anthocyanin pigment, hairs and bristles all over and fleshy calyx. The agricultural races are classified mainly on the basis of stem pigmentation. Var. *altissima* Wester is cultivated successfully in West Bengal, Bihar, Assam, Andhra Pradesh and Tamil Nadu as a Jute substitute.

13. *Hibiscus schizopetalus* (Masters) Hook. f. in Curtis. Bot. Mag. 3: 36. t. 6524. 1880; Haines, Bot. Bihar & Orissa 69. 1921. *H. rosa-sinensis* L. var. *schizopetalus* Masters in Gard. Chron. n.s. 12: 272. f. 45. 1879.

Beng.: *Lanthan jaba*.

Shrubs, 2 - 3 m high; stems woody; branches pendulous, glabrous. Leaves 2 - 8 x 1 - 4 cm, ovate-elliptic, more or less cuneate at base, acute at apex, coarsely serrate towards apex, 3 - 5-nerved at base, glabrous; stipules minute, subulate, caducous. Flowers axillary, solitary, pendulous, infundibular; pedicels 5 - 11 cm long, jointed near or above the middle, minutely ciliate. Epicalyx segments 6 - 7, 1 - 2 mm long, subulate,



minutely ciliate. Calyx tubular, ca 1.6 cm long, spathaceous, irregularly, 2 - 4-lobed, minutely ciliate outside, glabrous inside. Petals 4 - 7 cm long, scarlet or reddish white, deeply lacinate into many linear-oblong segments. Staminal column twice as long as petals, flaccid, pendulous, widened and antheriferous towards apex. Ovary pear shaped, minutely hairy; styles 1 - 1.3 cm long, ascending; stigmas capitate.

*Fl. & Fr.* Throughout the year.

Cultivated throughout tropics and subtropics of India.

Native of tropical E. Africa; cultivated throughout tropics.

**14. *Hibiscus syriacus* L., Sp. Pl. 695. 1753; Masters in Fl. Brit. India 1: 344. 1874.**

Beng.: *Swet joba*; Hindi: *Gurhul*; Punj.: *Gurhal*.

Shrubs, 3 - 6 m high, bushy; young branches pubescent with stellate hairs, ultimately glabrous. Leaves 4 - 7 x 1.5 - 5 cm, deltoid-ovate to rhomboid-ovate, often 3-lobed, cuneate at base, acute at apex, coarsely toothed, young leaves sparsely stellate-pubescent, ultimately glabrescent; petioles 1.2 - 2 cm, puberulous; stipules filiform. Flowers solitary, axillary; pedicels equal to or shorter than petioles. Epicalyx segments 6 - 8, 1 - 1.5 x 1 mm, linear, with one prominent nerve, sparsely stellate-hairy. Calyx 12 - 20 mm long, connate up to middle, lobes oblong or ovate-lanceolate, acute, sparsely stellate-hairy. Corolla 4 - 7.5 cm across; petals obovate, ciliate. Staminal column 2 - 4 cm long, antheriferous towards base, white. Capsules 1.5 - 2.5 cm high, obtuse or abruptly short beaked, sparsely hispid. Seeds pilose.

*Fl. & Fr.* June - Oct.

Cultivated in gardens throughout India.

Native of China.

*Notes.* This species is cultivated in the gardens for its showy flowers. There are several horticultural varieties classified mainly on the colour of the flower. Colour varies from blue purple to violet, red, buff and white. Several horticultural types with single, semidouble and double flowers are also known.

Stem yields strong fibres. Bark, roots, leaves, decoction of flower and seeds variously used in medicine.

**15. *Malvaviscus arboreus* Cav., Diss. 3: 131, t. 48. f. 1. 1787. *Hibiscus malvaviscus* L., Sp. Pl. 694. 1753.**

## KEY TO THE VARIETIES

- 1a. Leaves 3 - 5-lobed; corolla less than 3 cm long 15.1. var. **arboreus**  
 b. Leaves entire to 3-lobed; corolla more than 4 cm long 15.2. var. **penduliflorus**  
**15.1. var. arboreus.**

Cultivated throughout in India.

Native of tropical America.

**15.2. var. penduliflorus** (DC.) Schery in Ann. Miss. Bot. Gard. 29: 223. 1942. *M. penduliflorus* Mocino & Sesse ex DC. Prodr. 1: 445. 1824.

Cultivated throughout India.

Native of tropical America.

**16. Plagianthus pulchellus** A. Gray, Bot. U.S. Expl. Exped. 1: 118. 1854; Chandrase in Nair & Henry, Fl. Tamil Nadu 1: 36. 1983.

Shrubs.

Cultivated in the hills of Tamil Nadu.

**17. Wissadula contracta** (Link) R.E. Fries, K. Svensk. Vent. Ak. Hansl. n.s. 43, 4: 60. 1908. *Sida contracta* Link, Enum. Hort. Berol. 2: 204. 1822. *S. leschenaultiana* DC., Prodr. 1: 468. 1824. *Wissadula leschenaultiana* (DC.) Masters in Fl. Brit. India 1: 325. 1874.

Erect undershrubs. Leaves orbicular to broadly ovate or oblong, cordate at base, abruptly acuminate at apex, entire, white stellate-hairy with ferruginous ones on nerves beneath; petioles ca 10 mm long; stipules ca 10 mm long, linear to lanceolate. Flowers in terminal 20 - 30 cm long panicles; pedicels jointed near apex, accrescent. Calyx campanulate, 5-lobed, lobes triangular, acute, stellate-tomentose outside, glabrous inside. Corolla white ca 10 mm across; petals obovate, emarginate, ciliate at base. Staminal column short sparsely hairy. Schizocarps ca 10 mm across, globular; mericarps ovoid, acuminate at apex with sharp awns, dorsally minute hairy. Seeds globular to reniform, warty, stellate-hairy.

Cultivated in gardens of India.

Native of tropical America; introduced elsewhere.

## BOMBACACEAE

(M.P. Nayar & M.C. Biswas)

Trees, rarely shrubs (not in India); stems and branchlets aculeate, glabrous or lepidote or with stellate or simple hairs. Leaves alternate, simple or digitately compound; stipules fugacious. Inflorescences racemose, cymose, fasciculate or flowers solitary, very rarely cauliflorous. Flowers often large and showy, bisexual, actinomorphic, rarely somewhat zygomorphic, usually pentamerous, bracteolate, sometimes subtended by epicalyx, receptacle glandular or eglandular. Calyx coriaceous, campanulate, valvate, lobate or truncate, caducous, persistent, accrescent. Petals 5, rarely absent, contorted, usually adnate to the base of staminal tube. Stamens 5 - many, monadelphous to pentadelphous, rarely free; anthers 1 - 2 to many locular, free or coherent, hippocrepiiform, linear to more or less globular, dehiscing longitudinally, rarely circumscissile or apically poricidal; pollen grains triporate, colpate or colporate, the sexine reticulate or tegillate and spinulate, rarely granulate or smooth. Ovary superior, rarely half inferior, 2 - 6 or 10-loculed with 2 - many ovules in each locule, rarely 1 in each, placentation axile; style simple; stigma capitate or lobed. Fruit generally capsular, pericarp smooth or spinose, loculicidally dehiscent into 3 - 5 valves, sometimes longanate within, pulpy and indehiscent, 1 - many-seeded. Seeds glabrous, arillate or alate, often oleaginous; endosperm absent or scanty; embryo usually curved; cotyledons epigeal, flat or plicate, foliaceous or carnosae.

Pantropical, predominantly in tropical America, ca 26 genera and 225 species; 3 genera and 5 species in India.

*Literature.* BAKHUIZEN, R.C. VAN DEN BRINK (1924). Revisio Bombacearum. Bull. Jard. Bot. Btz. ser. 3, 6: 161 - 240, t. 26 - 28. EDLIN, H.L. (1935). A critical revision of certain taxonomic groups of the Malvales. New phytol. 14: 1 - 20, 122 - 143. DAVIS, T.A. (1967). Stamen number and pollen size in levo- and dextro-rotatory flowers of Bombacaceae. Rev. paleobot. Palynol. 3: 133 - 139. SHARMA, B.D. (1970). Contribution to the pollen morphology and plant taxonomy of the family Bombacaceae. Proc. Ind. Nat. Sci. Acad. (B) 36: 175 - 191.

### KEY TO THE GENERA

- 1a. Leaves simple, densely lepidote below; flowers small, ramiflorous, with an epicalyx; corolla absent; staminal tube 5-lobed; capsules globose or subglobose, spinose; seeds arillate **3. Cullenia**
- b. Leaves digitately compound; indumentum if present, of stellate or tufted hairs; flowers small or large, never ramiflorous, without epicalyx; corolla present; stamens mon- or pentadelphous; capsules oblong or ovoid, smooth; seeds exarillate **2**
- 2a. Stems armed; flowers large, peduncles thick, 1 - 2 cm long; stamens numerous, anthers hippocrepiiform; capsules 11 - 14 cm long **1. Bombax**
- b. Stems smooth; flowers small, peduncles up to 5 cm long; staminal tube divided into 5 filaments, each with 2 - 3 anfractose anthers; capsules 11 - 13 cm long **2. Ceiba**

### 1. *Bombax* L., nom. cons.

Trees, deciduous; trunk buttressed, aculeate or smooth, branching from the trunk in all directions at particular interval. Leaves alternate, petiolate, stipulate, digitately compound, 5 - 9-foliolate; leaflets articulate, sessile or petiolulate, glabrous or tufted hairy. Flowers, solitary or in clusters, axillary or subterminal, precocious, pedicellate; bracteoles 3, fugacious. Calyx campanulate to tubiform, coriaceous, truncate or irregularly 5 - 7-lobed at apex, caducous. Petals 5, linear to obovate or oblong, adnate to the base of staminal tube, caducous. Stamens numerous in 2 whorls of 5 - 6 bundles, connate at base and divided above into numerous long filaments; anthers medifixed, unilocular, hippocrepiform, dehiscing longitudinally, extrorse; pollen grains 3-colpate or 3-colporate, sexine reticulate. Ovary 5-locular, ovules many in each locule; styles filiform or clavate, divided into 5 spreading stigmatic branches at the tip. Capsules cylindrically oblong, tapering at both ends, woody, adpressed hairy outside, dehiscing longitudinally into 5 valves, valves densely covered with silky fibres inside; the central column winged and persistent. Seeds numerous, pyriform to globose, glabrous, exarillate, embedded in silky fibres, albumen scanty; cotyledons crumpled.

Tropical America, Africa and Asia, ca 8 species; 3 in India.

*Literature.* NICHOLSON, D.H. (1979). Nomenclature of *Bombax*, *Ceiba* (Bombacaceae) and *Cochlospermum* (Cochlospermaceae) and their type species. *Taxon* 28: 367 - 373. ROBYNS, A. (1963). Essai de monographie du genre *Bombax* s.l. (Bombacaceae). *Bull. Jard. Bot. Brux.* 83: 1 - 144, 145 - 316. SANTAPAU, H. (1963). *Salmalia malabarica* and *Salmalia insignis*. *J. Bombay Nat. Hist. Soc.* 56: 364 - 365.

#### KEY TO THE SPECIES

- 1a. Large trees up to 30 m tall; trunk and branches sparsely prickled or unarmed; leaflets petiolulate; flowers solitary or in clusters; styles 5-fid; capsules glabrous or velvety 2
- b. Small trees up to 15 m tall; trunk and branches prickled in clusters; leaflets sessile; flowers solitary; styles simple; capsules velvety **3. *B. scopulorum***
- 2a. Trunk with hard conical prickles; flowers 10 - 12 cm long, ca 12 cm in diam.; stamens generally 65 - 80 in 6 bundles with one central and 5 surrounding it; capsules 10 - 13 cm long, velvety; seeds dark brown **1. *B. ceiba***
- b. Trunk without prickles; flowers 12 - 17 cm long; stamens numerous in 5 bundles; capsules 18 - 22 cm long, glabrous; seeds black **2. *B. insignis***

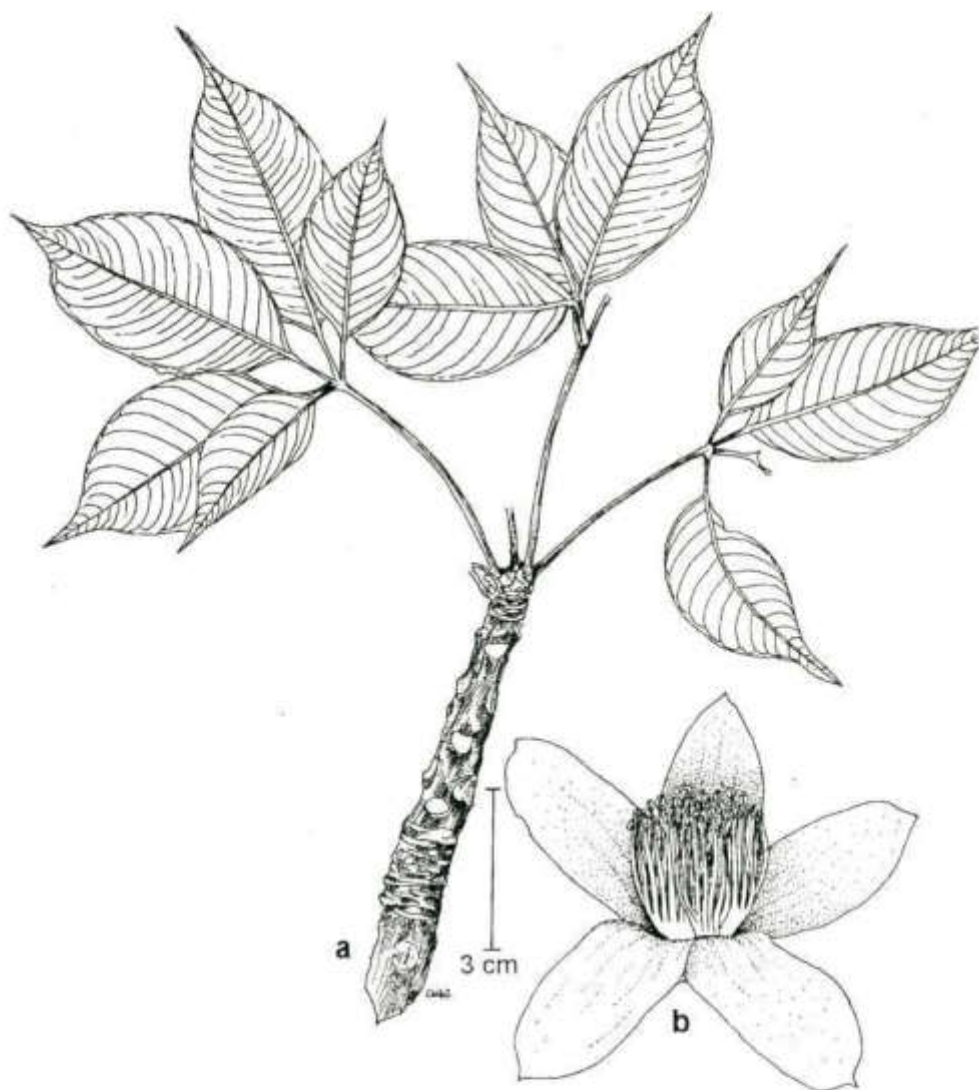


Fig. 111. *Bombax ceiba* L.: a. leafy twig; b. flower.

1. *Bombax ceiba* L., Sp. pl. 511. 1753 p.p.; Robyns in Taxon 10: 160. 1961 & in Bull. Jard. Bot. Brux. 83: 88, t.3.1963. *B. malabaricum* DC., Prodr. 1:479.1824; Masters in Fl. Brit. India. 1: 349. 1874. *Salmalia malabarica* (DC.) Schott in Schott & Endl., Melet. Bot. 35.1832. *Gossampinus malabaricus* (DC.) Merr. in Lingn. Sci. J. 5: 126. 1927.

Fig. 111.

Beng. & Hindi : *Simul* ; Mal.: *Mocha, Ilavu*; Sans. & Tel.: *Salmali*; Tam.: *Purani*.

Trees, 30 - 40 m tall; trunk straight, usually buttressed; bark greyish, aculeate when young with sharp, conical woody prickles; branches in whorls (3 - 5), spreading horizontally in all directions at intervals of 1.5 - 2.5 m, prickled, old prickles blunt. Leaves digitate, 5 - 7-foliolate; petioles 12 - 25 cm long; leaflets 12 - 24 x 7 - 10 cm, lanceolate to elliptic, tapering at base, usually long caudate or acuminate at apex, entire, glossy above, minutely tufted puberulous to glabrous beneath; petiolules 2 - 2.5 cm long. Flowers bright red or white showy, solitary or in clusters towards tips of leafless branchlets, 10 - 12 cm long; pedicels 1 - 2 cm long, thick, glabrous or tufted puberulous. Calyx campanulate, irregularly 2 - 5 lobed, lobes 3 - 4 x 3 cm, coriaceous, glabrous to sparsely puberulous outside, silky inside, falling off with corolla and stamens. Petals 5, bright red or white, 8.5 - 18 x 3.5 - 5 cm, obovate to elliptic-obovate, rarely oblong, recurved, fleshy, tomentellous outside, imbricate. Stamens 65 - 80, 3 - 7.5 cm long in 6 bundles in 2 series, the central bundle with 15 stamens, of which 5 longer (4 - 5 cm) and 10 shorter (3 - 3.5 cm) and 5 bundles in the outer series, each with 10 stamens (4.5 - 5 cm long); staminal tube short; filaments flat, angular; anthers involute, reniform, bilocular on longer filaments of central bundle, the rest unilocular. Ovary conical, minutely puberulous or glabrous; styles ca 6 cm long; stigmas 5-fid, lobes spreading. Capsules oblong to ovoid, cuneate at both ends, 11 - 18 cm long, velvety, 5-valved, valves silky inside. Seeds numerous pyriform, smooth, dark brown, embedded in creamy white silky fibers.

Fl. Feb. - March; Fr. April - May.

*Distrib.* India: Throughout up to 1500 m; often cultivated as an avenue tree.

*Notes.* Roots are reported to be a stimulant and are used as tonic in male impotency. Gum exuded from the trunk is used for curing dysentery and diarrhoea under the name "Mocha ras" by local people. The wood is light but hard and durable in water. The timber is used for construction of sea-going boats, for making plywood, packing boxes, match boxes and splinters. The Kapok' (Silk Cotton) produced from the fruits is extensively used for stuffing beds, pillows and quilts.

2. *Bombax insigne* Wallich, Pl. Asiat. Rar. 1: 71, t.79, 80. 1830; Masters in Fl. Brit. India 1: 349. 1874. *B. insigne* Wallich vars. *andamanica*, *polystemon* & *wightii* Prain in J. Asiat. Soc. Beng. 65: 62. 1893.

Beng.: *Semul*; Kh.: *Saitu*; Mal. & Tam.: *Ilavu*; Eng.: *The Silk Cotton Tree*.

Trees, up to 15 m tall; trunk marked with large leafscars, unarmed; branchlets sometimes prickly. Leaves digitate, glabrous, deciduous; leaflets 7 - 9, sessile, up to 12 cm long, obovate, cuspidate-acuminate at apex, glaucous beneath. Flowers 12 - 17 cm long, up to 22 cm in diam., solitary on leafless branchlets; peduncles stout, 1.5 cm long, curved, jointed. Calyx 3 - 5 cm long, campanulate, truncate or slightly bilobed, coriaceous, silky inside. Petals 5, scarlet 13 - 15 cm long, linear-oblong, narrowed at base, curved at apex, stellate-hairy outside. Stamens numerous in 5 bundles of 50 or more each opposite petals; filaments 8 - 10 cm long, unequal. Ovary ovoid, tomentose; stigmas 5-fid. Capsules 18 - 25 x 4 - 6 cm, 5 cm in diam., oblong, curved at apex, glabrous, 5-valved, woody. Seeds obovate, smooth, black, embedded in dense creamy silk fibers.

*Fl.* Jan. - March; *Fr.* April - May.

*Distrib.* India: Maharashtra, Karnataka, Tamil Nadu and Andaman & Nicobar Islands.

Myanmar.

*Notes.* very similar to *Bombax ceiba*, the wood is reported to be more durable than *B. ceiba*.

**3. *Bombax scopulorum*** Dunn in Bull. Misc. Inform. 1916: 65. 1916; Gamble, Fl. Pres. Madras 100. 1915. *B. insigne* auct. non Wallich 1830, Bourd., Trees Travancore 45. 1908.

Mal. & Tam.: *Kal ilavu*, *Parei ilavu*.

Small trees, up to 12 m tall; trunk up to 30 cm in diam. with ca 2 cm long sharp prickles in clusters of 2 - 12; bark grey. Leaves digitate; leaflets 6 - 8, sessile 12 - 22 x 5 cm, lanceolate, acuminate at both ends, dark green, glossy above; petioles 20 - 30 cm long. Flowers pink, solitary, large, up to 17 cm long and 10 cm in diam. Stamens numerous with long, white filaments; styles simple, exerted. Capsules 17 - 25 cm long, brown velvety. Seeds smooth, 6 mm in diam. black, embedded in white silky fibers.

*Fl.* Dec. - Jan.; *Fr.* Jan. - Feb.

*Distrib.* India: Tamil Nadu, Kerala and Andaman & Nicobar Islands.

## 2. *Ceiba* Mill. emend Gaertn.

Trees, generally tall, deciduous; trunk smooth, prickly when young; branches whorled. Leaves digitate, petiolate, 5 - 9-foliolate, leaflets articulate. Flowers solitary or clustered in axils of leaves or appear before them, actinomorphic, rarely zygomorphic, pedicellate, bracteolate; bracteoles tufted hairy fugaceous. Calyx campanulate to tubiform, truncate or irregularly 3 - 12-lobed, lobes valvate, persistent. Petals 5, white,

oblanceolate, adnate to the base of staminal tube, pubescent or glabrous inside. Staminal tube cylindrical, short, dividing into 5 filiform bundles bearing linear to anfractose anthers, anthers dehiscing longitudinally; pollen 3-colporate, sexine reticulate. Ovary superior or half inferior, ovoid, 5-loculed, ovules many in each locule; styles filiform dilated into 5-lobed stigma. Capsules oblong, ends pointed, coriaceous or woody, 5-valved, valves densely silky inside; central column winged and persistent. Seeds numerous, ovoid or globose, glabrous, exarillate, embedded in white silky cotton fibres; endosperm scanty; testa crustaceous; cotyledons leafy, contorted; radicles curved.

A small genus of ca 3 species mainly in America, one in tropical Africa. One species introduced and naturalised in hotter parts of India.

***Ceiba pentandra* (L.) Gaertn.**, Fruct. Sem. Pl. 2: 244, t.133 f.l. 1791; Alston in Trimen, Handb. Fl. Ceylon 6: 30. 1931. *Bombax pentandrum* L., Sp. Pl. 511. 1753. *Eriodendron anfractuosum* DC., Prodr. 1:479. 1824; Masters in Fl. Brit. India 1: 350. 1874. *E. pentandrum* (L.) Kurz in J. Asiat. Soc. Beng. 43: 113. 1874. *Eylon pentandrum* (L.) O. Kuntze., Rev. Gen. Pl. 1: 75. 1891. *Ceiba pentandra* (L.) Gaertn. var. *indica* (DC.) Bakh. f. in Bull. Jard. Bot. Buitenz. ser. 3, 6: 195. 1924. **Fig. 112.**

Beng.: *Swet simul*; Mal.: *Panya, Mullu lavu*; Mar.: *Safed savara, Salmali*; Sans.: *Swet salmali, Pulum imbul*; Tam.: *Panji, Ilavum*; Tel.: *Tella buraga*; Eng.: *Kapok, Floss* or *The white cotton tree*.

Trees, up to 20 m tall; trunk straight, smooth or prickly when young; buttressed at base; bark green; branches horizontal in whorls of 5 - 7 in all directions at intervals of 60 - 150 cm. Leaves digitate, 5 - 9-foliotate; leaflets 10 - 12 x 4 cm, narrowly ovate-oblong to obovate-oblong, narrowed at base, acute to acuminate at apex, entire, glabrous; petioles ca 14 - 20 cm long. Flowers usually in clusters of 3 - 10, axillary or grouped towards ends of leafless branchlets, rarely solitary, axillary; pedicels 2 - 3 cm long, stout, glabrous. Calyx campanulate, ca 1 cm long, irregularly 5-lobed, coriaceous, glabrous outside, silky inside, persistent. Petals usually 5, rarely 6, connate at base, 4 cm long, oblong to oblanceolate, rounded at apex, downy outside except at base, pubescent near apex inside, imbricate. Staminal tube divided into 5 phalanges, each dividing again into usually 3 filiform branches bearing 2 - 3 anfractose, 1-locular twisted anthers; sometimes one petaloid stamen present. Ovary globular or ovoid, glabrous, 5-locular, ovules many in each locule; styles 1 cm long, filiform, dilated above the staminal column; stigmas capitate or obscurely 5-lobed. Capsules 12 - 25 x 3.5 cm, up to 4 cm in diam. ellipsoid to fusiform, narrowed at both ends, coriaceous, green when young, browning with maturity, indehiscent or tardily dehiscing into 5-valves, septa membranous. Seeds numerous, globose to subpyriform, black with copious white silky fibres, testa thin; cotyledons leafy, crumpled; albumen scanty, radicle curved.

*Fl.* Dec. - Feb. ; *Fr.* Feb. - April.



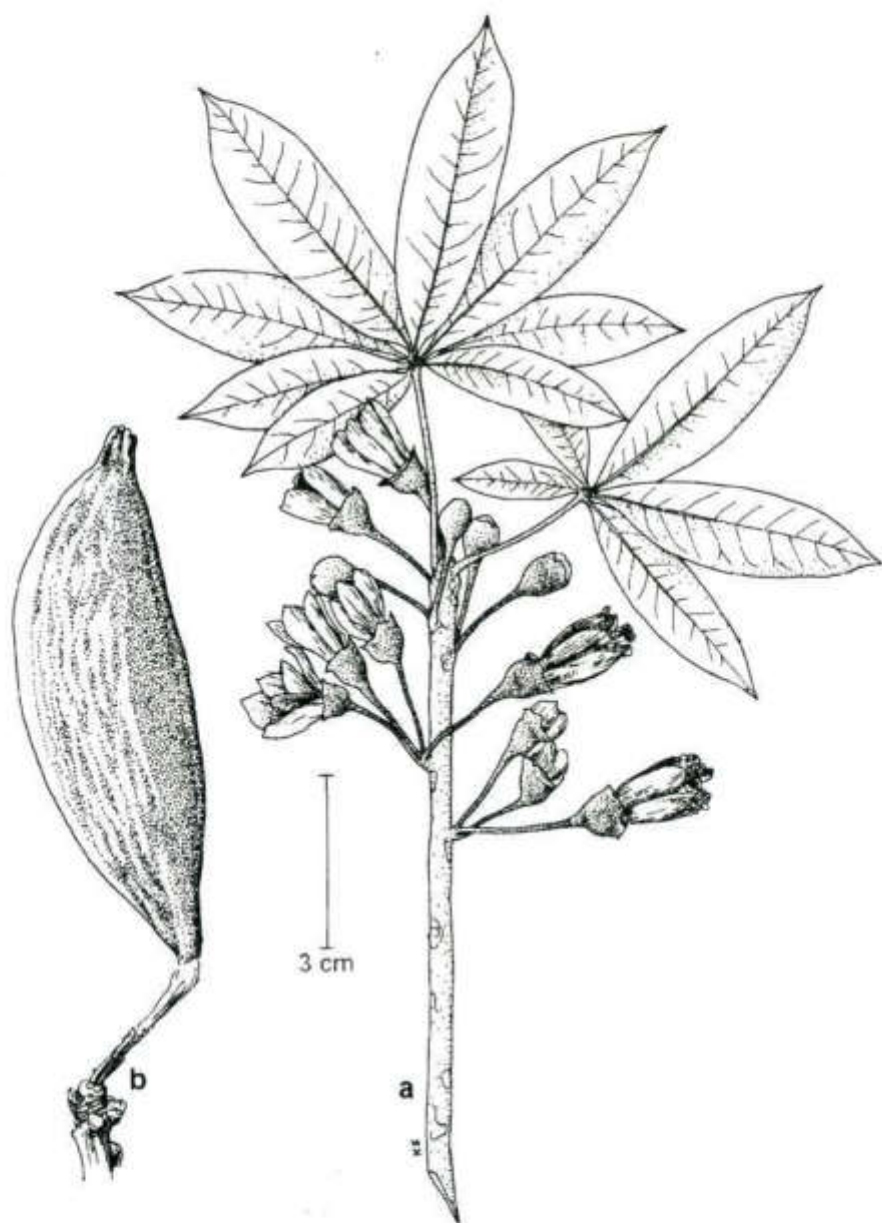


Fig. 112. *Ceiba pentandra* (L.) Gaertn. : a. flowering part of branch; b. fruit.

*Distrib.* Introduced and naturalised in all states of Peninsular India, West Bengal and Andaman & Nicobar Islands.

Native of tropical America.

*Notes.* Gum exuded from the trunk is an astringent used as tonic in bowel complaints. Roots are reported to be used in treating diarrhoea, as an antidote for scorpion sting and as a cure for diabetes. The other uses are similar to those of *Bombax ceiba* and *B. insigne*.

Often cultivated in gardens throughout India.

### 3. *Cullenia* Wight

Tall evergreen trees; branchlets lepidote. Leaves simple, oblong, rounded at base, acute to acuminate at apex, entire, glabrous and glossy on upper surface, covered with numerous overlapping scarious hyaline peltate scales on lower surface. Flowers ramiflorous, densely fasciculate on protuberances of stem and old branches; pedicels articulate near the middle, densely lepidote. Epicalyx irregularly 3 - 4-lobed, splitting to the base on one side, densely lepidote outside, deciduous. Calyx irregularly 5-dentate at apex, carnos, densely lepidote outside. Corolla absent. Staminal tube 5-lobed, each lobe with 7 - 11 stamens along the margin; filaments very short; anthers small, globose to subglobose, unilocular, circumscissile; pollen grains more or less sphaeroidal, 3-colporate, sexine finely granular to smooth. Ovary densely covered with long stipitate peltate scales, 5-locular, rarely 6, with 2 - 6 superposed ovules in each locule; style longer than staminal tube; stigma capitate and densely papillate. Capsules nearly globose covered with stout spines, dehiscent into 5-valves. Seeds 1-few in each locule, surrounded by fleshy aril.

Restricted to Sri Lanka and India; ca 3 species 1 in India.

*Literature.* KOSTERMANS, A.J.G.H. (1950). The genus *Cullenia* Wight (Bombacaceae). Reinwardtia 4: 69 - 74. RAIZADA, M.B. (1957). The genus *Cullenia* Wight. Ind. For. 83: 497 - 499. ROBYNS, A. (1970). A revision of the genus *Cullenia* Wight (Bombacaceae - Durioneae). Bull. Jard. Nat. Belg 40: 241 - 254.

*Cullenia exarillata* A. Robyns in Bull. Jard. Bot. Nat. Belg. 40: 249. 1970. *C. excelsa* Wight, Icon. Pl. Ind. Orient. 5:23, t.1761-62. 1852, p.p.; Masters in Fl. Brit. India 1: 350. 1874, p.p. & J. Linn. Soc. Bot. 14: 498. 1875, p.p. *C. rosayroana* Kosterm. in Comm. For. Res. Inst. Indonesia 51: 4, f.2e & 3.1956 & in Reinwardtia 4: 72. 1956, p.p. **Fig. 113.**

Mal.: *Karaini*; Tam.: *Korangu chakkai*, *Vedupla*, *Korangu Pola*.

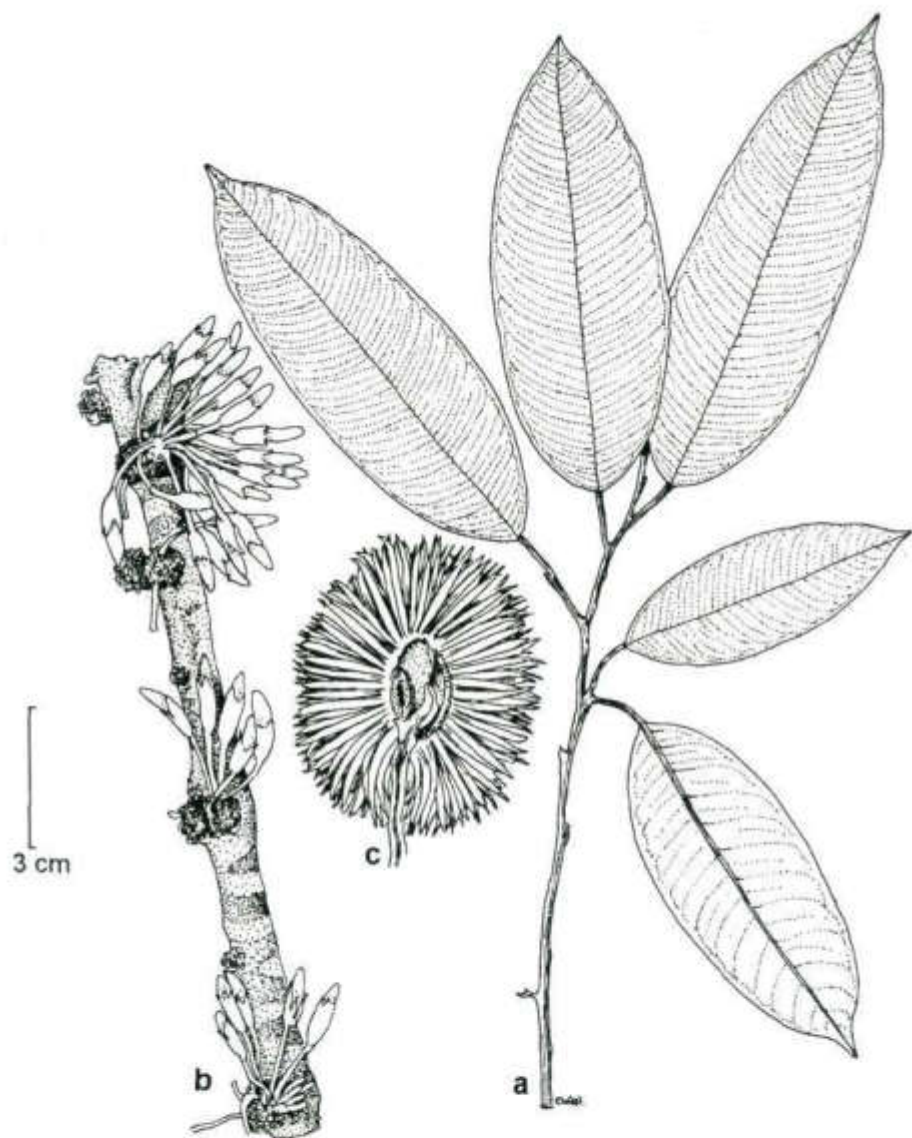


Fig. 113. *Cullenia exarillata* A. Robyns : a. leafy twig; b. part of branch showing cauliflorous flowers; c. l. s. of fruit.

Trees, up to 30 m tall; trunk straight, white, smooth, buttressed, 20 - 60 cm in diam. Leaves simple 10 - 17.5 x 3.5 - 5.5 cm, elliptic-lanceolate to oblong-lanceolate, rounded at base, shortly acuminate at apex, coriaceous, penninerved, midrib prominent; petioles 1.3 - 1.7 cm long, curved, densely lepidote. Flowers brownish white or olive green, ca 6 - 7 cm long, pedicels 2 - 2.5 cm long. Epicalyx 1 - 1.5 cm long, campanulate, 3 - 5-lobed at apex, densely lepidote outside, whitish puberulous inside. Calyx 3 - 3.5 cm long, tubular, 5-lobed at apex, densely lepidote outside, Corolla absent. Staminal tube ca 5 cm long, exerted, 5-lobed apically, each lobe ca 8 mm long with 7 - 9 stamens along the margin; free filaments 1.5 mm long; anthers globose, circumscissile. Ovary pentangular, densely lepidote, 5-locular with 3 - 6 ovules in each locule; styles ca 4.5 cm long, woolly with prominent scales at base; stigmas capitate, densely papillose. Capsules 12 - 14 cm in diam. almost globose with acute tip, spiny, spines 2.5 - 3 cm long, stout, brownish with puberulous base; pericarp 15 mm thick. Seeds 2 - 3 in each locule, dark brown, shining, ca 4.5 cm long, exarillate.

*Fl.* June - Aug.; *Fr.* Oct. - Dec.

*Distrib.* India: In evergreen forests of Western Ghats up to 1350 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

*Notes.* The fruits are relished by Giant Malabar squirrels.

#### CULTIVATED SPECIES

1. *Adansonia digitata* L., Sp. Pl. 1190. 1753; Masters in., Fl. Brit. India 1: 348. 1874.

Beng.: *Gadhagachh*; Hindi: *Gorak aml*; Tam.: *Papparappuli*; Tel.: *Simachinta*; Eng.: *The Baobab* or *Monkey Bread Tree*.

Trees, up to 25 m tall, deciduous; trunk short, thick up to 10 m in diam., abruptly tapering into thick branches, branches spreading, pubescent when young; bark usually smooth, greyish. Leaves usually gathered near tips of branchlets, digitate, 4 - 7-foliolate; petioles 10 - 25 cm long, pubescent when young, some- times glabrous; leaflets sessile to subsessile, ca 15 x 7 cm, oblong to obovate, cuneate and decurrent at base, gradually caudate-acuminate at apex, entire, tufted pubescent when young. Flowers showy, solitary, axillary, pendulous; peduncles ca 90 cm long, tomentose; bracteoles 2; flower buds globose to ovoid-elliptical, acute. Calyx triangular, acute at apex, sericeous inside, tomentose outside. Petals 5, 7 - 9 x 6 - 8 cm, obovate to flabelliform, rounded at apex, unguiculate; white becoming brown when dry, glabrous or sparsely hairy outside, adnate to the base of staminal tube. Staminal tube 5 - 7 cm long, cylindrical to conical, glabrous, divided above into numerous, slender filaments as long as tube; anthers 2 mm long, reniform. Ovary 5 - 10-loculed, hirsute, ovules many in each locule; styles 1 - 1.5 cm long,

exserted, hirsute at base; stigmas 5 - 10-lobed, lobes oblong, radiating. Capsules 20 - 40 cm long, oblong to oblong-ovoid, woody, longitudinally sulcate, acute at base, rounded at apex, indehiscent, 6 - 12 cm in diam., velvety tomentose outside. Seeds many, reniform, dark brown, embedded in farinaceous pulp, testa thick; albumen scanty; embryo curved; cotyledons contorted.

*Fl.* April - May; *Fr.* Sept. - Oct.

Cultivated in various parts of India, Uttar Pradesh, West Bengal, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu; Usually planted in gardens and near tombs of Muslim saints.

Native of tropical Africa.

*Notes.* All the known uses are reported from its original home in tropical Africa. The wood is light and soft. Owing to excessive thickness of the soft trunk, the natives in Africa hollow it and use as dwelling house. The bark yields fibre used for making ropes, young leaves are eaten as vegetable and a prophylactic against fever. Capsules are used as floats for fishing nets. The fruit pulp is also used as remedy in dysentery.

**2. Durio zibenthinus** Murray, Syst. Nat. Veg. ed. 13: 581. 1774; Masters in Fl. Brit. India 1: 351. 1874 & in J. Linn. Soc. Bot. 14: 501. 1875.

Eng.: *The Durian fruit* or *Civet cat fruit Tree*.

Trees, up to 30 m tall. Leaves simple, 12 - 18 x 5 - 6 cm, elliptic-oblong to obovate-oblong, rounded at base, acuminate at apex, entire, coriaceous, glossy above, scaly beneath, closely penninerved; petioles ca 2.5 cm long. Flowers creamy, in lateral, trichotomous cymes, ca 8 cm in diam.; peduncles subulate, angular, bracteoles 3, about half as long as calyx, caducous. Calyx campanulate, 5-lobed, coriaceous, densely covered with peltate scales. Petals 5, oblong, narrowed at base, longer than calyx. Stamens pentadelphous, connate at base, bundles opposite to and longer than petals; filaments many with 1-loculed anthers. Ovary oblong, 5-loculed, ovules many in each locule, scaly; styles long, tomentose; stigma capitate. Fruit sub globose to oblong, 20 - 30 cm long, indehiscent or longitudinally dehiscent, light brown, white pulpy inside. Seeds arillate; cotyledons fleshy.

*Fl.* Feb. - March ; *Fr.* May - June.

Cultivated in Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Native of Malay Peninsula.

*Notes.* The cream coloured sweet aril and the seeds are edible. The boiled unripe fruits are eaten as vegetable.

# STERCULIACEAE

(K.C. Malick)

Trees, shrubs, undershrubs, woody or perennial herbs, rarely annuals, rarely climbing; herbaceous portions more or less usually stellate pubescent; bark usually abounding in mucilage, inner fibrous. Leaves alternate, simple, lobed or digitate; stipules usually present, early caducous. Inflorescences various, usually cymose, sometimes 1-flowered, axillary to terminal. Flowers actinomorphic (except in *Helicteres* and *Kleinhovia*), bisexual or unisexual by abortion or polygamous. Sepals 5, usually more or less connate, rarely completely so, valvate. Petals 5 or absent, hypogynous, free or connate at base, contorted or imbricate. Stamens multi- or uniseriate by abortion, many in a column or 5, free; anthers in a head or in a single ring at the apex of the column or distributed on the outside of the tube or arranged along edge of cup or tube with intervening staminodes; anther locules, parallel or divergent, opening lengthwise by a slit or rarely by terminal pores. Ovary usually 2 - 5-carpellary, rarely unicarpellary, syncarpous or apocarpus; ovules many or few, attached to inner angle of the carpel, anatropous, ascending or horizontal; styles consolidated or as many as locules of ovary. Fruits often 5-valved, loculicidal capsules, woody, chartaceous, sometimes 1 - 6, spreading or spirally twisted follicles or samaras. Seeds few to many, sometimes arillate, occasionally winged; albumen fleshy, thin or absent; cotyledons flat, folded or rolled leafy.

Almost exclusively in tropics and subtropics, and rarely in temperate regions; ca 68 genera and 1100 species; 19 genera and 68 species in India.

*Literature.* ABEDIN, S. & A. GHAFOOR (1976) Sterculiaceae. In: NASIR, E. & ALI, F. W. Pakistan 99: 1 - 25. MALICK, K.C. & B. SAFUI (1982). A review of Androecium in Sterculiaceae with a key to the genera. Bull. Bot. Surv. India 22: 213 - 216. SHARMA, B.D. (1969). Studies of Indian Pollen grains in relation to taxonomy - Sterculiaceae. Proc. Natl. Inst. Sci. B, 35: 320 - 359. RAO, C.V. (1950). Pollen grains of Sterculiaceae. J. Ind. Bot. Soc. 29: 130 - 131.

## KEY TO THE GENERA

- |   |                         |
|---|-------------------------|
| 1a. Trees or shrubs (except <i>Byttneria herbacea</i> )   | 2                       |
| b. Herbs or undershrubs (except <i>Melochia umbellata</i> , <i>Melhania cannabina</i> , <i>M. futteyporensis</i> , <i>M. hamiltoniana</i> and <i>M. tomentosa</i> ) | 16                      |
| 2a. Flowers unisexual or polygamous; petals absent  | 3                       |
| b. Flowers bisexual; petals present   | 8                       |
| 3a. Leaves scaly beneath; fruits samaras  | 7. <i>Heritiera</i>     |
| b. Leaves without scales beneath; fruits follicular   | 4                       |
| 4a. Follicles opening long before maturity  | 5                       |
| b. Follicles not opening before maturity  | 6                       |
| 5a. Androgynophore exerted after anthesis   | 4. <i>Firmiana</i>      |
| b. Androgynophore remaining within flower after anthesis  | 14. <i>Pterocymbium</i> |

- |   |                         |
|---|-------------------------|
| 6a. Follicles membranous; seeds usually 2   | <b>8. Hillebrandia</b>  |
| b. Follicles coriaceous or woody; seeds many  | 7                       |
| 7a. Seeds winged  | <b>16. Pterygota</b>    |
| b. Seeds without wings  | <b>18. Sterculia</b>    |
| 8a. Staminal column bears fertile anthers throughout; staminodes absent   | <b>3. Eriolaena</b>     |
| b. Staminal column bears fertile anthers at apex; staminodes present  | 9                       |
| 9a. Staminal column adnate to gynophore forming stalk, dilated above into a cup; fertile anthers alternating with staminodes towards margin | 10                      |
| b. Staminal column free from carpels; anthers alternating with staminodes along the margin of the cupular column at its apex                | 13                      |
| 10a. Staminal column exerted  | <b>17. Reevesia</b>     |
| b. Staminal column remaining inside the flower  | 11                      |
| 11a. Flowers actinomorphic; staminal tube narrow, straight; seeds winged  | <b>15. Pterospermum</b> |
| b. Flowers zygomorphic; staminal tube dilated; seeds not winged   | 12                      |
| 12a. Large trees; fruits inflated   | <b>9. Kleinhovia</b>    |
| b. Usually shrubs, rarely small trees; fruits not inflated  | <b>6. Helicteres</b>    |
| 13a. Staminal column emarginate; capsules 5-winged  | <b>1. Abroma</b>        |
| b. Staminal column acute; capsules not winged   | 14                      |
| 14a. Fertile stamens 5; capsules covered with stiff spines and barbs  | <b>2. Byttneria</b>     |
| b. Fertile stamens 10 or 15; capsules tubercled or downy  | 15                      |
| 15a. Stamens 15; petals with hooded claw; capsules tubercled  | <b>5. Guazuma</b>       |
| b. Stamens 10; petals without hood; capsules downy  | <b>10. Leptonychia</b>  |
| 16a. Stamens 15 in 5 groups of 3 each; staminodes about 5 times longer than the stamens   | <b>13. Pentapetes</b>   |
| b. Stamens 5, solitary; staminodes if present up to twice the length of stamens   | 17                      |
| 17a. Staminal column present  | <b>11. Melhania</b>     |
| b. Staminal column absent   | 18                      |
| 18a. Ovary 5-carpellary; styles central   | <b>12. Melochia</b>     |
| b. Ovary 1-carpellary; styles excentric   | <b>19. Waltheria</b>    |

### 1. *Abroma* Jacq.

Trees or shrubs, stellate hairy. Leaves simple, alternate, cordate, ovate-oblong, serrulate, sometimes angled. Flowers bisexual, in few-flowered, leaf-opposed or sub-terminal or axillary peduncled cymes. Sepals 5, connate near the base. Petals 5, purplish, claw concave, broadly glandular at base, lamina large spatulate. Staminal cup bears 5 groups of fertile anthers in sinuses; staminodes longer than fertile filaments, obtuse. Ovary sessile, pyramidal, 5-locular, ovules many in each locule; styles 5, connivent. Capsules membranous, 5-angled, 5-winged, truncate at apex, septically 5-valved, valves villous at the edges. Seeds numerous; endospermous, embryo straight; cotyledons flat, cordate.

Tropical Asia to Australia and polynesia, ca 2 species; one in India.



**Abroma augusta** (L.) L.f., Suppl. Pl. 341. 1781, 'Ambroma'; Masters in Fl. Brit. India 1: 375. 1874. *Theobroma augusta* L., Syst. Nat. ed. 12: 233. 1770.

Asm.: *Bon-kapahi*, *Gorukia-korai*; Beng. & Hindi: *Ulatkambal*; Kh.: *Dieng-tyrkhum*; Eng.: *Devil's cotton*.

Large shrubs or small trees, 2 - 4 m tall; branches downy. Leaves 10 - 20 (- 30) x 5 - 15 (- 25) cm; ovate-lanceolate, ovate-oblong, cordate at base, acute or acuminate at apex, repand-denticulate, glabrescent above, tomentose beneath; petioles 1.5 - 2.5 cm long; stipules linear, as long as the petioles, deciduous. Flowers few in leaf-opposed, subterminal or axillary peduncled cymes, 5 cm in diam. Sepals ca 2 x 0.6 cm, lanceolate, connate at base, persistent. Petals ca 2.8 x 1.2 cm with hooded ca 5 mm long claw and spoon-shaped lamina, claws hairy outside. Stamens 3 in each group in the sinus; staminodes ca 2 x 1 mm, hairy, emarginate. Ovary 2.5 - 3 x 2 mm, oblong, 5-lobed, sessile; styles ca 2 mm long. Capsules 3.5 - 4 cm long, obpyramidal, membranous, 5-angled, truncate at apex, septicidally 5-valved, valves villous at the edge. Seeds many, ca 3 x 2 mm, obovate.

*Fl.* June - Sept.; *Fr.* June - Feb.

*Distrib.* India: In eastern parts and Uttar Pradesh.

Nepal, Bhutan to China, Malesia and Micronesia.

## 2. *Byttneria* Loeffl., nom. cons.

Herbs, shrubs or trees, often climbers, usually prickly. Leaves simple, alternate, lobed or entire; petiolate. Flowers minute, bisexual in much branched axillary or terminal umbellate cymes. Sepals 5, connate at base. Petals 5 with a narrow claw and a hooded limb which usually enter the staminal cup and cover the anther lobes, sometimes with two strap-shaped appendages on both sides of the hood and a long process. Staminal cup with an inner series of 5 stamens and an outer series of 5 staminodes alternating with stamens; anther lobes reniform, divergent, extrorse; staminodes ovate, acute. Ovary small, 5-loculed; ovules 2 in each locule; styles entire or 5-fid. Capsules globose, spiny, or prickly, septicidally 5-valved, valves breaking away from the central column. Seed 1 in each locule, exalbuminous; cotyledons folded.

Tropical America, Africa, Mascarene Islands, Tropical Asia, West Polynesia, ca 50 species; 4 in India.

## KEY TO THE SPECIES

- |  |                           |
|--|---------------------------|
| 1a. Leaves entire  | 2                         |
| b. Leaves lobed  | 3                         |
| 2a. Leaves longer than broad, up to 7 cm long, membranous, dentate | 3. <i>B. herbacea</i>     |
| b. Leaves orbicular, up to 20 cm in diam., chartaceous, entire     | 2. <i>B. grandifolia</i>  |
| 3a. Leaves glabrescent; capsules covered with stiff spines         | 1. <i>B. andamanensis</i> |
| b. Leaves pilose; capsules covered with barbed prickles            | 4. <i>B. pilosa</i>       |

**1. *Byttneria andamanensis*** Kurz in J. Asiat. Soc. Beng. 40: 47. 1871; Masters in Fl. Brit. India 1: 377. 1874; Parkinson, For. Fl. Andaman 102. 1923.

Scandent or climbing shrubs; stems terete; young shoots sparsely soft puberulous. Leaves 10 - 18 x 8 - 16 cm, broadly ovate, shortly 3 - 5-lobed, lobes, membranous, deeply cordate and 5 - 7-nerved at base, acuminate or acute at apex, irregularly and closely toothed, softly pubescent when young, glabrescent at maturity, puberulous along the nerves; petioles 6 - 16 cm long, glabrous; stipules ca 1.2 cm long, subulate, deciduous. Flowers on slender pedicels in 2 - 3-chotomously branched, slender, minutely puberulous, axillary cymes. Sepals 4 - 5 x 1 mm, ovate, acute, connate at base. Petals 4.5 - 6 mm long with a slender claw and a hooded limb which covers anthers outside the staminal cup; staminodes ovate, acute. Ovary 1 mm long, 5-loculed; styles as long as the ovary. Capsules 2 - 2.4 cm in diam., globose, septicidally 5-valved, glabrous, covered with unequally long stiff spines. Seeds 4 - 5 x 2 - 3 mm, triangular, 1 in each locule.

*Fl.* May - Aug.; *Fr.* Oct.

*Distrib.* India: Often found near the coasts and along creeks. Andaman & Nicobar Islands.

Myanmar.

*Notes.* The bark yields a mucilage which is used for making hair-wash.

**2. *Byttneria grandifolia*** DC., Prodr. 1: 486. Jan. 1824. *Buettneria aspera* Colebr. ex Wallich in Roxb., Fl. India 2: 383. March-June 1824; Masters in Fl. Brit. India 1: 377. 1874.

Fig. 114.

Large, woody climbers or trees; bark dark brown, longitudinally or spirally close furrowed on old stems; branchlets grooved, stellate pubescent. Leaves 10 - 20 cm in diam., suborbicular or broadly ovate-oblong, cordate at base, obtuse or abruptly acuminate at apex, entire or obscurely repand, chartaceous, glabrescent and shining above, puberulous on nerves beneath, 5 - 7-nerved at base; petioles 5 - 13 cm long, grooved, puberulous; stipules 8 - 12 mm long, linear-lanceolate, early caducous. Flowers minute,

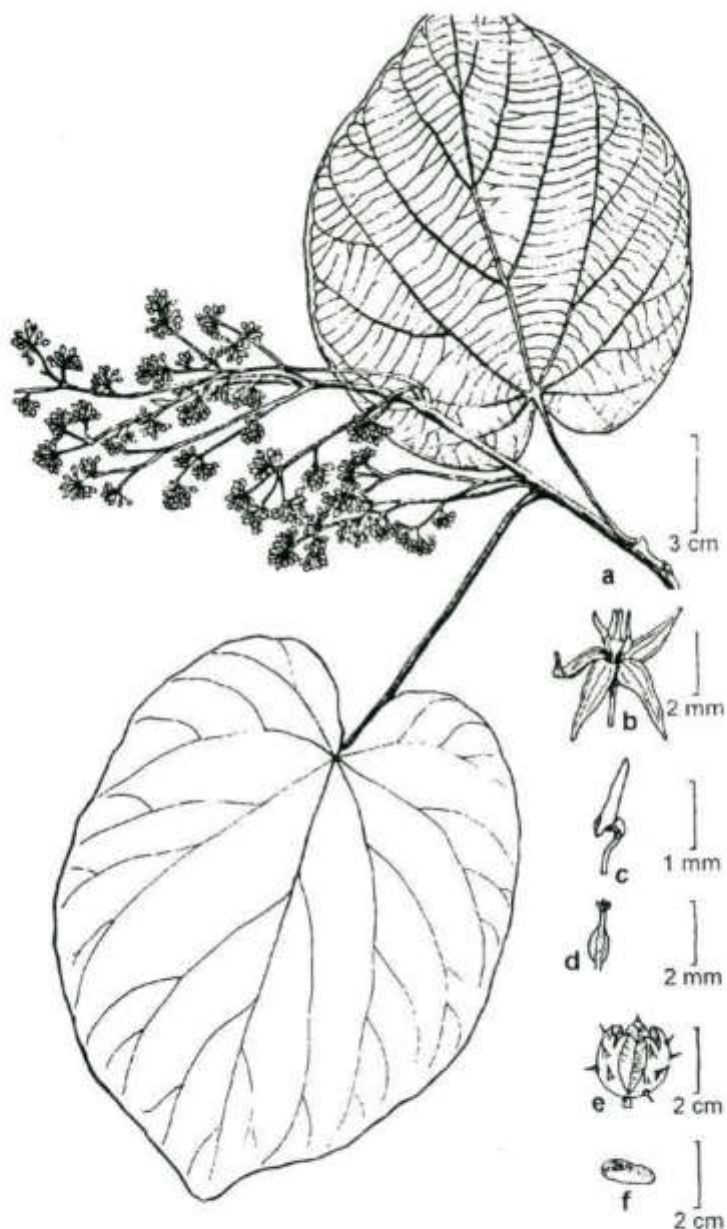


Fig. 114. *Byttneria grandifolia* DC. : a. flowering part of branch; b. flower; c. petals showing hooded limb and long appendage; d. pistil; e. fruit; f. seed.

in axillary, umbellate cymes; pedicels slender; bracts and bracteoles subulate. Sepals ca 3 x 1 mm, lanceolate to deltoid, hairy outside. Petals ca 2 mm long with short, narrow claw and limb with hood and an entire appendage which enter into the staminal cup covering the anther lobes. Anther lobes reniform, divergent; staminodes ovate. Ovary ca 1 mm in diam., styles about as long as ovary, 5-fid at tip. Capsules 2 - 4 cm in diam., globose, woody, covered with stout sharp, distant, curved prickles. Seed 1 in each locule, ca 12 x 7 mm, elliptic-oblong, triangular.

*Fl.* April - June; *Fr.* Sept. - March.

*Distrib.* India: Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya and Andaman & Nicobar Islands.

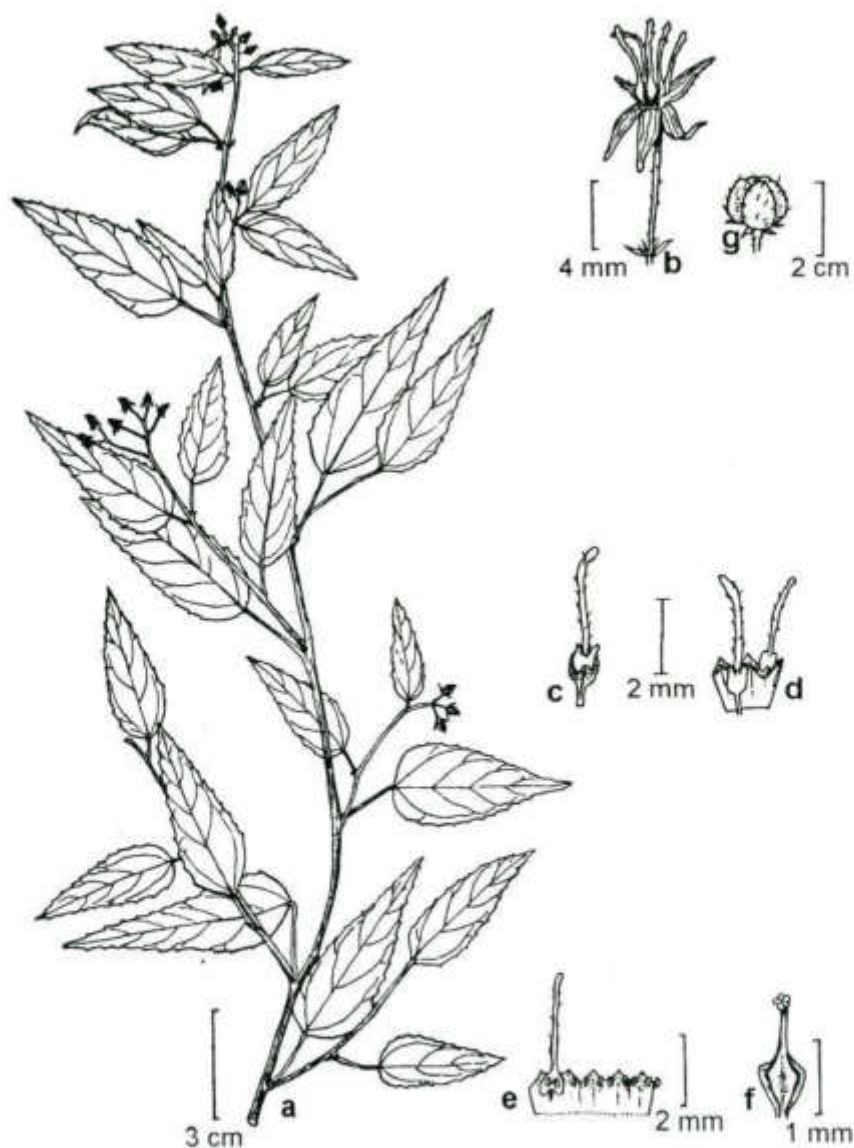
Nepal, Bhutan, Bangladesh, S. China, and Indo-China.

3. *Byttneria herbacea* Roxb., Pl. Corom. 1: t. 29, 1795; Masters in Fl. Brit. India 1: 376. 1874. Fig. 115.

Herbs, prostrate or ascending, sparsely branched, unarmed, with perennial root stock; stems angular when young, terete with age, stellate-tomentose. Leaves 1.5 - 7 x 1 - 3 cm, ovate, oblong, ovate-lanceolate to lanceolate, obtuse, rounded or subcordate at base, acute or acuminate at apex, irregularly dentate, sparsely hairy, more so along margins and veins; 3 - 5-nerved at base; petioles 2 - 3.2 cm long, slender, pubescent; stipules 2 mm long, subulate, equalling petioles. Flowers 2 - 3 in cymes arising from short axillary 1 cm long peduncles; pedicels ca 4 mm long, subulate; bracts 2 - 6, 1 - 2 mm long. Sepals up to 4 x 1.5 mm, connate at base, narrowly ovate-lanceolate, long acuminate, 3-nerved, sparsely tomentose outside, reflexed. Petals maroon coloured, up to 5 mm long, puberulous, claw slender, limb subulate with hood and 2-fid appendages which enter inside the staminal cup covering the stamens. Stamens in inner series of the staminal cup; anther lobes reniform, divergent; staminodes ovate, acute. Ovary 1 mm in diam., 5-loculed, sparsely hairy; styles 1 mm long, terete; stigmas lobed. Capsules globose, septically 5-valved, shortly prickly, apically horned. Seeds 1 in each locule, 3 x 2 mm, flat, muricate.

*Fl. & Fr.* Throughout the year

*Distrib.* India: An undergrowth in deciduous forests and shady places. Uttar Pradesh, Assam, Nagaland, West Bengal, Orissa, Andhra Pradesh, Karnataka and Tamil Nadu.



**Fig. 115.** *Byttneria herbacea* Roxb. : **a.** flowering part of branch; **b.** flower; **c.** petal showing hooded limb and long appendage; **d.** staminal column showing position of petals covering the stamens; **e.** split staminal column showing inner series of stamens; **f.** pistil; **g.** fruit.

4. *Byttneria pilosa* Roxb., Fl. India 1: 618, 381. 1824; Masters in Fl. Brit. India 1: 377. 1874.

Asm.: *Dim-soh-doukha*, *Dum-shoh-dowkha*; Kh. : *Jirmi*.

Large woody climbing shrubs; branchlets grooved, hispid with spreading hairs or sparsely stellate hairy. Leaves 10 - 18 x 6 - 15 cm, often broader than long, orbicular or ovate, shortly 3 - 5-lobed, lobes deltoid, entire or serrulate, abruptly acuminate, membranous, stellate-pilose on both surfaces. 7 - 9-nerved at base, midrib glandular; petioles 5 - 20 mm long, shaggy tomentose. Flowers minute, in much branched, pubescent axillary cymes; bracteoles subulate. Sepals ca 3 x 1 mm, ovate-lanceolate, acute. Petals yellow, incurved, shorter than the sepals with a slender claw and a hooded limb, the apex of which covers fertile anthers, a long process develops from upper side of hood. Anther lobes reniform, divergent; staminodes ovate. Ovary 1 mm long, 5-locular; styles about as long as the ovary. Capsules 1.2 cm in diam., globose, densely covered with subulate barbed prickles, septically 5-valved. Seeds 1 in each locule, ca 5 x 3 mm, triangular.

Fl. Sept. - Nov.; Fr. Nov. - May.

Distrib. India: West Bengal (Darjeeling), Sikkim, Assam Meghalaya and Manipur.

Bangladesh and Myanmar.

### 3. *Eriolaena* DC.

Large, stout shrubs or small trees, herbaceous portions usually stellate-hairy. Leaves simple, or lobed, alternate, usually cordate at base, crenate-serrate, stellate-hairy above, tomentose beneath, 5 - 9-nerved at base; petiolate; stipules caducous. Flowers in 1 - many-flowered peduncled cymes, pedicelled. Involucral bracts 3 - 5, multisect or entire or lobed. Sepals 5, spathaceous at first, ultimately 5-parted; stellate-pubescent. Petals 5, flat with dilated tomentose claws. Stamens many-seriate on long, erect column, usually pubescent; anthers 2-loculed, with locules parallel. Ovary sessile, 5 - 10-loculed; styles erect; stigmas 8 - 10-lobed or more, revolute. Capsules woody, loculicidally valved, beaked at the apex. Seeds many, winged at the apex, endosperm scanty; cotyledons plaited or contruplicate.

Exclusively in Asia (China and India), ca 8 species; 7 in India.

#### KEY TO THE SPECIES

- |  |                        |
|--|------------------------|
| 1a. Involucral bracts multisect or lacinate        | 2                      |
| b. Involucral bracts entire or nearly so           | 6                      |
| 2a. Involucral bracts near the sepals              | 3                      |
| b. Involucral bracts at a distance from the sepals | <i>E. lushingtonii</i> |

- |  |                               |
|--|-------------------------------|
| 3a. Peduncles 1 or 3-flowered  | 4                             |
| b. Peduncles many-flowered   | 5                             |
| 4a. Peduncles 1-flowered, shorter than the leaves                              | 7. <i>E. wallichii</i>        |
| b. Peduncles 3-flowered, longer than the leaves                                | 6. <i>E. stocksii</i>         |
| 5a. Styles glabrous; valves keeled or rounded, villous or glabrous in capsules | 1. <i>E. candollei</i>        |
| b. Styles pubescent; valves tubercled or pitted in capsules                    | 2. <i>E. hookeriana</i>       |
| 6a. Leaves ovate, scabrid above  | 5. <i>E. spectabilis</i>      |
| b. Leaves roundish, thinly stellate-hairy                                      | 4. <i>E. quinquelocularis</i> |

1. *Eriolaena candollei* Wallich, Pl. Asiat. Rar. 1: 51, t. 64. 1830; Masters in Fl. Brit. India 1: 370. 1874.

Kan.: *Kadegi*; Mar.: *Bothi, Hadang*.

Trees; bark grey; herbaceous portions stellate-hairy. Leaves 12.5 - 17.5 x 7.5 - 12.5 cm, broadly ovate, cordate at base, acute or acuminate at apex, crenate or crenate-dentate, glabrous or sparsely stellate-hairy above, grey tomentose beneath, 5 - 7-nerved; petioles 4 - 6.5 cm long. Flowers yellow in many-flowered, peduncled, corymbose cymes at the extremities; peduncles shorter than leaves; involucre bracts pinnatifid, pubescent. Sepals slightly longer than bracteoles, linear-oblong to lanceolate, acute, pubescent on both surfaces, glandular within at base. Petals oblong notched at apex, claw thick, villous. Stamens many in irregular series on staminal column. Ovary ovoid; styles glabrous; stigmas 8 - 10, revolute. Capsules 4 - 5 x 2 - 2.5 cm, woody, ovoid, acute, beaked, 10-lobed, 10-valved; valves oblong, acute, keeled or rounded at the back, villous or rarely glabrous along inner margins. Seeds many, imbricate.

Fl. March - May; Fr. Oct.

*Distrib.* India: Uttar Pradesh, Madhya Pradesh, Maharashtra and Karnataka.

Bhutan and Myanmar.

2. *Eriolaena hookeriana* Wight & Arn., Prodr. 70. 1834; Masters in Fl. Brit. India 1: 370. 1874. Fig. 116.

Mar.: *Bute, Bother*; Or.: *Bonta*; Sant.: *Ganguli*; Tel.: *Nar botku*.

Shrubs or small trees, up to 10 m tall; herbaceous portions stellate-tomentose. Leaves 10 - 13 cm in diam., roundish to cordate, cordate at base, acuminate at apex, irregularly crenate-dentate, dotted with small tufts of stellate hairs above and finely rusty pubescent beneath, nerves 5 - 9 at base, prominent beneath; petioles 2 - 11 cm long, rather stout, stellate-tomentose. Flowers many, in axillary, peduncled cymes; peduncles up to 15 cm long, stout, stellate-hairy becoming glabrous with age; involucre bracts shorter than calyx, multiseptate, segments linear; pedicels up to 4 cm long. Sepals 1.5 -

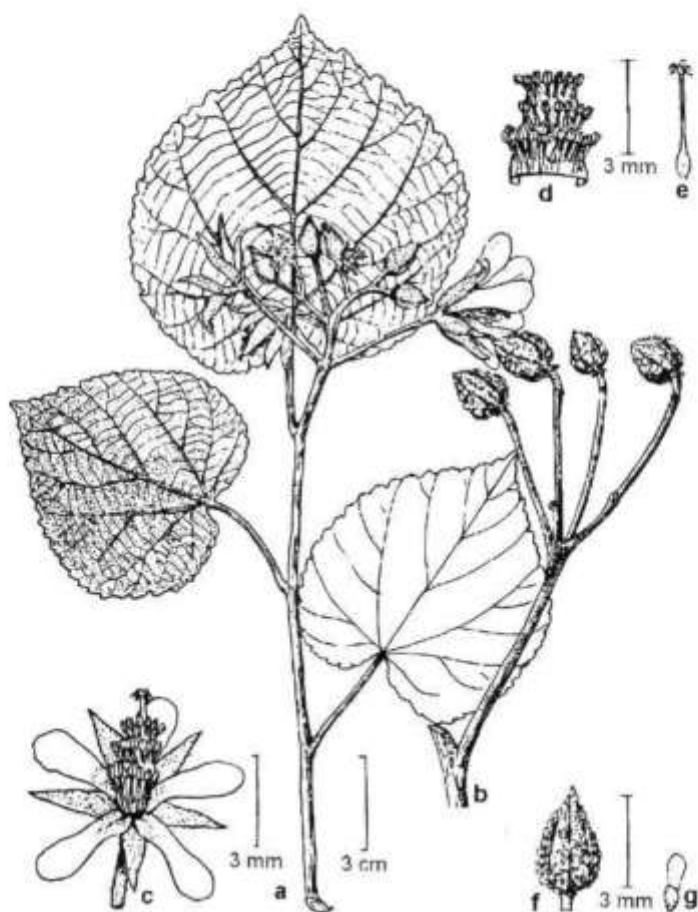


Fig. 116. *Eriolaena hookeriana* Wight & Arn. : a. flowering part of branch; b. branch; b. part of infructescence; c. flower; d. androecium; e. pistil; f. fruit; g. seed.



2 x 0.2 - 0.3 cm, linear-lanceolate, often subfalcate, pubescent outside, stellate-hairy and glandular at base inside. Petals 3 - 4 cm long, obovate, ca 5 mm broad towards the apex, claws densely pubescent within. Staminal column 1.5 - 2 cm long, antheriferous throughout its length; filaments up to 1 cm long; anthers many-seriate. Ovary ca 5 mm long, stellate-hairy; styles 2 - 2.4 cm long, pubescent; stigmas 8 - 10-lobed. Capsules 6 - 10, up to 4 x 2 cm, ovoid to pyriform, pointed, woody, loculicidal, 10-valved, valves downy, tubercled or pitted or smooth, 6 - 19 mm long, winged above, glossy.

#### KEY TO THE VARIETIES

- 1a. Petioles stout; leaves not green beneath, densely stellate-hairy beneath; capsules 8 - 10-valved, corrugate or tubercled 2.1. var. *hookeriana*  
 b. Petioles slender; leaves green beneath with minute, sparse stellate hairs; capsules 6-valved, smooth 2.2. var. *viridis*

#### 2.1. var. *hookeriana*

*Fl.* March - June; *Fr.* Nov. - Jan.

*Distrib.* India: Uttar Pradesh, Bihar, Sikkim, Orissa, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh and Tamil Nadu.

2.2. var. *viridis* Haines, Bot. Bihar & Orissa 1: 84. 1921.

*Fl.* April - June; *Fr.* Nov. - Jan.

*Distrib.* India: Orissa.

Endemic.

3. *Eriolaena lushingtonii* Dunn in Bull. Misc. Inform. 1915: 88. 1915 & in Gamble, Fl. Pres. Madras 109. 1915.

Trees, ca 4 - 5 m tall, herbaceous portions stellate-pubescent. Leaves 4 - 8 cm in diam., orbicular, cordate at base, acute at apex, irregularly dentate, sparsely stellate-pilose above, white hairy beneath; petioles half to one-third of the length of blade. Flowers 2 - 3 in axillary cymes; involucre bracts 4 - 6 mm long, multisect, tomentose, much below sepals, caducous. Sepals 5, ca 2 mm long, connate at base, ligulate, pubescent inside, tomentose outside. Petals 5, narrowly obovate, glabrous except for the dilated tomentose base, deciduous. Stamens 10 - 12; staminal column with series of fertile stamens; anthers erect, linear, basifixed; staminodes absent. Ovary sessile, ovoid, 7-locular, ovules many in each locule; styles simple, pubescent; stigmas minutely 5-lobed. Capsules ca 10 - 15 x 5 - 7 mm, ovoid, acuminate, woody, pubescent, loculicidally dehiscent. Seeds

5 - 8 in each locule, winged towards the apex.

*Fl. & Fr.* June - Aug.

*Distrib.* India: In open slopes of moist deciduous forests between 350 and 900 m, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Endemic.

4. *Eriolaena quinquelocularis* (Wight & Arn.) Cleghorn, Gen. Index 36. 1856. Masters in Fl. Brit. India 1: 371. 1874. *Microchlaena quinquelocularis* Wight & Arn., Prodr. 71. 1834.

Small trees; herbaceous portions stellate-hairy. Leaves ca 7 - 20 x 5 - 15 cm, orbicular, cordate at base, acute to subacuminate at apex, coarsely crenate-serrate, dotted with small tuft of stellate hairs above, softly tomentose beneath, nerves 7 at base, raised beneath; petioles up to 9 cm long, tomentose when young, becoming glabrous at length; stipules caducous. Flowers white, 2 - 3 in axillary peduncled cymes; peduncles often longer than leaves, usually at the ends of the branches; pedicels 2 - 3 cm long, quadrangular, stellate-hairy, jointed above the middle; involucre bracts short, entire or rarely lobed, caducous. Sepals 15 - 20 x 3 - 4 mm, linear-lanceolate, acute, pubescent on both surfaces, glandular at base inside. Petals 16 - 20 x 2 - 8 mm, obovate-oblong, claw hairy at base inside. Staminal column 1 cm long with linear-oblong anthers, irregularly arranged towards the apex. Ovary lobed; styles longer than staminal column; stigmas 5-lobed, lobes revolute. Capsules 5 - 10 x 1 - 1.5 cm, ovate-lanceolate, beaked, 5-loculed, 5 - 10-valved, valves more or less pubescent, usually silky villous at the inner angles. Seeds numerous, imbricate, winged, papery, flaccate.

*Fl.* Feb. - Aug.; *Fr.* April - Dec.

*Distrib.* India: Bihar, Rajasthan, Maharashtra, Karnataka, Tamil Nadu and Kerala.

5. *Eriolaena spectabilis* Planch. ex Masters in Fl. Brit. India 1: 371. 1874. *Wallichia spectabilis* DC., Mem. Mus. Paris 10: 104, t. 6. 1823, non *Wallichia* Roxb.

Shrubs or small trees; young portions stellate-hairy. Leaves 7.5 - 14 x 6 - 13 cm, ovate, cordate at base, acuminate at apex, ashy-pubescent beneath, nerves 7 - 9, prominent above, raised beneath; petioles 3 - 6 cm long; stipules capillary. Flowers yellow, in axillary, peduncled, many-flowered panicles. Peduncles longer than leaves, ultimate pedicels stellate-hairy, nearly as long as flowers. Involucre bracts linear, entire, rarely lobed. Calyx at first spathaceous, ultimately 5-lobed, lobes 15 - 18 x 3 - 4 mm, linear-lanceolate. Petals 15 - 20 x 5 - 7 mm, obovate-spathulate, claw thick, villous. Staminal column ca 1 cm long, with stamens in irregular series. Ovary ovoid, villous, many-loculed; styles pilose at base; stigmas many. Capsules up to 4 x 3 cm, ovoid-oblong,

woody, valves obtuse, tubercled, villous at the inner angles. Seeds many, winged.

*Fl.* March - May; *Fr.* June - Oct.

*Distrib.* India: Himachal Pradesh, Uttar Pradesh, Bihar and Manipur.

Nepal and Bhutan.

**6. *Eriolaena stocksii* Hook. f. & Thomson ex Masters in Fl. Brit. India 1: 370. 1874.**

Trees or shrubs; bark purplish; herbaceous portions stellate-pubescent, glaucous. Leaves simple, 7.5 - 12.5 x 6 - 10 cm, deeply cordate to orbicular, cordate at base, shortly and bluntly acuminate at apex, irregularly crenate, thinly dotted above with stellate hairs, more so on the nerves, finely pubescent beneath, 5 - 7-nerved at base; petioles 5 - 7 cm long, terete, densely stellate-pubescent; stipules linear-falcate, caducous. Flowers few in axillary peduncled racemose cymes; peduncles up to 15 cm long; pedicels ca 1 cm long, grooved, pubescent; involucre bracts multisect, segments many, linear or filiform, densely stellate-pubescent. Sepals 1 - 1.5 cm long, lanceolate, cuspidate, stellate-pubescent outside, villous and glandular at base inside. Petals obovate to spatulate. Staminal column 1 - 1.2 cm long. Ovary ca 4 mm long, lobed, stellate-pubescent; styles 2 cm long, pubescent.

*Fl.* May; *Fr.* Sept.

*Distrib.* India: Bihar, Gujarat, Maharashtra, Karnataka and Tamil Nadu.

Endemic.

**7. *Eriolaena wallichii* DC., Mem. Mus. Paris 10: 102, t. 5. 1823; Masters in Fl. Brit. India 1: 370. 1874.**

Large, stout shrubs or small trees; herbaceous portions shaggy tomentose. Leaves simple, 10 - 20 cm in diam., ovate or roundish, cordate at base, acuminate at apex, crenate-serrate, pilose above, stellate-tomentose beneath, nerves 7 at base, prominent and raised beneath; petioles up to 5 cm long, stellate-tomentose; stipules ca 2.5 cm long, lanceolate. Peduncles 1-flowered, axillary and terminal, shorter than leaves, villous. Involucre bracts 3, 3 - 4 x 0.5 - 0.7 cm, lanceolate, floccose-tomentose outside, villous inside. Petals 5, 2 - 2.5 cm long, glabrous, bearing multiseriate anthers. Ovary ca 5 x 3 mm, stellate-hairy; styles 1 - 1.5 cm long, pilose. Fruits not seen.

*Fl.* April - June.

*Distrib.* India: Uttar Pradesh, Bihar, Sikkim, West Bengal (Darjeeling) and Orissa.

Nepal.

#### 4. *Firmiana Marsili*

Trees. Leaves simple, entire or shallowly to deeply incised, ovate, often cordate, acute or shortly acuminate at apex, glabrous or stellate-hairy on the upper surface, often pubescent beneath; palmately nerved; petioles long. Flowers unisexual in coralliform panicles, stellate-pubescent. Calyx tubular, toothed. Corolla absent. Androgynophore exerted after anthesis. Stamens 10, filaments attached to the sunken top of androgynophore. Ovaries 5, conglutinate, separate and expand after anthesis, ovules 2 - 4 per ovary; styles short; stigmas curved outside. Male and female flowers differ only slightly in size and development of androecium or gynoecium. Fruits membranous follicles, opening before maturity, dispersed with adhering seeds. Seeds 2 - 4, ovoid, smooth, wrinkled when dry.

Tropical Asia and Pacific islands, ca 8 species; 2 in India.

*Literature.* KOSTERMANS, A.J.G.H. (1957). The genus *Firmiana* Marsili (Sterculiaceae). *Reinwardtia* 4: 281 - 310.

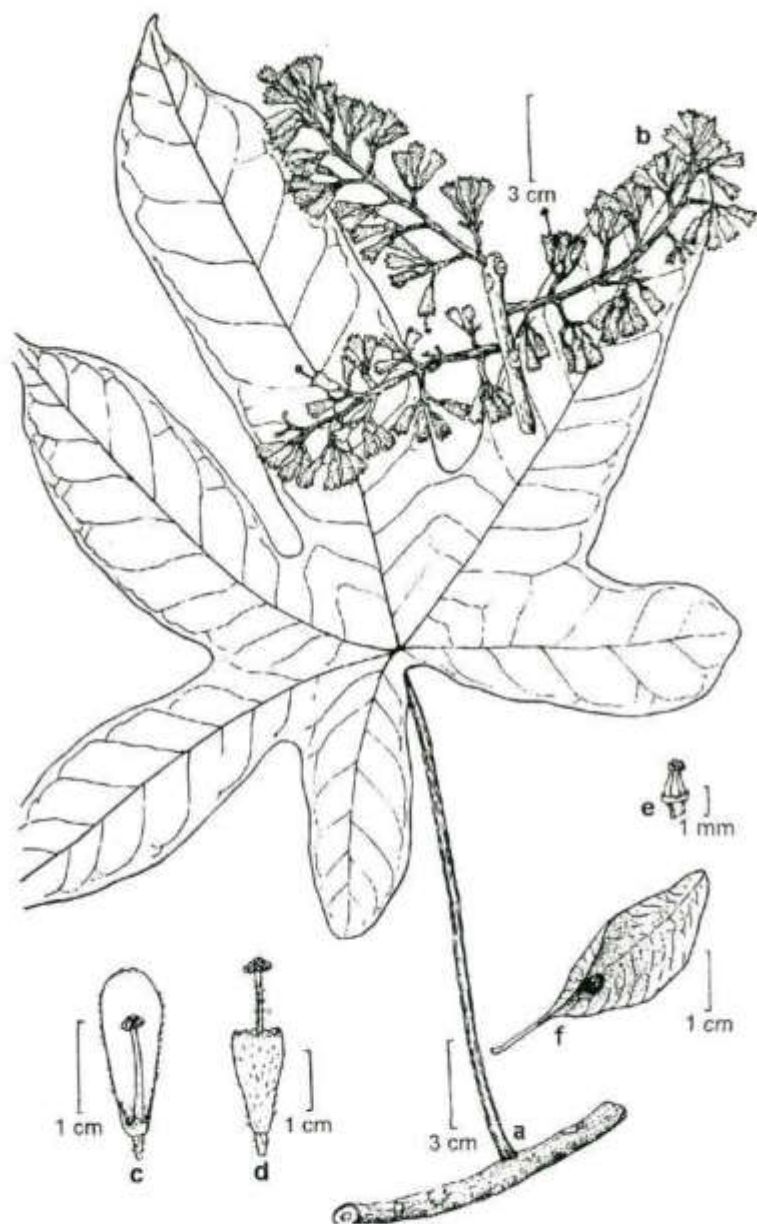
#### KEY TO THE SPECIES

- 1a. Lower surface of the leaves glabrous; calyx tube inside and androgynophore sparsely pilose  
**1. *F. colorata***
- b. Lower surface of the leaves softly pilose; calyx tube inside and androgynophore glabrous **2. *F. fulgens***

**1. *Firmiana colorata* (Roxb.) R. Br. in Benn. & R. Br., Pl. Jav. Rar. 235. 1844. *Sterculia colorata* Roxb., Pl. Corom. 1: 26, t. 25. 795, quoad t. 25. descr. excl. & Fl. Ind. 3: 146. 1832, p.p.; Masters in Fl. Brit. India 1: 359. 1874. *S. rubicunda* Wallich ex Masters in Fl. Brit. India 1: 360. 1874. **Fig. 117.****

*Asm.:* *Jariudal, Kathudal*; *Beng.:* *Samarri, Pisi*; *Hindi:* *Bodula, Walena, Samarri*; *Kan.:* *Bili sulige*; *Mal.:* *Malam Paratti*; *Mar.:* *Bhaikoi, Bharkoi, Khowsey, Kaushi*; *Tam.:* *Malam Parathi*; *Tel.:* *Karaka, Maraka, Karu boppaja*; *Eng.:* *The coloured Sterculia.*

Trees, up to 25 m tall; trunk erect, buttressed; lenticelled; bark smooth, grey or greyish green, branches spreading. Leaves 14 - 36 x 8 - 29 cm, variable in shape and size, usually ovate, entire or shallowly to deeply incised, base cordate or subcordate at base, acuminate at apex, dark green above, pale green beneath, palmately veined, primary veins slightly raised on the lower surface; petioles 10 - 30 cm long, pulvinate. Flowers bright red or orange in panicles in the axils of fallen leaves or terminal, densely covered with minute stellate hairs and scales. Calyx 1 - 1.5 cm long, funnel-shaped, slightly curved, inflated towards apex, teeth acute, with a ring of glistening bundles of long strigose hairs above base inside. Androgynophore 5 - 10 mm long, exerted; filaments



**Fig. 117.** *Firmiana colorata* (Roxb.) R. Br. : a. part of branch with a leaf; b. part of inflorescence; c. sectional view of male flower; d. male flower after anthesis with exserted column; e. pistil; f. fruit..

very short, attached to the rim of shallow tube at the top of androgynophore; anthers 10, locules curved. Ovaries 5, flask-shaped, glabrous. Follicles 8 - 11 x 3 - 5 cm, oblong, membranous, glabrous, strongly veined, stipitate, opening at early stage. Seeds 2 per follicle; yellow, globose to ovoid, compressed, wrinkled or smooth.

*Fl.* Feb. - April; *Fr.* April - June.

*Distrib.* India: Throughout including Andaman Islands.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Indo-China, Malay Peninsula and Indonesia (Sumatra).

*Notes.* In this species the flowers are structurally bisexual but functionally unisexual. In male, anthers are smaller than those in the female flowers but in the later the anthers do not open.

**2. *Firmiana fulgens*** (Wallich ex Masters) Corner, *Wayside Trees Malaya* 1: 610. 1940, p.p. quoad descr. *Sterculia colorata* Roxb., *Pl. Corom.* 1: 26. 1795 quoad descr. t. 25. excl. & *Fl. Ind.* 3: 146. 1832, p.p. *Sterculia fulgens* Wallich [Cat. 1135. 1829, nom. nud.] ex Masters in *Fl. Brit. India* 1: 360. 1874. *Sterculia wallichii* Falconer ex Brandis, *For. Fl. N. W. & C. India* 34. 1874, non G. Don, 1831. *Sterculia pallens* Wallich [ex Voigt, *Hort. Sub. Calc.* 105. 1845 nom. nud.] ex King in *J. Asiat. Soc. Beng.* 60: 73. 1891. *Firmiana pallens* F.v. Muell. in *Vict. Nat.* 3: 48. 1866; Stearn in *Blatt. & Millard, Beaut. Indian Tr.* ed. 2, 79. 1954.

Trees, up to 20 m tall; young parts pubescent. Leaves 16 - 25 x 19 - 25 cm, more or less reniform, chartaceous, shallowly 3 - 4-lobed, lobes acute, cordate at base, glabrous above, sparsely pilose beneath, veins flat, prominent below, with main veins; petioles up to 15 cm long, pulvinate, densely pilose. Flowers in panicles on leafless branches only. Female flowers slightly smaller than male. Calyx 1.5 - 2.5 cm long, subcampanulate, lobes 4 - 6 mm long, ovate, acute, fleshy, a ring of hairs present near base inside. Androgynophore ca 1 cm long; anthers ca 20, locules curved. Carpels 5, free; ovary flask-shaped. Follicles 5 - 6 x 2 - 3 cm, stipitate, glabrous, membranous. Seeds 2, globose.

*Fl.* March - May; *Fr.* May - June.

*Distrib.* India: North Western Himalaya. Jammu & Kashmir (Jammu) and Uttar Pradesh (Garhwal, Mussoorie, Rajpur).

Nepal, Myanmar and Indonesia (Java).

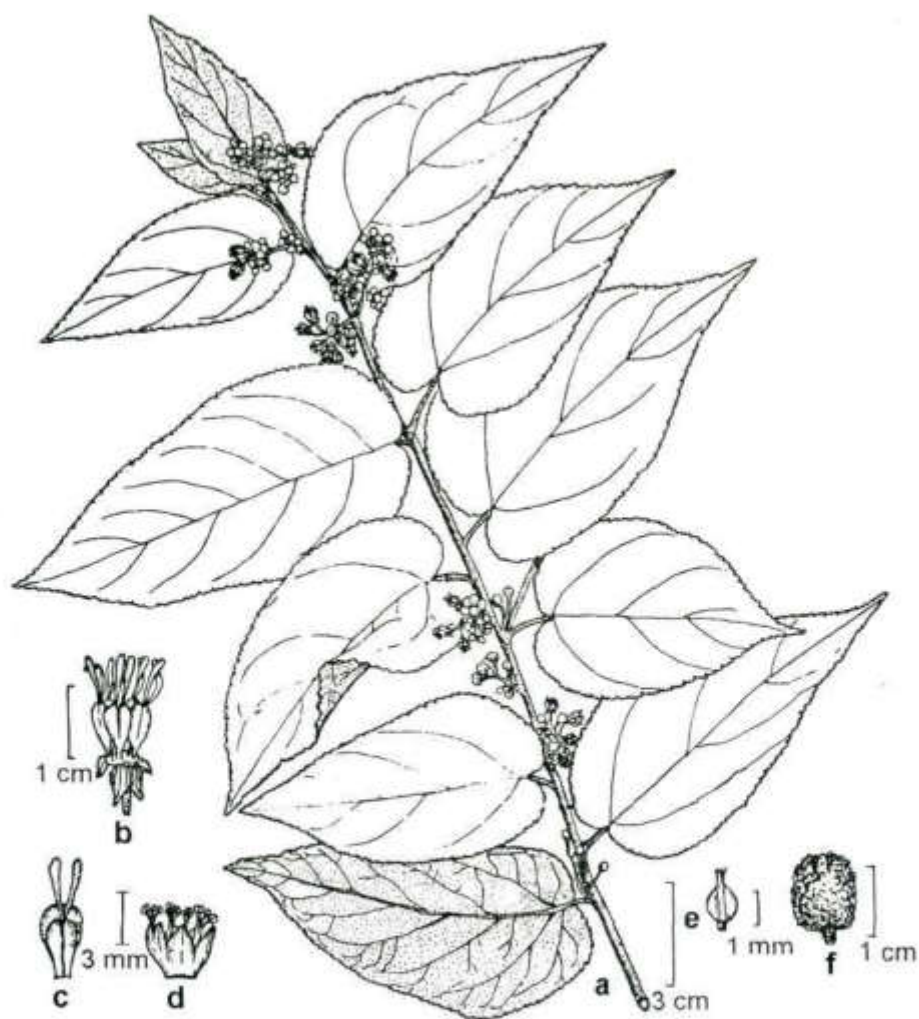


Fig. 118. *Guazuma ulmifolia* Lam.: a. flowering part of branch; b. flower; c. petal; d. staminal column; e. pistil; f. fruit.

### 5. *Guazuma* Mill.

Trees. Leaves simple, alternate, stellate-tomentose. Flowers bisexual in axillary peduncled cymes. Sepals 5, connate at base, at first spathaceous. Petals 5, claw narrow, lamina concave, hood-shaped, apex terminating in two long ligulate processes. Staminal cup bearing 5 staminodes, alternating with 5 groups of 3 fertile stamens. Anther lobes divergent. Ovary 5-lobed, finely tubercled; styles more or less connate. Capsules woody, tubercled, septicidally 5-valved. Seeds many, exalbuminous; embryo curved; cotyledons leafy, folded.

Tropical, Central and South America, ca 4 species; one in India (introduced ?).

*Guazuma ulmifolia* Lam., Encycl. 3: 52. 1789. *Theobroma guazuma* L., Sp. Pl. 782. 1753. *Guazuma tomentosa* Kunth in H.B.K., Nov. Gen. Sp. 5: 320. 1823; Masters in Fl. Brit. India 1: 375. 1874. **Fig. 118.**

Moderate-sized trees, up to 15 m tall; herbaceous portions stellate-tomentose; bark fissured in older parts. Leaves 6 - 17.5 x 3 - 9 cm, ovate-oblong or oblong-lanceolate, lanceolate, sometimes falcate, obliquely cordate at base, rounded to shortly acuminate at apex, irregularly serrulate, scabrid or glabrescent above, pubescent beneath; petioles 1 - 2 cm long, terete to subterete, tomentose. Flowers yellow, numerous, small in terminal and axillary panicles. Sepals ca 4 x 2 mm, spathaceous at first, divided into lobes later; lobes oblong-lanceolate, acute, slightly concave, ultimately reflexed, tomentose outside. Petals ca 6 x 3 mm, obovate, cucullate, claw narrow, lamina with 2, ca 4 mm long, strap-shaped forked appendages. Staminal cup ca 3 x 2 mm, bearing the stamens and staminodes, fimbriate, acute. Ovary sessile, 1 mm in diam., globose with fine tubercles; styles 5, ca 2 mm long, connate at base. Capsules up to 3 cm in diam., oblong-globose, woody, septicidally 5-valved, tubercled. seeds many, 1 mm in diam., globose.

*Fl.* March - Sept.; *Fr.* June - Feb.

*Distrib.* India: Almost throughout in plains (often cultivated).

Tropical America and Indonesia (Java).

### 6. *Helicteres* L.

Shrubs or small trees, more or less stellate-pubescent. Leaves simple, alternate. Flowers bisexual, axillary or in fascicles or in long or short spikes. Calyx tubular, 5-fid, lobes often unequal. Petals 5, entire or somewhat 2-lipped with long claw, claws often with ear-shaped appendages. Staminal column adnate to gynophore, slightly curved towards apex, exerted, dilated above into 3 lobes, each lobe again bifurcated bearing an anther on each tooth; anthers 2-celled; staminodes arising from inner wall of the



staminal column alternately between fertile lobes. Ovary at the top of the gynophore, 5-lobed, 5-locular; styles awl-shaped, more or less united, slightly thickened and stigmatose at the tips. Follicles straight or spirally twisted. Seeds tubercled; endosperm scanty; cotyledons leafy.

In tropics of both the hemispheres, predominantly in America, ca 60 species; 5 in India.

#### KEY TO THE SPECIES

1a. Ripe carpels spirally twisted	3. <i>H. isora</i>
b. Ripe carpels straight and not twisted	2
2a. Leaves oblique	3
b. Leaves symmetrical	4
3a. Flowers in many-flowered elongated slender racemose cymes	1. <i>H. elongata</i>
b. Flowers in few-flowered short spikes	5. <i>H. plebeja</i>
4a. Leaves oblong-obtuse, entire	4. <i>H. obtusa</i>
b. Leaves ovate-oblong, acuminate, unequally serrate	2. <i>H. hirsuta</i>

1. *Helicteres elongata* Wallich [Cat. No. 1845. 1831, nom. nud.] ex Masters in Fl. Brit. India 1: 365. 1874.

Diffuse, straggling shrubs; branchlets very slender, stellate-hairy. Leaves 5 - 8 x 2 - 4 cm, obliquely ovate or oblong-lanceolate, serrate, sparsely stellate-pubescent; petioles 6 - 13 mm long. Flowers bisexual in axillary or terminal, many-flowered elongated racemose cymes; cymes as long as or longer than leaves; bracteoles setaceous. Calyx campanulate, 5-fid, lobes deltoid-lanceolate, pubescent. Petals clawed. Staminal column adnate to gynophore. Carpels 5. Follicles 2.5 - 3.8 cm long, cylindric, oblong, beaked, shaggy outside, opening along the inner edge.

*Distrib.* India: Sikkim; rare (known from type collection only).

Bhutan, Bangladesh and Myanmar.

2. *Helicteres hirsuta* Lour., Fl. Cochinch. 2: 648. 1793. *H. spicata* Colebr. ex Masters in Fl. Brit. India 1: 366. 1874 incl. var.

Shrubs. Leaves 5 - 15 x 2.5 - 5 cm, ovate-oblong to oblong-lanceolate, obliquely subcordate at base, acuminate at apex, unequally serrate, stellate-hairy above, downy beneath, petioles 1.2 - 1.5 cm long; stipules setaceous, as long as petiole. Flowers in elongated spike-like axillary cymes; cymes shorter than leaves; pedicels shorter than flowers. Calyx ca 1.2 cm long, bell-shaped, curved, distended at base, downy. Petals nearly twice as long as abruptly toothed claws. Stamens 10. Ripe carpels 3.5 - 4 cm long

on a glabrous, exerted stalk, oblong-lanceolate, beaked, densely covered with stellate-villous hairs.

*Fl.* June.

*Distrib.* West Bengal (Darjeeling), Sikkim and Assam.

Myanmar, Indo-China, China and Malesia (sometimes cultivated).

**3. *Helicteres isora* L., Sp. Pl. 963. 1753; Masters in Fl. Brit. India 1: 365. 1874 incl. vars.**

Beng.: *Atmora*; Hindi: *Murad, Marorphal*; Kan.: *Yedamuri*; Mal.: *Isvarmuri, Kaiyam, Valambari*; Or.: *Murmuria, Santali, Fetcamra*; Tam.: *Kaiva, Valampuri, Idampuri*; Ur.: *Ovla*.

Large shrubs or small trees, 3 - 8 m tall; branchlets rough with scattered stellate hairs. Leaves 10 - 23 x 11 - 17 cm, broadly elliptic, elliptic-obovate, ovate-cordate, rounded-cordate or suborbicular, slightly obliquely cordate at base, shortly acuminate at apex, often 3-lobed, scabrous with stellate hairs mixed with simple hairs on the upper surface, densely so along margins, thinly scattered stellate-hairy to stellate-tomentose beneath, main nerves 3 - 7, arising from the base; petioles 1 - 2.5 cm long, pubescent; stipules up to 1 cm long, subulate, deciduous. Flowers axillary, solitary or in clusters, often supra-axillary. Calyx 2 cm long, gibbous, laterally compressed, somewhat 2-lipped, densely stellate-hairy. Petals crimson, 4 - 5 cm long, reflexed, 2 lower shorter and broader than the 3 upper ones, claws winged. Staminal tube 3 - 4 cm long, slightly bent on one side at the tip, exerted; stamens 10, surrounding ovary and alternating in pairs with 5 minute scaly staminodes attached to the staminal tube. Ovary 5-celled, 5-lobed; styles united, as long as the ovary, deflexed. Follicles 4 - 8 x 0.5 - 1 cm, cylindrical, spirally twisted with an apical beak, up to 1 cm long on 2.5 cm long androgynophore, stellate-tomentose. Seeds many, 2 mm long, angular, wrinkled, tomentose.

*Fl.* April - Dec.; *Fr.* Oct. - Jan.

*Distrib.* India: In dry deciduous forests up to 1500 m as an undergrowth, throughout.

Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh, S. China, S.E. Asia and Australia.

**4. *Helicteres obtusa* Wallich [Cat. No. 1184. 1813, nom. nud.] ex Kurz in J. Asiat. Soc. Beng. 42: 62. 1873. Masters in Fl. Brit. India 1: 366. 1874.**

Small shrubs; herbaceous portions ferruginous. Leaves 7.5 - 10 x 2 - 2.5 cm, oblong to oblong-lanceolate, rounded at base, obtuse or acute and mucronulate at apex,

chartaceous, densely stellate-hairy above, shortly tawny stellate-pubescent beneath, 3-nerved from base; petioles up to 1.5 cm long, tawny tomentose. Flowers small in short axillary cymes; pedicels short, with 3 minute setaceous bracteoles at base. Calyx 5 - 8 mm long, tubular to campanulate, stellate-tomentose and somewhat scurfy. Petals slightly longer than calyx. Staminal column ca 1 cm long, glabrous. Ripe carpels 12 - 16 x 3 mm, oblong, obtuse straight, closely cohering, densely villous.

*Fl. & Fr.* May - June.

*Distrib.* India: Andaman and Nicobar Islands.

Myanmar and China.

**5. *Helicteres plebeja*** Kurz in *J. Asiat. Soc. Beng.* 39: 67. 1870. *H. glabriuscula* Wallich [Cat. No. 1185. 1831, nom. nud.] ex Masters in *Fl. Brit. India* 1: 366. 1874.

Diffuse shrubs; branchlets very slender, virgate, purple glabrescent. Leaves 9 - 10.5 x 1.2 - 3 cm, obliquely lanceolate, cordate at base, acuminate at apex, serrulate, thinly stellate-hairy; petioles 5 mm long; stipules as long as petioles, subulate, deciduous. Flowers few in short spikes; peduncles half the length of the leaf. Calyx 5 - 7 mm long. Petals slightly longer than calyx. Ripe carpels 12 - 20 x 5 mm, oblong, beaked, stellate-hairy.

*Fl.* June - Nov.; *Fr.* Dec. - Feb.

*Distrib.* India: West Bengal, Assam and Nagaland.

Bhutan and Myanmar.

### 7. *Heritiera* Aiton

Trees, usually lofty buttressed; wood very hard; bark black, grey or brownish red; branchlets lepidote. Leaves alternate, unifoliolate or digitate, chartaceous or coriaceous, usually glabrous or rarely scaly when young above, adpressed fimbriate scaly beneath, pinnately nerved, pseudopeltate; petioles thickened at both ends; stipules lanceolate or aciculate, caducous. Flowers small, unisexual, in axillary panicles. Peduncles and branches adpressed lepidote; pedicels articulate. Calyx campanulate or urceolate, 5 or rarely 6-toothed, stellate-pubescent. Petals absent. Male flowers with 8 - 10 anther locules clustered, regularly or irregularly arranged in a ring at the top of the androgynophore with a minute sterile ovary in the centre, androgynophore granular papillose at base. Female flowers with 4 or 5(6), sessile, minute, laterally compressed, conglutinate, almost free ovaries encircled by sterile anthers at base; styles short, spreading or incurved with minute stigmas. Samaras with an ellipsoid or globose nut, woody epicarp, winged or keeled.

Tropical Asia from India through Myanmar, Thailand, Vietnam to Malesia, tropical Australia, Pacific regions and Africa; ca 31 species; 5 in India.

*Literature.* KOSTERMANS, A.J.G.H. (1959). A monograph of the genus *Heritiera* Aiton (Sterculiaceae). *Reinwardtia* 4: 465 - 583.

#### KEY TO THE SPECIES

- |  |                          |
|--|--------------------------|
| 1a. Nut of samaras much longer than wing   | 2                        |
| b. Nut of samaras shorter or as long as wing                                       | 4                        |
| 2a. Nuts with transverse circular ridge  | 2. <i>H. fomes</i>       |
| b. Nuts without transverse ridge   | 3                        |
| 3a. Plants of mangrove zone; anthers in a regular ring; ovaries glabrous           | 3. <i>H. littoralis</i>  |
| b. Plants of the hilly areas; anthers in irregularly arranged ring; ovaries hairy  | 1. <i>H. dubia</i>       |
| 4a. Fruits lepidote; anthers in irregular clumps; lateral nerves more than 8 pairs | 4. <i>H. macrophylla</i> |
| b. Fruits glabrous; anthers in regular rings; lateral nerves 4 or 5 pairs          | 5. <i>H. papilio</i>     |

1. *Heritiera dubia* Wallich ex Kurz in J. Bot. 12: 65, t. 141: f., 4-6, 1874; Kanjlal *et al.*, Fl. Assam 1: 156. 1934.

Trees; bark greyish, warty. Leaves unifoliolate, 10 - 15 x 3 - 5.7 cm, coriaceous, oblong or oblong-lanceolate, elliptic-oblong, cuneate at base, acute or acuminate at apex, entire, glabrous above, densely adpressed, silvery, fimbriate scaly beneath, veins prominent on both surfaces; petioles 1.5 - 2.6 cm long, rather stout, lepidote. Flowers small in panicles; panicles shorter than leaves, rusty pubescent; pedicels slender, 4 cm long. Calyx campanulate, 5(-3)-lobed. Male flowers: staminal column shorter than calyx, anther thecae 7 - 10, sessile in irregularly arranged ring on glabrous, 1 mm long androgynophore, topped by a sterile ovary. Female flowers: ovaries 4, 1 mm long, hairy, sterile anthers in groups 24 at base. Mature carpels 4 cm long, compressed, cuneate-oblong, thickly winged towards the tip on one side, smooth, brown.

*Distrib.* India: Tropical evergreen forests at low elevations. Assam and Meghalaya.

Endemic.

2. *Heritiera fomes* Buch.-Ham. in Symes, An account of an Embassy to the Kingdom of Ava, ed. 2, 3: 319. 1800; Masters in Fl. Brit. India 1: 363. 1874. *H. minor* Roxb., Fl. India 3: 142. 1832 p.p., non Lam. 1797; Masters in Fl. Brit. India 1: 363. 1874.

Beng.: *Sundri*

Trees, 15 - 18 m tall; branchlets lepidote. Leaves unifoliolate, 10 - 17 x 3 - 6.5 cm, elliptic to lanceolate, tapering to rounded at base, acute or rounded and mucronate at

apex, coriaceous, glabrous above, adpressed scaly beneath, midrib prominent; pseudo-peltate, petioles up to 2 cm long. Flowers in lax, axillary, rusty pubescent panicles. Calyx ca 3 x 2 mm, campanulate, 4 or rarely 5-lobed, stellate-hairy inside. Male flowers: anther thecae 8 in a ring at the top of androgynophore; androgynophore 1 mm long, white glandular at base. Female flowers: somewhat fleshy, ovaries 4 or 5, 2-3 mm long, rigidly hairy; sterile anthers in 4 groups at base between ovaries. Samaras 4-5 cm in diam., glossy with obliquely transverse ridge and an apical beak.

*Fl.* Jan. - May; *Fr.* June - Dec.

*Distrib.* India: Among mangroves in West Bengal (Sunderbans) and Orissa.

Bangladesh and Myanmar (Irrawaddy delta).

*Notes.* Yields hard, close-grained, elastic and durable timber. Good charcoal is made from the wood. Tanin is extracted from the seeds. Tanin free seeds are edible.,

3. *Heritiera littoralis* Dryand. in Aiton, Hort. Kew. ed. 2, 3: 546. 1789; Masters in Fl. Brit. India 1: 363. 1874. *Balanopteris tothila* Gaertn., Fruct. Sem. Pl. 2: 94, t. 99. 1791. *Heritiera minor* auct. non Lam. 1797; Roxb., Fl. India 3: 142. 1832. p.p.

And.: *Mawtd*; Beng.: *Sundri*; Kan.: *Chandamara*; Mar.: *Sundrichand, Koland*; Tam.: *Choomuntri*.

Trees, 15 - 25 m tall, low-branched; bark vertically and superficially fissured; branchlets lepidote. Leaves 12.5 - 20 x 5 - 10 cm, elliptic-oblong to ovate-elliptic, rounded or subcordate and often oblique at base, rounded and mucronate to obscurely acuminate at apex, entire, coriaceous, glabrous above, minute, silvery adpressed scaly beneath; petioles up to 2.5 cm long, rather stout. Flowers in axillary panicles; peduncles and lower ramifications lepidote; pedicels up to 1 mm long, articulate. Calyx 5 - 6 mm long, campanulate, 4 - 6-toothed, teeth short, orange yellow, stellate-pubescent. Male flowers: anther thecae 8 on 1 mm long androgynophore. Female flowers: ovaries 4 or 5, 1 mm long, sessile, glabrous; sterile anther thecae in 4 groups of 2 at the base between ovaries. Samaras 3 - 8 x 2 - 5 cm, ellipsoid, convex, ventrally flat, woody, glossy, tubercled or smooth.

*Fl.* July - Oct.; *Fr.* Aug. - March

*Distrib.* India: Mangrove forests of West Bengal, Orissa, extending inland up to Meghalaya, in south Western Ghats, Karnataka, Kerala, Tamil Nadu and Andaman and Nicobar Islands.

Coasts of East Africa, S.W. Myanmar, Thailand, Indo-China, Hongkong, Taiwan, Malesia, Tropical Australia, Pacific Islands up to Hawaii and New Caledonia.

4. *Heritiera macrophylla* Wallich ex Kurz in J. Asiat. Soc. Beng. 42: 61. 1873; Kanjilal *et al.*, Fl. Assam 1: 155. 1934.

Asm.: *Tepop-pomik*, *Thing-ansil*; Abor: *Tepop-Pomik*.

Large to medium-sized trees; buttressed when old; bark brown to black, almost smooth. Leaves unifoliolate, 8 - 10 x 4 - 18 cm, elliptic, ovate-elliptic, oblong or lanceolate, rounded, truncate, often oblique at base, acute or acuminate at apex, entire, chartaceous, glabrous above, densely silvery adpressed fimbriate scaly beneath, lateral nerves 8 - 11 pairs, prominent below, pseudopeltate; petioles up to 11 cm long, stout. Flowers in lax, pyramidal panicles. Calyx ca 4 mm long, campanulate, 6-lobed, stellate-pubescent. Male flowers: slightly smaller than female flowers, anther thecae globose, irregularly clumped on androgynophore topped by sterile ovary; androgynophore 1 mm long, white glandular at base. Female flowers: ovaries 4 - 6, ca 2 mm long, conglutinate, lepidote, sterile anther thecae in few groups present at the base of the ovaries. Samaras 2 - 3.5 x 1.5 - 2 cm, subglobose, oblique at base with an apical beak.

Fl. July; Fr. July - Jan.

*Distrib.* India: Tropical evergreen forests of Arunachal Pradesh, Assam and Meghalaya.

Indo-China.

5. *Heritiera papilio* Beddome, Fl. Sylv. t. 218. 1872; Masters in Fl. Brit. India 363. 1874. *H. acuminata* Wallich ex Kurz in J. Bot. 12: 65, t. 141. f. 1. 1-3. 1874; Kanjilal *et al.*, Fl. Assam 1: 155. 1934. Fig. 119.

Asm.: *Akhar*; Tam.: *Soundalaya-unnu*; Naga: *Chingren*.

Large trees, 10 - 15 m tall; branchlets stellate-tomentose. Leaves unifoliolate, 7 - 16 x 3.5 - 7 cm, lanceolate or ovate-lanceolate, obtuse at base, obscurely acuminate at apex, entire, coriaceous, upper surface closely scaly when young, glabrous when old, lower surface densely silvery fimbriate scaly; petioles ca 2 mm long. Flowers in lax, axillary panicles. Calyx campanulate. Male flowers: anther thecae in a regular ring on an androgynophore topped by sterile ovary. Female flowers: ovaries 5 - 6, sessile, stellate scaly; sterile anther thecae present at the base of the ovaries. Samaras 5 - 7 cm long consisting of an ellipsoid nut of 2 cm long and a membranous wing, 1-seeded.

Fl. Jan. - May; Aug. - Sept.; Fr. July - Dec.



Fig. 119. *Heritiera papilio* Beddome

*Distrib.* India: Tropical evergreen forests of E. India and S. Western Ghats up to 1500 m. Assam, Mizoram, Meghalaya, Karnataka, Tamil Nadu and Kerala.

Bangladesh.

### 8. *Hildegardia* Schott & Endl.

Large trees. Leaves simple, very broadly rounded-cordate, glabrous, entire, digitately nerved at base. Flowers polygamous, some bisexual, others unisexual by abortion in raceme-like panicles crowded at the ends of the branchlets; pedicels jointed at the apex; bracts rudimentary. Calyx tubular, shortly 5-lobed, persistent. Corolla absent. Stamens 10 on a column round the abortive carpels. Carpels 5, shortly stipitate. Follicles membranous, winged at the top, ultimately dehiscent. Seeds usually 2.

Tropical Asia, Africa and Madagascar, ca 9 species; 1 in India.

*Hildegardia populifolia* (Roxb.) Schott & Endl., Melet. Bot. 33. 1832. *Sterculia populifolia* Roxb., [Hort. Beng. 50. 1814, nom. nud.] Fl. Ind. 148. 1832; Masters in Fl. Brit. India 1: 361. 1874. Fig. 120.

Trees, up to 20 m tall; branchlets angular, warty; bark smooth. Leaves 7.5 - 11 x 10 - 14 cm, rounded, reniform or deeply cordate, cordate at base, acuminate at apex, entire, membranous, glabrous, 7-nerved; petioles 5 - 15 cm long. Flowers polygamous in axillary and terminal, up to 15 cm long panicles; glabrous, spreading. Calyx scarlet, lobes 6 - 12 mm long, free nearly to the base, linear-spathulate, downy outside. Stamens 10 on ca 2 mm long staminal column, adnate to the base of ovary. Ovary ovoid, hispid, tapering into a short style; stigmas 5-lobed. Follicles 5, up to 10 x 5 cm, oblique, strongly veined, obtuse, winged; stalk up to 4 cm long. Seeds 2, ca 1.3 cm long, ovate-oblong.

*Fl.* April; *Fr.* June - Feb.

*Distrib.* India: In deciduous forests up to 700 m. Orissa, Andhra Pradesh and Tamil Nadu.

### 9. *Kleinhovia* L.

Trees. Leaves simple, ovate, acuminate, entire, palminerved. Flowers bisexual, zygomorphic, in terminal, lax cymose panicles; bracteoles small; ensiform remote from calyx. Sepals 5, nearly free, deciduous. Petals 5, unequal, upper with longer claw, margins involute. Staminal column elongated, adnate to the gynophore, slightly curved at apex, dilated above into 5-fid, campanulate cup, 3 anther bearing segments alternate with antherless teeth; anther cells divaricate. Ovary inserted within the dilated apex of the staminal column, 5-lobed, 5-locular; styles slender, at length divided. Capsules membranous, inflated, pyriform or turbinate, 5-lobed, loculicidally 5-valved. Seeds



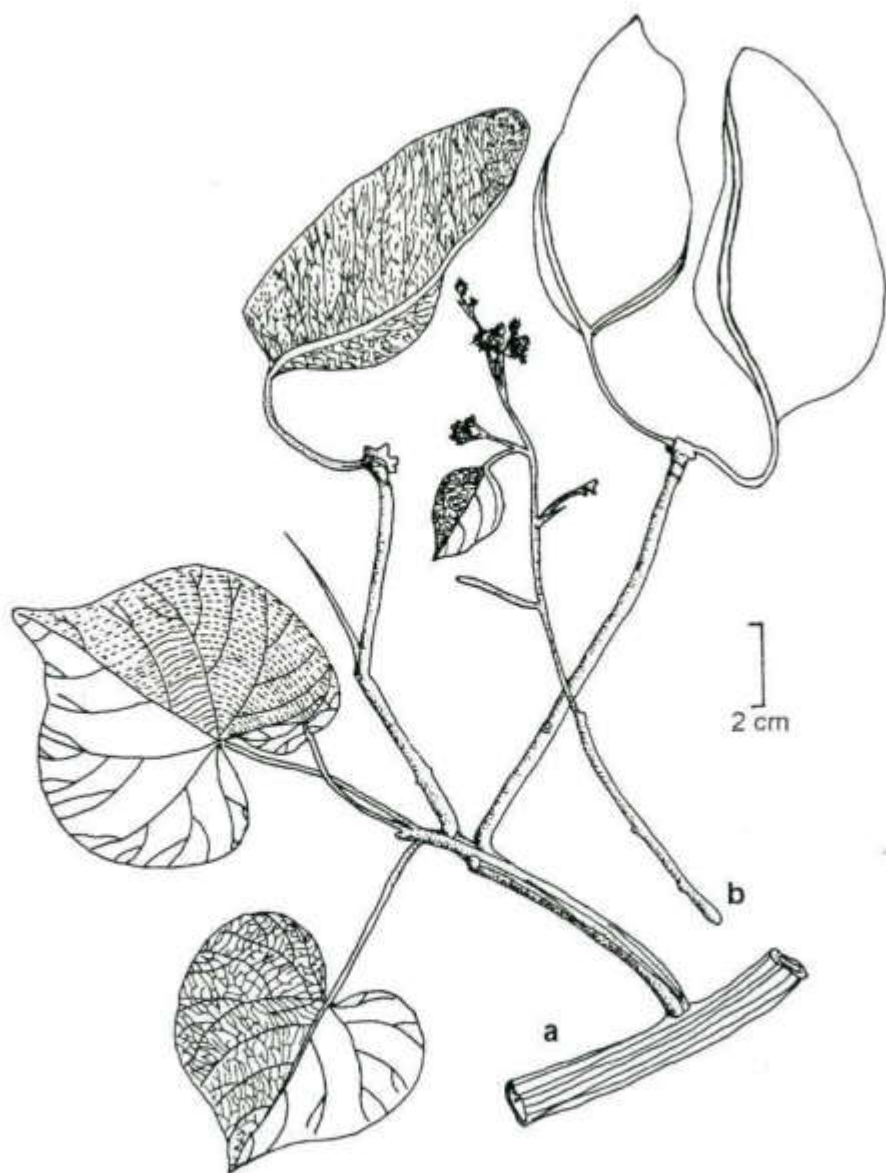


Fig. 120. *Hildegardia populifolia* (Roxb.) Schott & Endl.

solitary, rarely 2 in each locule, tubercled; endosperm scanty or absent; cotyledons convolute.

Tropical Asia and E. Tropical Africa, monotypic.

**Kleinhovia hospita** L., Sp. Pl. ed. 2, 1365. 1763; Masters in Fl. Brit. India 1: 364. 1874.

Tall trees with straight trunks and spreading branches; bark smooth; branchlets and inflorescence tomentose. Leaves alternate, 10 - 13 x 8 - 16 cm, ovate, subreniform, deltoid, cordate, truncate or rounded at base, acuminate or obtuse at apex, glabrous on both surfaces except on nerves at base; petioles 6 - 8 mm long, straight. Flowers in lax, terminal, cymose panicles; bracteoles linear to ensiform; pedicels 2 mm long. Sepals 6 - 7 mm long, thick, connate at base, stellate-tomentose outside. Petals gibbous at base on the bent side of the staminal column, folded. Staminal column 6 - 7 mm long, with a thin, 1.5 mm long striated disc at base, apex divided into 5 teeth bearing 15 divaricate anthers. Ovary seated on the top of staminal column, hairy; styles 1 mm long. Capsules 1.5 - 2 x 2 - 2.5 cm, pyriform, 5-winged, inflated, loculicidally 5-valved. Seeds usually 1 in each locule, tubercled.

*Fl.* Oct. - Nov.; *Fr.* Dec. - Jan.

*Distrib.* India: Tripura, Orissa and Southern India- cultivated in most parts.

Sri Lanka, Tropical E. Africa, Malesia and Polynesia.

### 10. *Leptonychia* Turcz.

(Ratna Dutta)

Small trees or shrub. Leaves simple, alternate, oblong to elliptic-oblong, obtuse or rounded at base, acuminate at apex, entire, membranous, glabrous on both surfaces, 3-nerved at base, lateral nerves 5 - 6 pairs, pinnately reticulate, petiolate, stipulate. Flowers bisexual, few in short, axillary cymes, shortly pedicelled, bracteate. Sepals 5, free, valvate in bud, stellate-hairy outside, velvety inside. Petals 5, imbricate in bud, short, orbicular, concave, densely villous. Stamens 10; staminal tube short, embracing the base of the ovary; filaments 3-seriate, outer series of 10 - 15 ligulate staminodes, middle of 10 fertile stamens, inner most of 5 very short fleshy staminodes; anthers linear-oblong, introrse, dehiscing longitudinally at the sides. Ovary sessile, obscurely obovoid, verrucose, densely downy, 2 - 3-loculed or unilocular by abortion, dehiscing septucidally or loculicidally or irregularly; locules 1-seeded. Seeds black with orange-coloured fleshy aril, albumen fleshy; cotyledons flat, leafy.

Mostly tropical Africa and a few in Southeast Asia, ca 45 species; one in India.

*Literature.* VELDKAMP, J.E. & R.C.H. FILIPPI (1987) A revision of *Leptonychia* (Sterculiaceae) in Southeast Asia. *Blumea* 32: 443-457.

***Leptonychia caudata*** (Wallich ex G. Don) Burret, *Notizbl. Bot. Gart. Berlin-Dahlem* 9: 729. 1926. *Grewia caudata* Wallich [Cat. No. 1099. 1929, nom. nud.] ex G. Don, *Gen. Hist.* 1: 547. 1831. *G. heteroclita* Roxb., [Hort. Beng. 93. 1814.] *Fl. Ind.* 2: 590. 1832. *Leptonychia heteroclita* (Roxb.) Kurz in *J. Asiat. Soc. Beng.* 39: 67. 1870, M.K.V. Rao in *J. Econ. Tax. Bot.* 8: 114. 1986. *L. glabra* Turcz. in *Bull. Soc. Imp. Nat. Moscou* 31: 223; Masters in *Fl. Brit. India* 1: 379. 1874; Brandis *Indian Trees* 92. 1906. *Grewia acuminata* Beddome in *Madras J. Litt. Sci.* 3(1): 38. 1864 & in *Trans. Linn. Soc.* 25: 210. 1866; Masters in *Fl. Brit. India* 1: 379. 1874, sp. dub.; non Juss. 1804. *Leptonychia acuminata* Burret in *Notizbl. Bot. Gart. Berlin-Dahlem* 9: 727. 1926, non Masters 1874. *L. moacurroides* Beddome, *Fl. Sylv.* 1: 114, t. 114. 1869; Masters in *Fl. Brit. India* 1: 379. 1874. *L. acuminata* Masters in *Fl. Brit. India* 1: 379. 1874, non Burret, 1926. *Paragrewia poilanei* Gagnepain ex R. Rao in *J. Bombay Nat. Hist. Soc.* 52: 190. 1954. **Fig. 121.**

Small trees or shrubs, 1 - 10 m tall; branches virgate, white or yellowish velutinous, soon glabrous or glabrescent. Leaves 10 - 14 x 3 - 4.5 cm, oblong or elliptic, ovate or obovate rounded at base, acuminate to caudate at apex, obscurely undulate glabrous; petioles 6 - 10 mm long, glabrescent; stipules 3 - 5 mm long, lanceolate, acute, velutinous outside, glabrous inside, caducous. Flowers axillary, solitary or up to 7 in short cymes; peduncles 5 - 10 mm long; pedicels 2 - 6 mm long; bracts 1 - 3 x 1 mm, ovate to triangular oblong, subglabrous to velutinous outside. Sepals 7 - 10 mm long, free, linear-lanceolate, finely pubescent outside. Petals greenish-white or light green, ca 2 x 2 mm, free, orbicular, densely villous, margins prominently hairy. Stamens 10, united at base around the ovary; filaments in pairs, 3 - 5 cm long, alternating with 5 small, tooth-like staminodes, each fertile filament bears a sterile filament at its back; anthers up to 1.5 mm long, ovoid to sagittiform. Ovary 2 - 2.5 mm long, obovoid, pubescent, 2 - 5-loculed; styles 4 - 5 mm long, pubescent; stigmas indistinctly 2 - 3-lobed, linear. Capsules 1.5 - 2.5 x 1.5 cm, globose to obovoid, shortly acuminate, 4-lobed, verrucose, densely downy, 2 - 5-loculed, 1 - 3-seeded, dehiscent loculicidally or septically or irregularly. Seeds 6 - 10 mm long, ellipsoid to ovoid, shining black with an orange-coloured fleshy aril.

*Fl. & Fr.* July - March.

*Distrib.* India: In evergreen forests of Western Ghats between 500 and 1000 m. Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands (S. Andaman Islands).

Myanmar, Thailand, Vietnam and Malesia

## 11. *Melhania* Forsskal

Herbs, undershrubs or shrubs, softly stellate-tomentose. Leaves simple, alternate, crenate or serrate, tomentose, paler beneath; petiolate; stipules usually filiform, tomen-

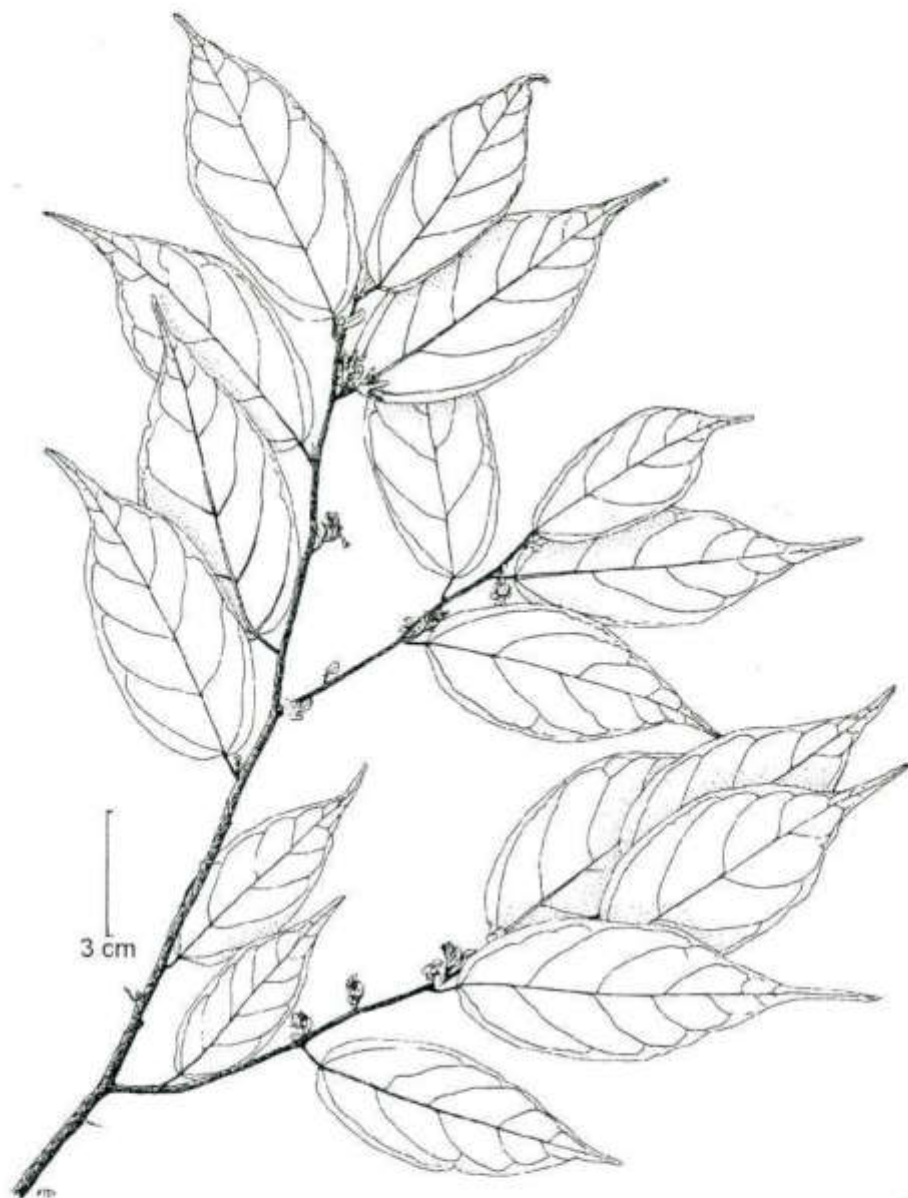


Fig. 121. *Leptonychia caudata* (Wallich ex G. Don) Burret

tose. Flowers yellow or rarely orange-yellow in 1 - 4-flowered axillary or terminal peduncled cymes. Involucral bracts 3, rarely 5, linear, ovate or cordate-reniform, usually tomentose, fleshy, accrescent, often recurved, larger than the sepals and persistent enclosing the fruits. Sepals 5, connate at base, acuminate or cuspidate, stellate-tomentose outside, glabrous inside. Petals 5, membranous, yellow or orange yellow, broadly obovate, macrescent. Stamens 5, alternating with 5 ligulate staminodes, connate at base into a short tube. Ovary sessile, usually subglobose, sometimes oblong, tomentose, 5-loculed, ovules 1 - many in each locule; styles long with 5 stigmatic branches. Capsules subglobose, loculicidally 5-valved. Seeds usually 4, rarely 2, angled, tubercled, rarely smooth; endospermous; cotyledons plicate, biparted, radicle inferior.

Africa, Asia and Australia, ca 600 species; 7 in India.

#### KEY TO THE SPECIES

- |  |                             |
|--|-----------------------------|
| 1a. Involucral bracts linear-oblong  | 5. <i>M. incana</i>         |
| b. Involucral bracts lanceolate, ovate-cordate or cordate-reniform                           | 2                           |
| 2a. Involucral bracts cordate-reniform, accrescent; seeds smooth                             | 2. <i>M. denhamii</i>       |
| b. Involucral bracts lanceolate, ovate-cordate, fleshy; seeds tubercled, rugose or mucricate | 3                           |
| 3a. Capsules subglobose  | 1. <i>M. cannabina</i>      |
| b. Capsules not subglobose   | 4                           |
| 4a. Cymes terminal; seeds 2 in each locule of capsules                                       | 7. <i>M. tomentosa</i>      |
| b. Cymes both terminal and axillary; seeds 4 or more in each locule of capsules              | 5                           |
| 5a. Involucral bracts longer than the sepals   | 4. <i>M. hamiltoniana</i>   |
| b. Involucral bracts shorter than or equal to the sepals                                     | 6                           |
| 6a. Leaves broadly ovate-lanceolate; flowers yellow  | 3. <i>M. futteyporensis</i> |
| b. Leaves narrowly lanceolate; flowers orange yellow   | 6. <i>M. magnifolia</i>     |

1. *Melhanhia cannabina* Wight ex Masters in Fl. Brit. India 1: 372. 1874. *M. balakrishnanii* Ravikumar et al. in Bull. Bot. Surv. India 31: 172, fl. A - O. 1989, *syn. nov.*

Shrubs, herbaceous portions white tomentose. Leaves 3.7 - 6.2 cm long, oblong, subcordate at base, crenulate, paler beneath, velvety above, 3-nerved; petioles 3 cm long; stipules fugaceous. Flowers in peduncled cymes. Involucral bracts lanceolate to ovate-cordate, cuspidate. Capsules subglobose, villous. Seeds numerous, angled, rugose.

*Distrib.* India: Karnataka and Tamil Nadu.

Endemic.

*Notes.* The species *M. balakrishnanii* is considered as a synonym of *M. cannabina*.

2. *Melhania denhamii* R. Br. in Denh. & Clapp., Trav. App. 232. 1826; Masters in Fl. Brit. India 1: 373. 1874.

Suffruticose herbs, woody at base, softly white stellate-tomentose; branches many, spreading. Leaves 2 - 4 x 0.6 - 2.4 cm, ovate-oblong, elliptic or elliptic-obovate, usually rounded at base, apiculate at apex, crenate-serrate, stellate-hairy above, hoary pubescent and paler beneath, 5-nerved at base; petioles 1.2 - 3 cm long, subterete, tomentose; stipules ca 5 mm long, subulate, filiform-setaceous, hairy. Flowers 2 - 3 in axillary, peduncled racemose cymes; peduncles ca 2 cm long; pedicels 2 - 4 mm long, hairy; involucre bracts 3, ca 1 x 1.5 cm, cordate-reniform, membranous, apiculate, accrescent. Sepals 4 - 6 mm long, ovate-lanceolate, pubescent outside, glabrous inside. Petals yellow, ca 4 mm in diam., obovate-spathulate, glabrous, veined. Stamens ca 2 mm long, alternating with ca 3 mm long staminodes. Ovary ca 2 mm in diam., globose, hairy; styles 4 mm long with 5 stigmatic branches. Capsules 4 - 6 mm in diam., globose, densely stellate-villous, loculicidally 5-valved. Seeds 1 or 2 in each locule, smooth, angular.

*Fl. & Fr.* March - Dec.

*Distrib.* India: Rajasthan.

Pakistan, Arabia and Tropical Africa.

*Notes.* Flowers open in the evening.

3. *Melhania futteyporensis* Munro ex Masters in Fl. Brit. India 1: 373. 1874. *M. tomentosa* Stocks ex Masters var. *major* Blatt. & Hallb. in J. Bombay Nat. Hist. Soc. 26: 228. 1918. 'maior'. *M. futteyporensis* Munro ex Masters var. *major* (Blatt. & Hallb.) Santapau in J. Bombay Nat. Hist. Soc. 56: 278. 1959.

Shrubs, coarsely pubescent. Leaves 7 - 15 x 3 - 8 cm, ovate, broadly ovate-lanceolate or oblong-lanceolate, oblong, cordate at base, acute or subacuminate at apex, unequally serrate, stellate-pubescent; petioles 2.5 - 5.5 cm long, terete, stellate-pubescent; stipules setaceous. Flowers yellow, 2 - 4 in axillary and terminal, peduncled cymes; peduncles 5 - 10 cm long; involucre bracts 3, 1.5 - 2 x 0.6 - 1 cm, about equalling sepals, ovate-oblong, cordate at base, acuminate at apex, margins recurved towards base, stellate-pubescent. Sepals 5, 10 - 14 x 3 mm, ovate-oblong, acuminate at apex, stellate-pubescent outside, glabrous inside. Petals yellow, 1.5 - 2 x 1 - 1.8 cm, obovate, membranous, veined. Stamens ca 1 cm long; staminodes 1 - 1.5 cm long, staminal tube ca 2 mm long. Ovary ca 3 mm in diam., hairy, 5-loculed; styles 1 cm long, with 5 stigmatic branches. Capsules oblong, villous, 5-veined, loculicidal. Seeds 4 in each locule, tubercled, angled.

*Fl. & Fr.* May - Oct.

*Distrib.* India: Punjab, Delhi, Uttar Pradesh, Rajasthan and Gujarat.

Pakistan.

**4. *Melhania hamiltoniana*** Wallich, Pl. Asiat. Rar. 1: 69, t. 77, 1830; Masters in Fl. Brit. India 1: 372. 1874, incl. vars.

Shrubs with spreading tomentose branches. Leaves 6 - 11 x 4 - 7 cm, roundish-ovate, subcordate at base, obtuse at apex, usually toothed, sometimes younger leaves towards ends of branches slightly smaller, elliptic-lanceolate or elliptic-oblong, acute or subacute at apex, unequally toothed, pubescent on both sides, whitish beneath, 5-nerved at base; petioles 1.5 - 2.5 cm long, pubescent; stipules 1 - 2 cm long, linear, setaceous, tomentose. Flowers yellow in axillary and terminal, peduncled cymes; peduncles 3 - 5 cm long, 1 - 3-flowered; involucre bracts 3, 1 - 1.5 cm long, ovate-lanceolate, recurved along margins, stellate-tomentose. Sepals 1 - 1.2 cm long, linear-oblong to lanceolate, cuspidate, stellate-tomentose outside, glabrous inside. Petals yellow, 1.2 - 1.8 cm long, obovate, oblique. Staminal tube 2 mm long bearing stamens and staminodes; staminodes ca 1 cm long. Ovary ca 5 mm in diam., subglobose, hairy, 5-loculed; styles 1 cm long with 5 stigmatic branches. Capsules ca 1 cm in diam., ovoid, villous, loculicidally dehiscent. Seeds 4 or more in each locule, 4-sided, tubercled.

*Fl. & Fr.* July - March.

*Distrib.* India: Punjab, Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, Gujarat and Tamil Nadu. \*

**5. *Melhania incana*** Heyne ex Wight & Arn., Prodr. 68. 1834; Masters in Fl. Brit. India 1: 372. 1874.

Suffruticose herbs or undershrubs, branchlets densely stellate-tomentose. Leaves 1.5 - 3.5 x 1 - 1.5 cm, linear-oblong to elliptic-lanceolate, rounded or subcordate at base, obtuse and apiculate at apex, serrulate, chartaceous, glabrous above, tomentose beneath; petioles 1 - 1.5 cm long, slender; stipules 5 - 7 mm long, filiform. Flowers yellow in axillary, peduncled cymes; peduncles longer or shorter than the petioles; pedicels short. Involucre bracts 3, linear-oblong, slightly shorter than sepals, tomentose. Sepals ca 7 mm long, lanceolate to ovate-oblong, acuminate, slightly incurved, stellate-tomentose outside, glabrous inside. Petals yellow, ca 8 mm long, orbicular to obovate. Stamens 2 mm long; staminodes up to 4 mm long; staminal tube 1 mm long. Ovary ca 5 mm in diam., hairy, 5-loculed; styles 3 mm long with 5 stigmatic branches. Capsules ca 6 x 3 mm, subglobose, hairy, dehiscence loculicidal. Seeds 2 - 4 in each locule, ovoid tubercled, angled.

*Fl. & Fr.* July - Dec.

*Distrib.* India: On red-soil in open dry places and scrub jungles. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Australia.

6. *Melhanhia magnifolia* Blatt. & Hallb. in J. Bombay Nat. Hist. Soc. 26: 228. 1918.

Erect undershrubs, woody, somewhat spreading; stems grey, stellate-downy. Leaves 7 - 11 x 3 - 5 cm, narrowly lanceolate to ovate-oblong, caudate or roundish at base, obtuse to subacute at apex, irregularly crenate or crenate-dentate, densely stellate-velvety above, white woolly tomentose beneath, 7-nerved; petioles 2 - 3 cm long, grey stellate-downy; stipules ca 5 mm long, filiform, tomentose. Flowers 1 - 5 in axillary and terminal, 4 - 5 cm long, peduncled cymes; pedicels 10 - 13 mm long; involucre bracts 3, 12 - 14 x 5 - 9 mm, cordate, broadly ovate, acuminate. Sepals 1.3 cm long, ovate-lanceolate, tomentose outside, glabrous inside. Petals orange-yellow, 1.5 - 2.2 x 1 - 1.5 cm, obovate, glabrous, veined. Stamens ca 1 cm long alternating with ca 2 cm long staminodes. Ovary 5 mm in diam., hairy; styles 1.5 cm long with stigmatic branches. Capsules 10 - 15 mm in diam., densely tomentose. Seeds 4 - 5 in each locule, more or less rhomboid, rugose, angular.

*Fl. & Fr.* Dec.

*Distrib.* India: Punjab, Rajasthan, Gujarat and Maharashtra.

7. *Melhanhia tomentosa* Stocks ex Masters in Fl. Brit. India 1: 373. 1874. *M. abutiloides* Aitch., Cat. Pl. Punjab & Sindh 23. 1869, p.p. non Arn. ex Wight 1840.

Shrubs, branches subterete, tomentose. Leaves 2.5 - 8 x 0.6 - 5 cm, ovate-elliptic, ovate-oblong, oblong-lanceolate, cordate to rounded at base, acute at apex, crenate-serrate, thinly stellate-hairy above, pale and softly pubescent beneath; petioles ca 2 cm long, tomentose; stipules subulate, pubescent. Flowers 2 - 3 in terminal peduncled cymes; pedicels 6 - 12 mm long, softly pubescent; involucre bracts 3, ca 8 mm long, ovate-lanceolate, acuminate, tomentose. Sepals 2 mm long, oblong, cuspidate, tomentose. Petals 1.5 - 2 cm long, obovate-oblong, thin, veined. Stamens 6 mm long; staminodes ca 1 cm long; staminal tube 2 mm long. Ovary ca 6 mm in diam., subglobose, hairy, 5-loculed; styles 8 - 10 mm long with 5 stigmatic branches. Capsules ca 1 cm in diam., oblong, villous, loculicidally dehiscent, 5-valved. Seeds 2 in each locule, muricate, angled.

*Fl. & Fr.* Dec.

*Distrib.* India: Punjab, Rajasthan, Gujarat and Maharashtra.

Pakistan.



## 12. *Melochia* L.

Herbs, undershrubs or rarely trees, more or less pubescent; bark fibrous. Leaves simple, alternate, more or less pubescent, serrate, petiolate. Flowers small, in axillary or terminal clusters or umbellate corymbs. Sepals 5, connate at base, tube cup-shaped or funnel-shaped with 2 fine teeth. Petals 5, free, spatulate, marcescent. Stamens 5; filaments connate forming a spindle-shaped staminal cup or tube; anthers extrorse. Staminodes absent. Ovary sessile, 5-loculed, ovules 2 in each locule, ascending; styles 5, free or connate at base. Capsules globose or subglobose, loculicidally 5-valved. Seeds 1 in each locule, angular or flat with a wing, brown or black; endospermous; embryo straight; cotyledons flat.

Tropics of both the hemispheres, ca 60 species; 3 in India.

### KEY TO THE SPECIES

- |   |                            |
|---|----------------------------|
| 1a. Small trees; flowers in umbellate corymbs; capsules oblong; seeds wigned                      | 3. <i>M. umbellata</i>     |
| b. Herbs or undershrubs; flowers in clustered cymes; capsules globose or subglobose               | 2                          |
| 2a. Herbs or undershrubs; flowers mostly in terminal clusters; calyx teeth much shorter than tube | 1. <i>M. corchorifolia</i> |
| b. Undershrubs; flowers in axillary clusters; calyx teeth equal to or longer than tube            | 2. <i>M. nodiflora</i>     |

1. *Melochia corchorifolia* L., Sp. Pl. 675. 1753; Masters in Fl. Brit. India 1: 374. 1874.

Herbs or undershrubs, up to 1m high; stems slender, ridged when young, glabrous except for 2 lines of hairs along internodes. Leaves 3 - 10 x 1.5 - 7 cm, variable in shape, ovate, ovate-lanceolate, oblong-ovate or suborbicular, rarely slightly lobed, rounded or cordate at base, acute or rounded at apex, coarsely irregularly serrate, glabrous or very rarely hairy on nerves beneath, 5-nerved at base; petioles up to 3.5 cm long. Flowers in densely crowded, terminal peduncled heads, surrounded by 4 - 5 bracteoles. Calyx 1 - 2 mm long, ciliate, hairy outside, teeth much shorter than tube, lanceolate. Petals white or pink, 3 - 4 mm long, obovate to spatulate. Staminal cup somewhat spindle-shaped, narrowed at mouth; anther cells divergent. Ovary ca 1 mm long, 5-loculed hairy; styles long. Capsules 3 - 5 mm in diam., depressed subglobose, hispid, loculicidally 5-valved. Seed 1 in each locule, brown, 2 mm long, trigonous.

*Fl. & Fr.* July - April.

*Distrib.* India: Throughout.

Pantropical.

2. *Melochia nodiflora* Swartz, Nov. Gen. Sp. Pl. Prodr. 97. 1788; Sreekumar & N.C. Nair in J. Bombay Nat. Hist. Soc. 78: 424. 1981. *M. borbonica* Cav., Diss. 6: 321. 1788.

Shrubs or undershrubs, 0.5 - 2.5 m high; stems terete, woody, much branched; branches drooping, reddish when mature, young portions stellate-pubescent. Leaves 7 - 13 x 0.7 - 7 cm, broadly ovate to ovate-lanceolate, cordate or rounded at base, acuminate at apex, serrate, sparsely pubescent on both surfaces, sometimes purple red; petioles 1 - 6 mm long, slender, pubescent; stipules 5 - 7 x 3 - 6 mm, pubescent. Flowers few to many, in axillary, clustered cymes; bracts linear, ca 2 mm long. Calyx funnel-shaped, ca 4 mm long, teeth 5, equal to the tube, lanceolate, pubescent outside, 3-nerved, persistent. Petals white, 5 - 6 mm long, spatulate. Ovary ca 2 mm long, tomentose; ovules 1 in each locule. Capsules ca 4 mm in diam., subglobose, deeply longitudinally 5-lobed, pubescent. Seed 1 in each locule, trigonous, brown with a white spot at the tip; testa smooth, minutely reticulate.

*Fl.* Oct. - Feb.; *Fr.* Nov. - April.

*Distrib.* India: West Bengal, Bihar, Tamil Nadu and Kerala - a naturalised weed.

3. *Melochia umbellata* (Houtt.) Stapf in Bull. Misc. Inform. 1913: 317. 1913. *Visenia umbellata* Houtt., Handl. 8: 309, t. 46. f. 3. 1777. *Melochia velutina* Beddome, Fl. Sylv. t. 5. 1859; Masters in Fl. Brit. India 1: 374. 1874.

*Mar.*: Methuri

Small trees; young parts stellate-hairy; bark striated, brown on mature stems. Leaves 13 - 25 x 15 - 24 cm, often broader than long, broadly ovate or suborbicular, cordate-truncate or subacute at base, acuminate at apex, serrate, velvety on both surfaces when young, sparsely stellate-hairy or glabrescent above, downy beneath when mature; 5 - 7-nerved at base; petioles 4 - 14 cm long, striated, stellate-pubescent; stipules very caducous. Flowers pink, many in axillary and terminal umbellate corymbs, ca 7 mm diam., peduncles and pedicels velvety, often striate. Sepals 5, connate up to the middle, lobes deltoid-ovate. Petals twice the length of the calyx, oblong, truncate, recurved, veined. Stamens inserted on a lobed disk with the petals; filaments flat, forming a basal cup. Ovary 5-carpellary, pilose, ovules 1 in each locule. Capsules 6 - 9 mm long, deeply 5-lobed, pilose. Seed 1 in each locule, 2 mm long, black, winged, wings more than double the size of the seed.

*Fl. & Fr.* Dec. - April.

*Distrib.* India: Maharashtra, Karnataka (Coorg), Kerala and Andaman & Nicobar Islands (Nicobar Islands).

Myanmar, Malesian Islands and Mauritius.

### 13. *Pentapetes* L.

Annual herbs, much branched. Leaves simple, alternate, elongated, hastate-lanceolate, crenate-dentate. Flowers axillary, pedicellate, solitary or in pairs; bracteoles 3, subulate, caducous. Calyx 5-partite, connate at base. Petals 5. Stamens 15 in 5 groups of 3 each, alternating with 5 staminodes, staminal cup cylindrical. Ovary sessile, 5-locular, ovules many in each locule; styles elongated, often twisted, thickened upwards; stigmas 5, minute. Capsules subglobose to oblong, loculicidally dehiscent, 5-valved. Seeds 8 - 12, 2-seriate in each locule; cotyledons plaited.

Widely distributed in tropical Asia, monotypic.

*Pentapetes phoenicea* L., Sp. Pl. 698. 1753; Masters in Fl. Brit. India 1: 371. 1874.  
Fig. 122.

Beng.: *Kat-lata*, *Bandhuli*; Tipp.: *Dupure chandi*.

Herbs, up to 2 m high, much branched, sparsely stellate-hairy. Leaves 7 - 15 cm long, deltoid or hastate to linear, deltoid at base, acute at apex, often broad up to 3 cm, strongly crenate-serrate, glabrous above, stellate-hairy on the veins beneath; petioles 1 - 3 cm long; stipules linear-subulate, equalling petioles. Flowers 1 - 3 in axillary fascicles. Sepals up to 1 cm long, connate at base, lobes lanceolate, acuminate, stellate-hairy mixed with simple bristles outside. Petals 1 cm long, obovate, truncate. Staminal cup bearing 5 groups of 3 stamens alternating with 5 staminodes; staminodes as long as petals, linear-spathulate, glandular on inner surface. Ovary 5-locular, hairy, ovules many in each locule; styles 1 - 1.5 cm long, often twisted. Capsules 1 - 1.5 x .6 - 1 cm, subglobose to oblong, 5-valved, stellate-tomentose with scattered bristles equalling or shorter than the persistent calyx. Seeds 8 - 12 in two series, ca 2 mm long, obovate, dotted.

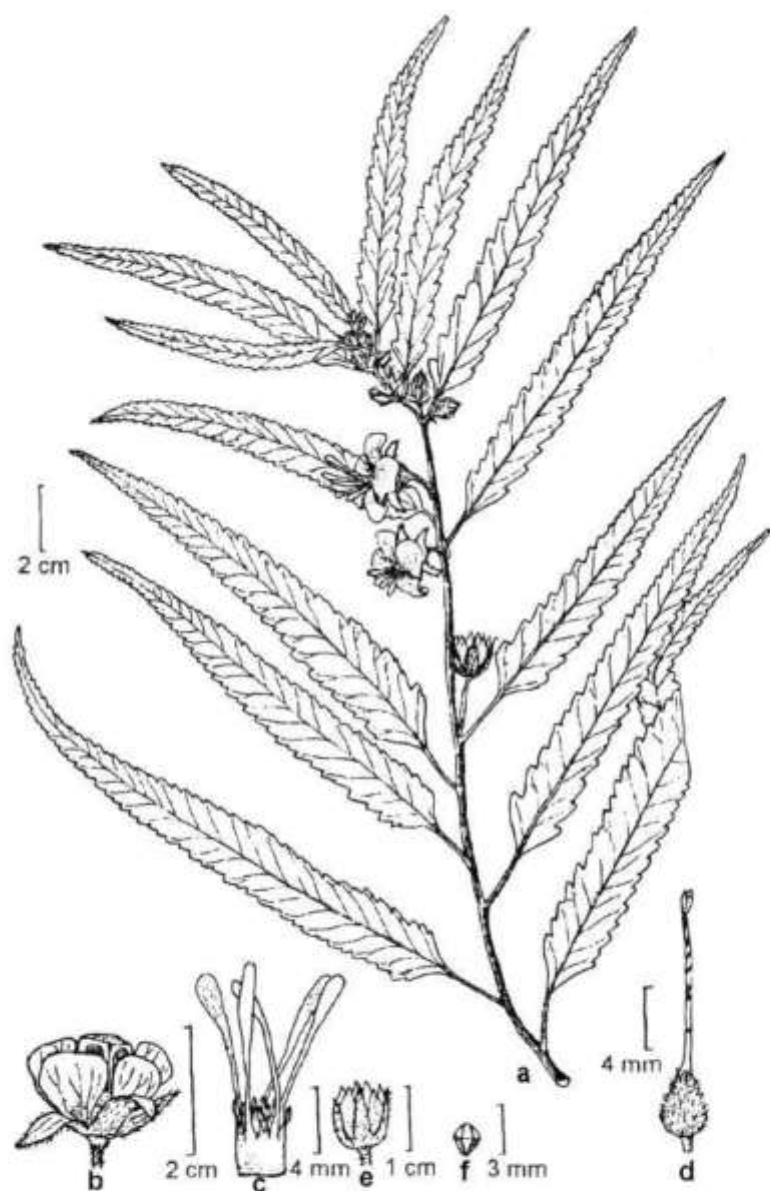
Fl. & Fr. Aug. - Jan.

*Distrib.* India: Punjab, Uttar Pradesh, Bihar, West Bengal, N.E. India, Orissa, Andhra Pradesh and Tamil Nadu; often cultivated.

Tropical Asia.

### 14. *Pterocymbium* R. Br.

Trees. Leaves simple, broad, entire or lobed with 3 or more basal nerves, simple or stellate-hairy; stipules lateral, subulate, caducous. Flowers polygamo-monoecious appearing before the leaves at the apices of branchlets umbellately arranged in large branched panicles. Calyx 5-lobed, divided nearly to the middle, turbinate. Petals absent. Male flowers: stamens on a staminal column; anthers 10 or 8 in a single whorl, annulately coherent, covering the abortive ovaries. Female flowers: carpels 3 - 6, free. Follicles



**Fig. 122.** *Pentapetes phoenicea* L.: a. flowering part of branch; b. flower; c. staminal column showing stamens and staminodes; d. pistil; e. fruit; f. seed.

1 - 6, stipitate, boat-shaped with a pouch-like bulging at base, membranous, dehiscent long before maturity. Seed 1, basal.

Southeast Asia, New Guinea to Fiji Islands, ca 5 species; one in India.

**Pterocymbium tinctorium** (Blanco) Merr., Govt. Lab. Publ. Philipp. 27: 24. 1905. *Heritiera tinctoria* Blanco, Fl. Filip. 653. 1837. *Sterculia campanulata* Wallich ex Masters in Fl. Brit. India 1: 362. 1874; Parkinson, For. Fl. Andaman 100. 1923. **Fig. 123.**

Large trees, 15 - 20 m tall; bark greyish to brownish. Leaves 10 - 15 x 7 - 15 cm, broadly ovate or oblong-ovate, rounded at base, acute or acuminate at apex, entire, petioles 3 - 10 cm long, slender; stipules ca 6 mm long, subulate, caducous. Pedicels jointed; bracteoles caducous. Calyx ca 1.5 x 4 cm, campanulate, glabrous, lobes ca 7 mm long, lanceolate, tube coriaceous, green, velvety along margins. Male flowers: staminal column as long as the sepals, pubescent below; anther lobes parallel, covering abortive ovaries. Female flowers: ovaries 5, sessile, gibbous at base; styles short. Follicles 5 or fewer by abortion, glabrous, membranous, as long as the enlarged sepals, 5 - 9 x 1.8 - 2.5 cm, boat-shaped, 2-lobed, lower broad, round; upper linear, obtuse, glabrous. Seed 1, 1 cm long, ellipsoid to ovoid.

#### KEY TO THE VARIETIES

- |  |                               |
|--|-------------------------------|
| 1a.. Leaves cordate-rotundate, glabrous                      | 1.1. var. <b>glabrifolium</b> |
| b. Leaves ovate or ovate-oblong, pubescent on nerves beneath | 1.2. var. <b>tinctorium</b>   |

#### 1.2. var. **tinctorium**

*Fl.* Feb. - March; *Fr.* Soon after.

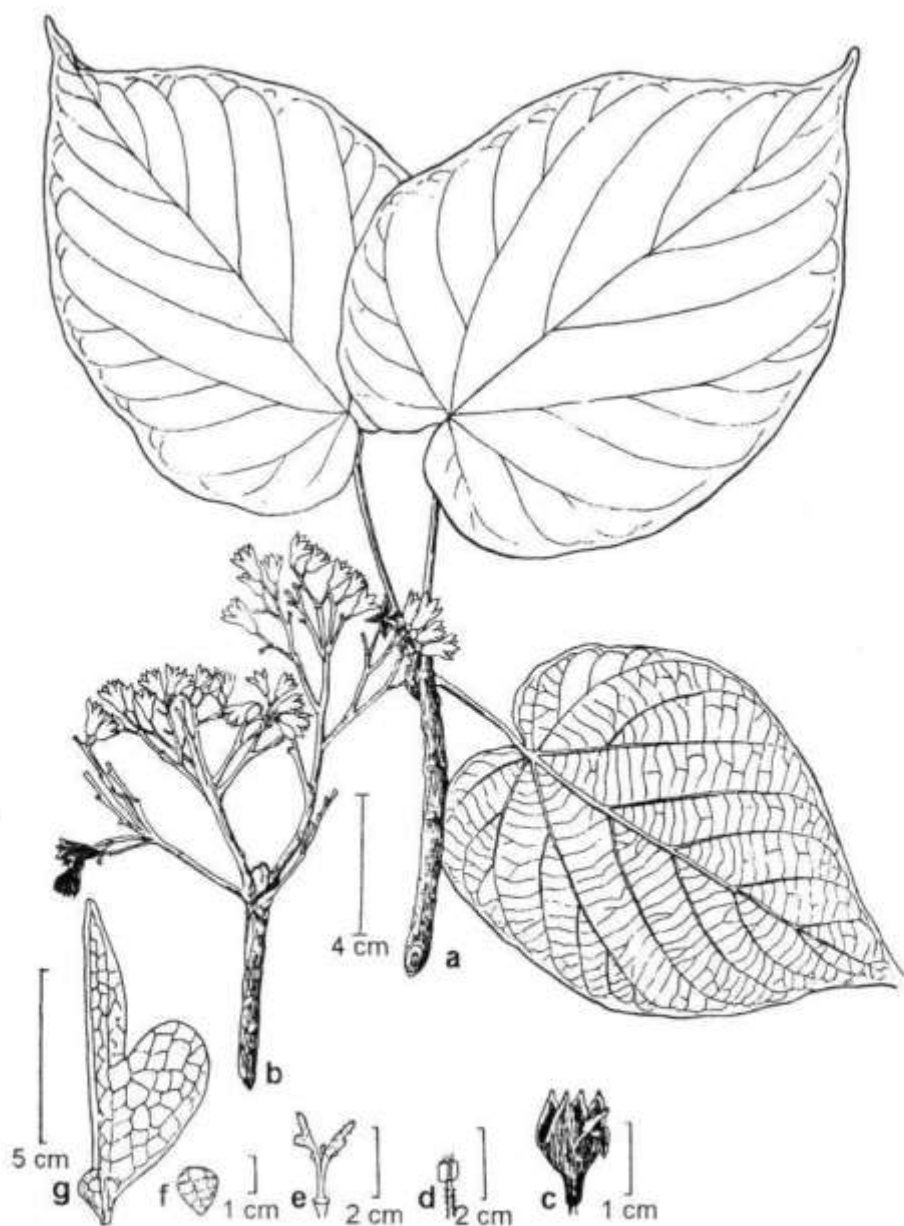
*Distrib.* India: Andaman & Nicobar Islands and Tripura.

1.1. var. **glabrifolium** (Kurz) Thoth. in Bull. Bot. Surv. India 3: 83. 1961. *Sterculia campanulata* Wallich ex Masters var. *glabrifolia* Kurz in J. Asiat. Soc. Beng. 45: 120. 1876.

*Fl. & Fr.* Feb.

*Distrib.* India: Andaman & Nicobar Islands (Kamorta and Katchall Islands).

Endemic.



**Fig. 123.** *Pterocymbium tinctorium* (Blanco) Merr.: a. part of branch with leaves; b. branch with inflorescences; c. female flower; d. fertile stamen; e. gynoecium; f. seed; g. fruit with prominent wing.

15. *Pterospermum* Schreb. nom. cons.

(S.K. Chandra)

Trees or shrubs; scally or stellate-tomentose. Leaves simple or lobed coriaceous, oblong, oblong-lanceolate or obovate, rounded, cordate, often oblique at base, sometimes peltate to subpeltate, acuminate or obtuse or lobed at apex, entire or serrate, penninerved; petioles long or short; stipules pinnate to palmately laciniate or absent. Flowers regular, bisexual, large, 1 - 3 in axillary and terminal peduncles; bracteoles 3, entire, laciniate, pectinate, persistent or caducous or absent. Sepals 5, connate at base, deciduous. Petals 5, obovate, oblong or linear, deciduous with the calyx. Staminal column adnate to gynophore bearing 15 fertile stamens in 5 groups of 3 between the staminodes and opposite sepals; anthers linear, erect, connective, apiculate, cells parallel. Ovary inserted on the top of the staminal column, 5-locular; ovules many; styles entire with furrowed stigmas. Capsules woody or coriaceous, terete or angled, loculicidally 5-valved. Seeds winged above, attached in 2 rows to the inner angle of the locules; endosperm scanty or absent; cotyledons plaited or corrugated.

E. Himalayas, S. E. Asia and W. Malesia, ca 40 species; 11 in India.

## KEY TO THE SPECIES

- |   |                                    |
|---|------------------------------------|
| 1a. Capsules angular  | 2                                  |
| b. Capsules terete  | 5                                  |
| 2a. Capsules oblong, covered with brown tubercles; flowers ca 15 cm long  | 3                                  |
| b. Capsules oblong, tapering at both ends, glabrous or tomentose; flowers up to 6 cm long   | 4                                  |
| 3a. Leaves broadly ovate-oblong, usually 3-lobed at apex; peltate to subpeltate at base; petioles more than 7 cm long; bracteoles palmately divided | <b>1. <i>P. acerifolium</i></b>    |
| b. Leaves narrowly obovate-oblong, abruptly triangular at apex, cordate at base; petioles up to 3 cm long; bracteoles entire                        | <b>3. <i>P. diversifolium</i></b>  |
| 4a. Leaves entire throughout; capsules glabrous, sulcate; bracts ovate, entire  | <b>2. <i>P. aceroides</i></b>      |
| b. Leaves coarsely toothed or lobed towards apex; capsules hairy, not sulcate; bracts variously lobed   | <b>11. <i>P. xylocarpum</i></b>    |
| 5a. Bracteoles linear; leaves creamy-pubescent beneath  | <b>10. <i>P. suberifolium</i></b>  |
| b. Bracteoles laciniate or palmately divided; leaves tomentose beneath  | 6                                  |
| 6a. Leaves oblique at base  | 7                                  |
| b. Leaves symmetrical at base   | 9                                  |
| 7a. Leaves large (up to 27 cm long), semisagittate at base; bracteoles with many divisions  | <b>9. <i>P. semisagittatum</i></b> |
| b. Leaves small (up to 17.5 cm long); not semisagittate at base; bracteoles with few divisions  | 8                                  |
| 8a. Leaves up to 8.5 cm long; stipules and bracts without cucullate appendage at base   | <b>8. <i>P. rubiginosum</i></b>    |
| b. Leaves more than 8.5 cm long; stipules and bracts with cucullate appendage at base   | <b>3. <i>P. javanicum</i></b>      |
| 9a. Leaves lanceolate; capsules ovoid   | <b>5. <i>P. lancifolium</i></b>    |
| b. Leaves ovate-oblong; capsules oblong   | 10                                 |

- 10a. Leaf apex often cut into several lobes or coarsely toothed; bracteoles laciniate; capsules without tubercles at base<sup>2</sup> 7. *P. reticulatum*
- b. Leaf apex two-lobed; bracteoles pectinate; capsules tubercled at base 6. *P. obtusifolium*

1. *Pterospermum acerifolium* (L.) Willd., Sp. Pl. 3: 729. 1800; Masters in Fl. Brit. India 1: 368. 1874, p.p. *Pentapetes acerifolia* L., Sp. Pl. 698. 1753.

Asm.: *Morra, Moragos*; Beng.: *Muskunda*; Hindi: *Kanak-champa*; Mar.: *Kamikar*; Sans.: *karnikara*.

Large trees, 12 - 15 m tall; bark smooth; young portions clothed with rusty stellate or floccose pubescence. Leaves 23 - 38 x 14 - 30 cm, broadly ovate to elliptic-oblong, cordate and subpeltate or often peltate at base, acute at apex, entire, lobed or coarsely toothed, coriaceous, glabrous above, grey or white tomentose beneath, palmately 7 - 12-nerved at base (juvenile leaves up to 0.5 m long, usually palmately lobed); petioles 7 - 9 (- 30) cm long, stout, striated; stipules multifid, caducous. Flowers ca 15 cm long, axillary, solitary or in 2 - 3-flowered cymes, fragrant, 10 - 15 cm across; pedicels ca 1 - 3 cm long; bracts semilunar, clawed; bracteoles palmately divided, caducous. Sepals 5, fleshy, 8 - 11 x 0.6 - 0.9 cm, linear, connate at base, rusty stellate-tomentose outside, silky inside, caducous. Petals 5, white, 7 - 9.5 cm long, linear-revolute. Staminodes 6 - 8.5 cm long, club-shaped. Ovary 1 - 3 cm long on 1 - 1.3 cm long gynophore, oblong, white pubescent, 5-locular; ovules many in 2 rows; styles 5 - 6.5 cm long; stigmas clubshaped. Capsules 10 - 20 x 3 - 6 cm, woody, oblong, 5-angled; covered with brown tubercles. Seeds 1 - 2 x 1 - 1.5 cm, obliquely-ovoid, compressed, many in 2 rows, winged, wings 4 - 7 x 1 - 1.4 cm; testa brown, smooth, endosperm scanty, mucilaginous.

Fl. March - Nov.; Fr. July - Dec.

Distrib. India: Throughout warmer regions; often cultivated.

Continental Asia, introduced elsewhere.

2. *Pterospermum aceroides* Wallich ex Kurz in J. Asiat. Soc. Beng. 42: 62. 1873; *P. acerifolium* auct. non (L.) Willd., Masters in Fl. Brit. India 1: 368. 1874, p.p.

Trees, 12 - 16 m tall; young portions covered with a thin felted layer of minute white tomentum. Leaves 20 - 28 x 11 - 16 cm, obovate to oblong, cordate at base with somewhat unequal lobes, acuminate at apex, entire, coriaceous, glabrous above, pale whitish stellate-pubescent beneath; nerves 11 - 14 (juvenile leaves much larger and palmately lobed); petioles 1 - 2 cm long, stout. Flowers 4 - 5 cm long; bracts broadly ovate, tomentose, thick. Sepals 5, 3.5 - 5 x 0.4 - 0.6 cm, recurved, scurfy tomentose outside, adpressed pubescent inside. Petals 5, white, 3 - 4 cm long, obovate. Stamens 15, as long as the petals or shorter; staminodes 5, longer than the stamens. Ovary 5-locular, densely



sericeous; styles shorter than stamens; stigmas clavate. Capsules 12 - 18 x 3 - 4 cm, glabrous, black when mature. Seeds many, in two rows, ca 1 x 1 cm, somewhat rhomboid; wing 3 - 4 cm long, narrowed towards apex.

*Fl.* Oct. - March; *Fr.* March - June.

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands).

Myanmar.

**3. *Pterospermum diversifolium*** Blume, Bijdr. 88. 1825; Masters in Fl. Brit. India 1: 367. 1874. *P. glabrescens* Wight & Arn., Prodr. 69. 1834; Masters in Fl. Brit. India 1: 369. 1874.

Trees, up to 20 m tall with horizontal branches; young portions tawny tomentose or rufous stellate-hairy. Leaves 15 - 30 x 9 - 15 cm, obovate-oblong to elliptic, caudate at base, acuminate at apex, entire, coriaceous, glabrous above, hairy beneath, nerves 8 - 10 pairs; petioles 1 - 1.5 cm long, stout; stipules 10 - 13 mm long, lanceolate, caducous. Flowers up to 15 cm long, scented; pedicels ca 5 mm long; bracteoles 2, 5 mm long, linear, entire recurved, caducous. Sepals 5, 10 - 14 x 0.4 - 0.6 cm, linear, rusty tomentose outside, silky inside. Petals 10 - 12 cm long, membranous, spatulate. Stamens 8 - 10 cm long; staminodes 10 - 11 cm long. Gynophore 2.5 - 3.5 cm long; ovary 1 - 1.5 cm long, downy; styles 4 - 5 cm long; stigma fusiform. Capsules 10 - 25 x 2 - 4 cm, woody, sulcate 5-angled, abruptly constricted at base and apex. Seeds ca 1 x 1 cm, compressed, slightly rhomboid with 2.5 - 3 cm long wing at one end.

*Fl.* Sept. - Nov.; *Fr.* April - June.

*Distrib.* India: Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Malesia.

**4. *Pterospermum javanicum*** Jungh. in Hoen. & De Vriese, Tijdschr. 7: 306. 1840. *P. blumeianum* Korthals in Ned. Kruidk. Arch. 1: 311. 1848; Brandis, Indian Trees 92. 1921.

Trees; bark dark brown, peeling off in recurved flakes, younger parts brownish tomentose. Leaves 10 - 12 x 40 - 6 cm, obliquely oblong or ovate, unequally cordate or rounded at one side while acute at the other side of the base, acuminate at apex, entire, chartaceous, glabrous above, densely tomentose beneath; petioles ca 3 mm long; stipules 1 - 1.5 cm long, subulate with a basal cucullate appendage. Flowers white, 4 - 6 cm long, axillary. Peduncles 1 - 1.5 cm long; bracteoles 4 - 6 mm long with a basal cucullate appendage. Sepals 5.5 - 6.5 x 0.2 - 0.3 cm, linear, stellate-tomentose on both sides. Petals 2 - 3 x 0.5 - 0.8 cm, obovate. Stamens ca 2 cm long; filaments glabrous;

staminodes 2 - 2.5 cm long. Ovary ca 3 mm long, densely villous; styles 2.2 - 2.7 cm long, glabrous; stigmas obtusely 5-lobed. Capsules 6 - 8 x 1 - 2.5 cm, spindle-shaped, narrowed at both ends. Seeds 2 in each locule.

*Fl.* March.

*Distrib.* India: Assam and Meghalaya.

Bhutan, Myanmar and Malesia.

**5. *Pterospermum lancifolium*** Roxb., [Hort. Beng. 50. 1814, nom. nud.] Fl. Ind. 3: 163. 1832; Masters in Fl. Brit. India 1: 368. 1874 'lanceaefolium'.

*Asm.*: Ban-baguri, Motanahor; *Kh.*: Dieng-pen-swang; *Naga.*: Ching-nai; *Nep.*: Singani.

Trees, 13 - 15 m tall; branchlets slender with short white tomentum. Leaves 6 - 15 x 2 - 5 cm, lanceolate, rounded or subcordate or cuneate at base, acuminate at apex, entire, lateral nerves 4 - 5 on either side, stellate-hairy; petioles 5 - 12 mm long; stipules ca 8 mm long, subulate, 2 - 4-fid, lobes filiform, caducous. Flowers pale white, axillary, 5 - 6 cm across, fragrant; peduncles 3 - 5 cm long; pedicels 1 - 1.5 cm long. Sepals 2.5 - 3 x 0.2 cm, rusty tomentose outside, villous inside. Petals white, 3 - 3.5 x 0.3 - 0.4 cm, white, sweet-scented. Stamens ca 1.5 cm long; staminodes ca 2 cm long. Ovary ca 1 x 1.5 cm; styles ca 2 cm long, ribbed. Capsules 5 - 7 x 2.5 - 3 cm, ellipsoid-ovoid, acute, covered with light grey tomentum, woody, loculicidally 5-valved. Seeds 2 - 4 in each locule, ca 1 x 0.8 cm, wing 2 - 2.5 x 0.6 - 0.1 cm, oblong.

*Fl.* May - June; *Fr.* Oct. - April.

*Distrib.* India: Punjab, Uttar Pradesh, Assam, Meghalaya and Manipur.

Nepal, Bangladesh and Myanmar.

**6. *Pterospermum obtusifolium*** Wight ex Masters in Fl. Brit. India 1: 369. 1874.

Trees. Leaves 7 - 18 x 4 - 8 cm, ovate-oblong to obovate-oblong, cuneate at base, 2-lobed at apex, entire, coriaceous, glabrous to glabrescent above, ashy tomentose beneath; petioles 3 - 5 cm long; stipules ca 5 cm long, subulate. Cymes axillary; bracteoles laciniate. Sepals ca 25 x 5 mm, linear-lanceolate, stellate-tomentose. Petals ca 22 x 8 mm, oblanceolate, clawed. Stamens 15, staminal tube 2 mm long; staminodes 5, filiform, stellate-pubescent. Ovary ca 2.5 mm long, globose, pubescent. Capsules ca 5 x 3 cm, oblongoid, obtuse, covered with squarish truncated tubercles. Fruiting pedicels ca 1 cm long, jointed at the middle.

*Fl. & Fr.* March - Aug.

*Distrib.* India: Karnataka, Tamil Nadu and Kerala; rare.

**7. *Pterospermum reticulatum*** Wight & Arn., Prodr. 69. 1834; Masters in Fl. Brit. India 1: 369. 1874.

Mal.: *Mala vuram, Mala viriam*; Tam.: *Muli polavu, Thopuli*.

Trees, 10 - 25 m tall. Leaves 8 - 12 x 6 - 9.5 cm, elliptic-obovate to cuneate-oblong, cuneate to oblique subcordate at base, acuminate at apex, entire, or coarsely toothed near apex, glabrous above, cream coloured mealy tomentum with darker minute stellate hairs beneath, 3-nerved at base; petioles 8 - 15 mm long. Flowers 1 - 3, axillary, 3 - 4 cm across; pedicels ca 5 mm long; fruiting peduncles longer than petioles; bracteoles 3- to multisect, ca 5 mm long, segments linear. Sepals 2 - 3.5 x 0.3 cm, linear-lanceolate, rusty stellate-hairy outside, silky tomentose inside. Petals yellowish, 12 - 18 x 3 - 4 mm, obovate-oblong, recurved. Stamens 11 - 14 mm long. Capsules 5 - 7 x 3 cm, ovoid to oblong, acute, slightly angular contracted at base, stellate-pubescent. Seeds 4 in each locule, ca 1 cm in diam., wings 2 - 3 x 0.6 - 0.7 cm.

*Fl.* Dec. - March; *Fr.* March - Nov.

*Distrib.* India: In evergreen forests of Western Ghats at low elevations. Karnataka, Tamil Nadu and Kerala; sometimes planted as a roadside tree.

**8. *Pterospermum rubiginosum*** Heyne ex Wight & Arn., Prodr. 68. 1834; Masters in Fl. Brit. India 1: 368. 1874. **Fig. 124.**

Mal.: *Malam - thodali*; Tam.: *Chittilei - polavu*.

Tall trees, up to 25 m tall; branchlets slender, pendulous. Leaves 6 - 8 x 2 - 3 cm, obliquely ovate-lanceolate, obliquely cordate at base, acuminate at apex, entire, glabrous, rusty pubescent beneath, 4-nerved at base; petioles 4 - 6 mm long; stipules ca 3 mm long, oblique laciniate, caducous. Flowers white, solitary, axillary, fragrant; bracteoles as long as stipules, laciniate, caducous; peduncles ca 1 cm long. Sepals 4 - 4.5 x 0.3 cm, linear. Petals 2 - 3 x 0.2 cm, obovate-oblong to linear. Stamens ca 1.5 cm long; connective produced into a terminal point; staminodes ca 2 cm long, filiform. Ovary ca 3 mm long; styles 2.7 - 3.7 cm long; stigmas obscurely 5-lobed. Capsules 4 - 8 x 1 - 2 cm, oblong, beaked, 5-angled, glabrous.

*Fl.* Sept. - Feb.; *Fr.* May - July.



Fig. 124. *Pterospermum rubiginosum* Heyne ex Wight & Arn.

*Distrib.* India: In evergreen forests up to 1000 m, Karnataka, Tamil Nadu, Kerala and Assam.

*Notes.* Wood used for making boats, match boxes, splints and paper pulp.

**9. *Pterospermum semisagittatum*** Buch.-Ham. ex Roxb., Fl. Ind. 3: 160. 1832; Masters in Fl. Brit. India 1: 368. 1874.

Lus.: *Mukua*

Trees, 9 - 12 m tall; bark ash-coloured. Leaves 12 - 27 x 2 - 5 cm, oblong-lanceolate, very obliquely cordate or sagittate auricled on one side at base, acuminate at apex, entire, glabrous above, hoary beneath, 5 - 7-nerved; petioles 3 - 5 mm long; stipules 1 - 1.5 cm long, pinnatifid. Flowers white, axillary or terminal, solitary on short drooping peduncles; peduncles ca 5 mm long; bracteoles 3, ca 2.5 cm long, palmately lobed, conspicuous. Sepals 5, 5 - 7 x 0.5 - 0.6 cm, linear, connate at base, stellate-tomentose outside and silky pubescent inside. Petals 5, 4.5 - 5.5 x 0.8 - 1.2 cm, obliquely obovate-cuneate to spatulate, white or dark brown on drying, fragrant, stellate-hairy outside. Stamens 15, 3 - 3.5 cm long; staminodes 5, 5 - 5.5 cm long. Ovary ca 4 mm in diam., globose, 5-locular, ovules 2 in each locule; stigmas club-shaped. Capsules 7 - 8 x 3 - 3.5 cm, elliptic-oblong, terete. Seeds 8 - 10 in each locule, winged, compressed.

*Fl.* May - June; *Fr.* July - Nov.

*Distrib.* India: Bihar, West Bengal, Manipur, Tripura, Orissa and Tamil Nadu.

Bangladesh and Myanmar.

**10. *Pterospermum suberifolium*** (L.) Lam., Tabl. Encycl. 3: 136, t. 576. 1794; *Pentapetes suberifolia* L., Sp. Pl. 698. 1753. *Pterospermum canescens* Roxb., [Hort. Beng. 50. 1814, nom. nud] Fl. Ind. 3: 1162. 1832.

Beng., Hindi & Mar.: *Muchakund*; Kan.: *Muchukunda gida*; Or.: *Baila*; Tam.: *Tada*, *Polavu*, *Sembolavu*; Tel.: *Lolagu*, *Tada*.

Small trees, 8 - 10 m tall; young portions stellate-tomentose. Leaves 7.5 - 11.5 x 3.5 - 6 cm, oblong to obovate-oblong, cuneate rounded or subcordate at base, acuminate at apex, entire or often lobed towards apex; petioles 8 - 12 mm long, tomentose; stipules caducous. Flowers white, 4 - 5 cm across, 1 - 3 in axillary peduncles, fragrant; pedicels 5 - 10 mm long, stout, jointed, tomentose; bracteoles 5 mm long, linear, caducous. Sepals 5, 1.5 - 2 x 0.2 cm, linear, revolute, stellate-tomentose outside, silky hairy inside. Petals 5, ca 12 x 4 mm, oblong, sparsely stellate-hairy. Stamens 15, ca 5 mm long; staminodes ca 1 cm long, filiform. Ovary ca 1 cm in diam., ovoid, silky villous. Capsules 4 - 6 x 2 - 2.5 cm, ovoid-oblong or ovoid, terete tapering at both ends, 4 - 5-valved, creamy

tomentose outside. Seeds usually 2 - 4 in each locule with a broad terminal wing, twice as long as seed, ca 5 x 4 mm; wing ca 1.3 x 1.6 cm.

*Fl.* June - July; *Fr.* Nov. - Feb.

*Distrib.* India: Orissa, Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu.

Sri Lanka and Myanmar.

**11. *Pterospermum xylocarpum*** (Gaertn.) Santapau & Wagh in Bull. Bot. Surv. India 5: 108. 1963. *Velago xylocarpa* Gaertn., Fruct. Sem. Pl. 2: 245, t. 133. f. 2. 1791. *Pterospermum suberifolium* Willd., Sp. Pl. 3: 728. 1800. *Pterospermum heyneanum* Wallich ex Wight & Arn., Prodr. 69. 1834; Masters in Fl. Brit. India 1: 369. 1874.

*Kan.:* Rajataru, Kanaka champaka; *Mal.:* Palaka-unam; *Or.:* Giringa; *Tam.:* Polavu, Masapoondi, Masippuluvu; *Tel.:* Tada.

Trees, up to 20 m tall; young portions rusty tomentose. Leaves 10 - 19 x 6 - 12 cm, variable in size and shape, usually oblong or oblong-obovate, cordate at base, acuminate at apex, entire but coarsely toothed or lobed at apex, coriaceous, glabrous above, greyish pubescent beneath; petioles 6 - 10 mm long, stout, pubescent. Flowers white, 5 cm across, fragrant, solitary or in 2 - 3-flowered fascicles; bracteoles ca 1 x 0.7 cm, broadly ovate, deeply and variously lobed, imbricated round the base of the flower, stellate-tomentose, persistent. Sepals 5, 3 - 5 x 0.3 - 0.5 cm, oblong, rusty stellate-tomentose, persistent. Sepals 5, 3 - 5 x 0.7 cm, oblong, rusty stellate-hairy outside, silky villous inside. Petals 5, white, 2.5 - 4 x 0.6 - 1 cm, obovate, stellate-pubescent outside, spreading. Stamens 15, 1 - 1.3 cm long; anthers ca 9 mm, with a long produced connective; staminodes 5, 2 - 3 cm long, filiform. Ovary ca 6 x 3 cm, densely rusty stellate-hairy. Capsules 5 - 7.5 x 2 - 3.6 cm, oblong to pyriform, narrowed at both ends, obtusely 5-angled, rusty stellate-tomentose. Seeds 8 - 10 in each locule, 10 x 3 mm, orbicular, wing ca 2.2 x 0.8 cm, papery.

*Fl.* May - Jan.; *Fr.* Jan. - July.

*Distrib.* India: West Bengal, Orissa, Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu.

### 16. *Pterygota* Schott & Endl.

Trees. Leaves entire to irregularly lobed. Flowers unisexual to polygamous in panicles in the axils of fallen leaves. Calyx deeply 5-partite. Corolla absent. Staminal column cylindric, bearing 4 - 5 groups of ca 5 anthers in each male flower. Ovaries 5, sessile, ovules many; styles short, recurved; stigmas 2-lobed. Follicles 5, hard, woody, large follicles. Seeds many, winged at apex.

India, Sri Lanka, Myanmar, Malesia, S. China, New Guinea, Tropical Africa and Madagascar, ca 5 species; one in India.

***Pterygota alata*** (Roxb.) R. Br. in Benn. & R. Br., Pl. Java Rar. 234. 1844. *Sterculia alata* Roxb., Pl. Corom. 3: 84, t. 287. 1820. *S. haynii* Beddome, Fl. Sylv. t. 230. 1872. *Pterygota roxburghii* Schott & Endl., Melet. Bot. 32. 1832.

Asm.: *Pahari*; Beng.: *Budh-Narikel*; Kan.: *Kolugida*; Kh.: *Diang-klong*; Lus.: *Phumber-pul*; Mal.: *Kodathani, Anathodi*; Nep.: *Khamari*; Eng.: *The Buddha's coconut Tree*.

Trees, up to 35 m tall; trunk straight, buttressed; bark smooth, greyish with light and darker patches; young parts covered with dense golden stellate-pubesence. Leaves clustered towards ends of branches, 10 - 16 x 7 - 12 cm, cordate to truncate at base, entire, glabrous, 5-nerved at base; petioles 5 - 13 cm long, slender. Flowers 9 - 10, in axillary panicles. Calyx 5 - 6-lobed, lobes, 1 - 1.5 cm long, linear-oblong, densely stellate-hairy outside, margins and inside subglabrous. Male flowers: staminal column 0.5 - 1 cm long bearing 4 - 6 minute pistillodes at the apex, around which stamens are arranged regularly in 4 - 5 groups, each bearing 4 anthers. Female or bisexual flowers: ovaries 5, 2.5 mm long; styles 3 - 3.5 mm long. Stamens in bisexual flowers similar to those in male flowers. Follicles 12 - 14 cm in diam., shortly beaked. Seeds winged.

#### KEY TO THE VARIETIES

- |  |                              |
|--|------------------------------|
| 1a. Leaves broadly ovate to cordate, unlobed | 1.1. var. <i>alata</i>       |
| b. Leaves variously shaped and lobed         | 1.2. var. <i>irregularis</i> |

#### 1.1. var. *alata*

*Fl.* Dec. - March; *Fr.* July - March.

*Distrib.* India: Bihar, West Bengal, Assam, Arunachal Pradesh, Maharashtra, South India and Andaman & Nicobar Islands.

Bangladesh, Bhutan and Myanmar.

*Notes.* Seeds are roasted and eaten.

1.2. var. *irregularis* (W. Smith) Deb & Basu in Bull. Bot. Surv. India 24: 203. 1982. *Sterculia alata* Roxb. var. *irregularis* W. Smith in J. Asiatic Soc. Beng. n. s 7: 85. 1911.

Beng.: *Paglagach*; Eng.: *The Mad tree*.

*Fl.* Dec. - March; *Fr.* July - March.

*Distrib.* So far known only in cultivation at Indian Botanic Garden, Howrah.

### 17. *Reevesia* Lindley

Shrubs or trees. Leaves simple, alternate, coriaceous. Flowers white, bisexual, numerous, in much-branched terminal cymes; bracteoles small, remote from the calyx. Calyx clavate-campanulate, irregularly 3-5-fid. Petals clawed. Staminal column elongated and long exserted, adnate to gynophore, bearing ca 15 anthers in a globose head; anther cells divaricate, ultimately confluent. Ovary at the top of gynophore almost covered by anthers, 5-lobed, 5-locular, ovules 2 in each locule, pendulous; styles short; stigmas sessile, 5-lobed. Capsules woody, septicidally 5-valved. Seeds 1-2, superposed, ascending, oblong, compressed, winged downwards, hilum lateral near the top; endosperm fleshy; cotyledons flat, foliaceous.

Mainly in Eastern Asia, ca 23 species; one in India.

*Reevesia wallichii* R. Br. in Benn. & R. Br. *Pl Java Rar.* 231. 1844; Masters in *Fl. Brit. India* 1: 364. 1874.

Trees, ca 18 m tall; bark grey and somewhat smooth, exfoliating in round flakes. Leaves 8 - 13 x 5 - 7 cm, oblong, ovate, ovate-oblong, elliptic or elliptic-oblong, subcordate, rounded, truncate or obtuse at base, acuminate at apex, entire coriaceous, thick or thin, very sparsely stellate-hairy above, sparsely to densely minute stellate-hairy beneath, main lateral nerves 6-8 on either side; petioles 2-3 cm long, thickened at both ends; stipules early deciduous. Flowers in dense corymbose, terminal panicles; pedicels 5-8 mm long, jointed; bracteoles 2. Calyx ca 1 cm long, clavate-campanulate, 5-fid, brown stellate-pubescent, persistent. Petals white, 1-1.5 cm long, spatulate, clawed. Staminal column 1.8-2.3 cm long, slender to stout, adnate to gynophore with 5 very short terminal divisions, each division bearing 3 anthers forming a globose head; anther locules parallel, connective thick. Ovary ca 2 x 2 mm, 5-lobed at the tip of gynophore, covered by anthers; stigmas 5-lobed, pubescent. Capsules pendulous, 3-5 x 2-6 cm, obovoid-oblong, obtuse, brown velvety outside, 5-loculed, valves woody, dorsally slightly keeled, dehiscing septicidally and along the dorsal suture. Seeds 1-2, pendulous, 2-3 cm long, winged below; wings membranous with veins.

### KEY TO THE FORMA

- |   |                             |
|---|-----------------------------|
| 1a. Leaves stellate-pubescent beneath; calyx 7-10 mm long         | I.1. forma <b>pubescens</b> |
| b. Leaves minutely stellate-puberulous beneath; calyx 4-5 mm long | I.2. forma <b>wallichii</b> |



**1.1. forma pubescens** (Masters) Malick, *comb. & stat. nov.* *Reevesia pubescens* Masters in Fl. Brit. India 1: 364. 1874.

Nep.: *Chiplipath*

Fl. May - Aug.; Fr. Aug. - Oct.

*Distrib.* India: West Bengal(Darjeeling), Sikkim, Assam, Meghalaya and Mizoram.

Bhutan.

**1.2. forma wallichii**

Fl. & Fr. May - Oct.

*Distrib.* India: Sikkim, West Bengal(Darjeeling), Meghalaya and Manipur.

Bhutan.

### 18. *Sterculia* L.

Small to large trees; bark, whitish, warty, cracked or peeling off like paper. Leaves simple, digitate or palmately lobed, elliptic-lanceolate, oblong or obovate, tapering, acute, rounded, subcordate or cordate at base, acute, acuminate or abruptly acuminate at apex; petioles short to very long; stipules often caducous. Flowers unisexual, male or female by abortion in the same inflorescence, in axillary to terminal, erect or drooping panicles or racemes. Calyx 5-lobed, lobes broad or narrow, often conniving at tip in early stages, usually stellate-hairy outside, densely so inside. Corolla absent. Stamens 10 - 30, monadelphous, in a short or long column. Ovaries on long or short gynandrophore bearing sterile anthers in 5 groups at the base of ovary in female flowers; styles long, connate; stigmas as many as carpels, 5-lobed or fid. Fruits coriaceous or woody follicles, 1 - many-seeded. Seeds sometimes arillate.

Tropics of both the hemispheres, predominantly in tropical Asia, ca 300 species; 15 in India.

*Literature.* DATTA, K. (1960) Some phytogeographical and economic aspects of the genus *Sterculia* (Sterculiaceae). Ind. For. 92: 510 - 516. TANTRA, I.G.M. (1976) A revision of the genus *Sterculia* in Malesia. Lembaga Penelitian Hutan, Bogor, Laporian no. 102: 1 - 194.

#### KEY TO THE SPECIES

- |  |   |
|--|---|
| 1a. Leaves digitate or palmately lobed | 2 |
| b. Leaves unlobed                      | 5 |

2a. Leaves digitate	3
b. Leaves palmately lobed	4
3a. Leaflets up to 14 cm long; follicles almost glabrous	3. <i>S. foetida</i>
b. Leaflets up to 27 cm long; follicles covered with dark brown urticating brittle hairs	14. <i>S. versicolor</i>
4a. Leaves shallowly 5-lobed, entire, velvety beneath; follicles radiating	13. <i>S. urens</i>
b. Leaves deeply 5 - 7-lobed, lobes 3-fid, villous beneath; follicles spreading	15. <i>S. villosa</i>
5a. Calyx lobes broadly ovate, spreading	6
b. Calyx lobes linear or linear-lanceolate, conniving at tip	9
6a. Leaves glabrous above, rusty tomentose beneath, cordate or subcordate at base	7
b. Leaves glabrous on both surfaces; rounded at base	11. <i>S. roxburghii</i>
7a. Inflorescences few-branched; leaves subcordate at base	8
b. Inflorescences many-branched; leaves deeply cordate at base	9. <i>S. macrophylla</i>
8a. Leaves characteraceous; flowers up to 1 cm long; calyx tapering to the pedicels in female flowers	4. <i>S. guttata</i>
b. Leaves crustaceous; flowers up to 0.5 cm long; calyx folded at base in female flowers	2. <i>S. cordata</i>
9a. Leaves rounded at base	10
b. Leaves acute at base	13
10a. Leaves glabrous above, pubescent beneath (except <i>S. rubiginosa</i> var. <i>glabrescens</i> )	11
b. Leaves glabrous on both surfaces	12
11a. Leaves up to 20 cm long; calyx globose, lobes short, connived at tips	10. <i>S. parviflora</i>
b. Leaves up to 30 cm long; calyx widely campanulate, lobes long, somewhat spreading	12. <i>S. rubiginosa</i>
12a. Inflorescences stellate-hairy; calyx thick	1. <i>S. balanghas</i> var. <i>glabrescens</i>
b. Inflorescences sparsely pilose or almost glabrous; calyx membranous	<i>S. kingii</i>
13a. Leaves minutely adpressed hairy or scabrid on the nerves beneath; calyx teeth linear, stellate-hairy	14
b. Leaves glabrous on both surfaces; calyx teeth linear-lanceolate, pilose	7. <i>S. khasiana</i>
14a. Leaves minutely adpressed hairy beneath; androphore ca 5 mm long	5. <i>S. hamiltonii</i>
b. Leaves scabrid on nerves beneath; androgynophore ca 1 mm long	6. <i>S. hyposticta</i>

**1. *Sterculia balanghas* L. var. *glabrescens* Masters in Fl. Brit. India 1: 358. 1874.**

Trees; young portions rusty tomentose. Leaves simple, crowded at the ends of branchlets, 10 - 33 x 5 - 13 cm, oblong-ovate, rounded at base, acuminate at apex, entire, chartaceous, glabrescent or sparsely stellate-hairy beneath; petioles 3 - 5 cm long, pubescent. Flowers yellow or greenish-purple, scented in axillary or terminal, erect, rusty tomentose, ca 15 cm long panicles; pedicels longer than flowers. Calyx ca 2 mm long, campanulate, 5-lobed; stellate-hairy outside densely along the margins, hispid inside; teeth narrow, incurved, connivent; tube ca 4 mm long. Male flowers: Staminal column ca 2 mm long, with a group of 2-loculed anthers at the tip. Female flowers: Stigmas recurved, as long as styles. Follicles 4 - 5, horizontally spreading, ca 8 cm long, woody, oblong, almost sessile, covered with rusty tomentum. Seeds oblong to ovoid, black, shining.

*Fl.* Sept. - Dec.; *Fl.* April - June.

*Distrib.* India: Throughout hotter parts.

Sri Lanka and Myanmar.

**2. *Sterculia cordata* Blume, Bijdr. 83. 1825. *S. pubescens* Masters in Fl. Brit. India 1: 357. 1874. Fig. 125.**

Trees, ca 10 m tall; bark and petioles rusty velutinous. Leaves simple, 20 - 28 (- 40) x 12.5 - 14.5 (- 23), cm, elliptic-obovate or obovate, subcordate at base, abruptly acuminate at apex, entire, crustaceous, glabrous above, rusty velutinous beneath, nerves 12 pairs or more, raised and stellate-hairy beneath; tertiary nerves prominent and connecting the secondary nerves beneath; petioles 2 - 18 cm long, terete, rusty stellate-velutinous; stipules 1 - 1.5 cm long, linear, caducous. Flowers unisexual in sparsely pubescent, axillary, few-branched panicles; panicles shorter than leaves. Male flowers: pedicels ca 1.5 mm long, terete, hairy, jointed. Calyx campanulate, hairy outside, 5-fid; tube 1 mm long; lobes ca 2 mm long, ovate or ovate-oblong, acute or subacute. Stamens ca 10 on ca 2.5 mm long column. Female flowers: pedicels 2 - 3 mm long, hairy jointed. Calyx broadly campanulate, sparsely hairy outside, densely so inside; tube 2 mm long, dilated at base; lobes ca 3 mm long, ovate, acute, tips recurved. Ovary ca 2 x 3 mm, obscurely 5-lobed, stellate-hairy, with 5 groups of 2 sterile anthers at base; gynandrophore 1 mm long, stout, glabrous; styles 1 mm long, curved, hairy; stigmas 5-lobed. Fruits not seen.

*Fl.* Oct.

*Distrib.* India: Andaman & Nicobar Islands.

**3. *Sterculia foetida* L., Sp. Pl. 1008. 1753; Masters in Fl. Brit. India 1: 354. 1874.**

**Fig. 126.**

Beng.: *Badam, Jangli-Badam*; Kan.: *Patala Mara, Penari*; Mar.: *Jungli-Badam, Pun*; Tam.: *Pinari, Pottaikavalam, Kudiraippiduku*.

Deciduous trees, up to 35 m tall; bark whitish, flaking off; branches whorled, horizontal. Leaves digitately 5 - 9-foliolate, crowded at the ends of branchlets; petioles 14 - 24 cm long, glabrous, terete, grooved; leaflets 7.5 - 14 x 2 - 4.5 cm, elliptic, elliptic-lanceolate to oblong-lanceolate, tapering at base, acute or acuminate at apex, entire, pubescent when young, glabrous at maturity, midrib with 20 - 25 pairs of prominent, parallel secondary nerves; petiolules up to 1 cm long, stipules ensiform, caducous. Flowers 2 - 3.5 cm in diam., many, in erect up to 20 cm long racemose panicles, appearing under young leaves of the current year; pedicels ca 1.2 cm long, jointed in the middle; bracteoles minute. Calyx 1.5 - 2 cm long, campanulate, deeply divided into 5 lobes; lobes linear-oblong to lanceolate, subacute, spreading stellate-hairy, densely so inside. Male flowers: anthers 10 - 15 on ca 1.2 cm long staminal column. Female flowers:

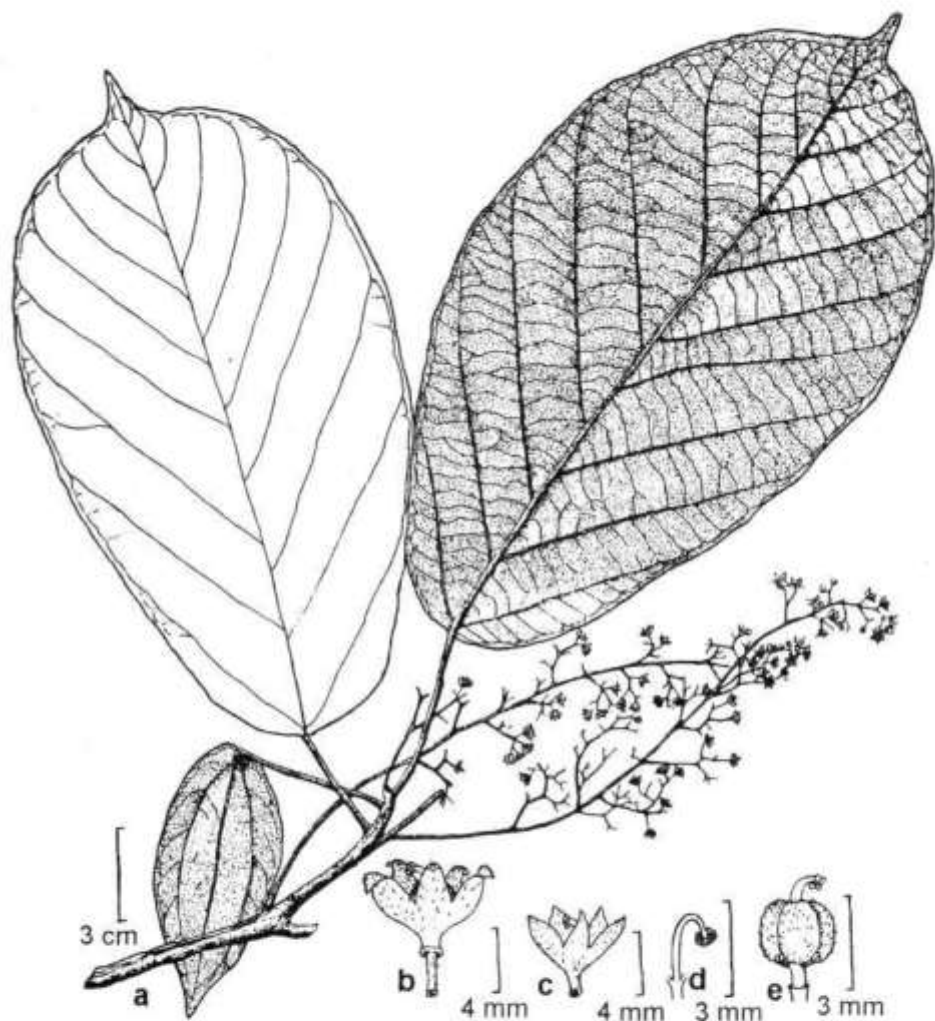


Fig. 125. *Sterculia cordata* Blume : a. flowering part of branch; b. female flower; c. male flower; d. androecium; e. pistil with sterile anthers at base of ovary.

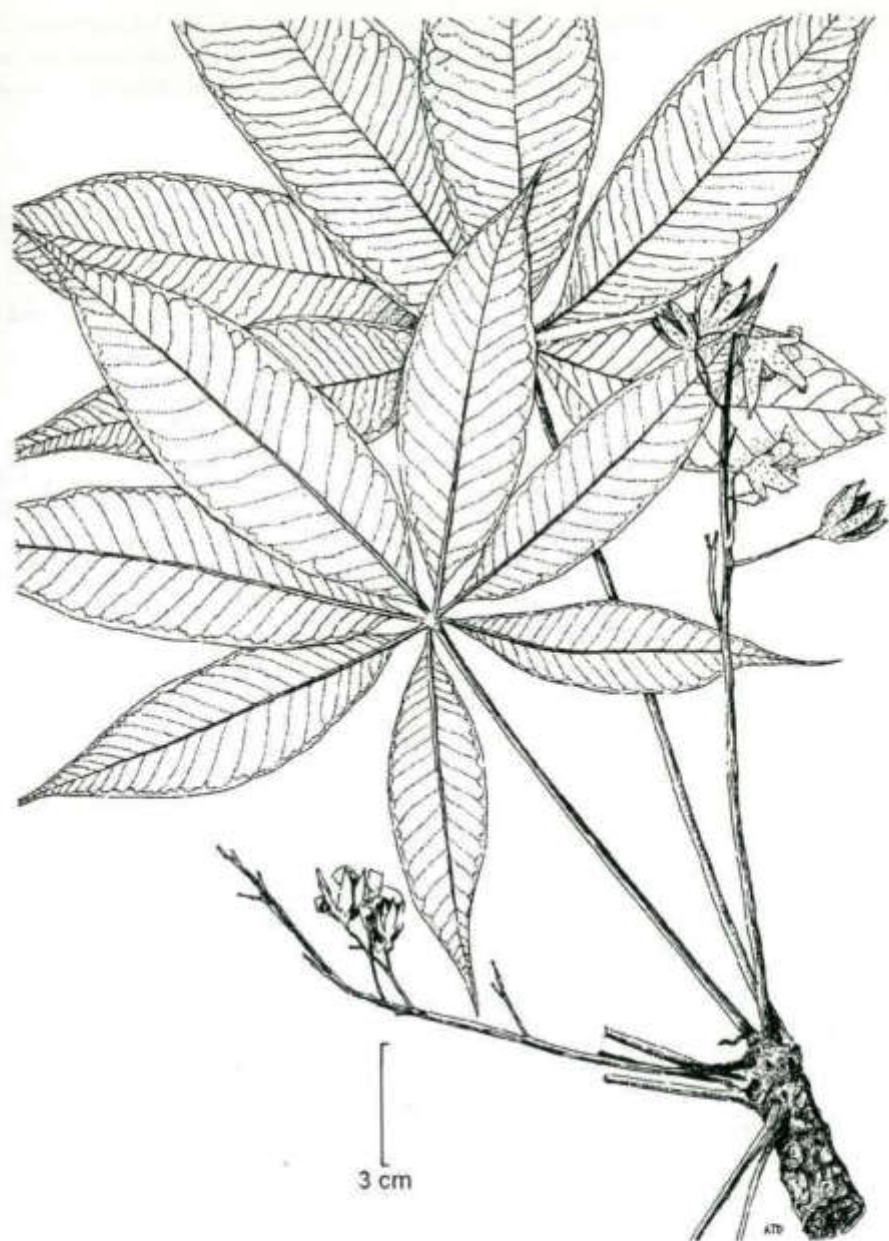


Fig. 126. *Sterculia foetida* L.

carpels 5. Ovaries on 5 - 7 mm long gynandrophore, hairy, surrounded by sterile anthers at base; stigmas as many as carpels, radiating. Follicles 5, 10 - 12 cm long, boat-shaped, beaked, woody, nearly glabrous. Seeds many, 1 - 1.5 cm long, ovoid-ellipsoid to oblong.

*Fl.* Feb. - May; *Fr.* May - Aug. (ripening in the following year).

*Distrib.* India: West Bengal, Bihar, Orissa, Andhra Pradesh, Maharashtra, Tamil Nadu and Kerala; often planted.

Pakistan, E. Tropical Africa, Sri Lanka, Bangladesh, Myanmar, Malesia, and N. Australia.

*Notes.* Seeds are eaten after roasting.

**4. *Sterculia guttata* Roxb.** [Hort. Beng. 50. 1814, nom. nud.] *Fl. Ind.* 3: 148. 1832; Masters in *Fl. Brit. India* 1: 355. 1874. **Fig. 127.**

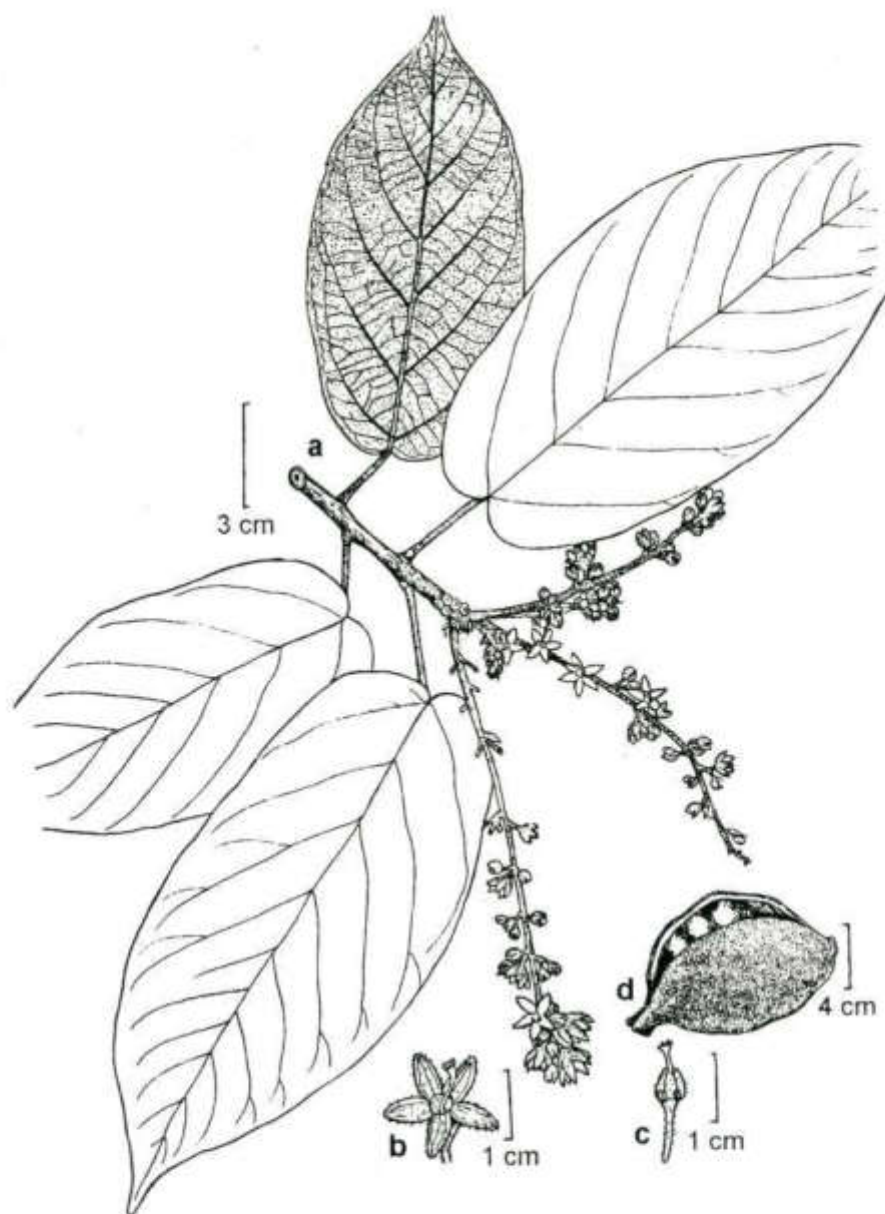
*Asm.:* *Hirikh*; *Kan.:* *Jenu kathala*, *Hulitaradu mar*; *Mal.:* *Kithondi*, *Kavalam*; *Tam.:* *Kavali*, *Thondi*.

Trees, up to 20 m tall; trunk straight, crown oval; bark much cracked, ash-coloured, inner fibrous, rough with warts outside; young shoots clothed stellate-tomentum. Leaves simple, 15 - 25 x 7 - 15 cm, ovate-oblong, ovate-elliptic or obovate, subcordate, rounded or subtruncate at base, acute or abruptly shortly acuminate at apex, entire, subcoriaceous, glabrescent above, rusty stellate-pubescent beneath, midrib prominent and nerves reticulate beneath; petioles 3 - 5 cm long, stout, stellate-pubescent, slightly swollen at base; stipules 1 cm long, ensiform, caducous. Panicles racemose, with rusty tomentose horizontal branches, up to 15 cm long. Calyx 7 - 12 x 5 - 8 mm, campanulate, densely pubescent outside, glandular inside, 5-partite, lobes ca 7 x 4 mm, spreading, stellate-pubescent, densely along margins inside. Male flowers: anthers 10 - 15, fertile on 6 - 8 mm long curved staminal column. Female flowers: ovaries on 4 - 5 mm long gynandrophore, hairy with sterile anthers at base, ca 2 mm in diam.; styles ca 2 mm long, curved; stigmas 5-lobed. Follicles 2 - 5, 7.5 - 12 x 3 - 5 cm, obovoid, coriaceous, compressed, obscurely ribbed, brown tomentose, pink inside. Seeds 3 - 4 in each follicle, 10 - 15 x 5 - 7 mm, oblong with ferruginous stiff hairs.

*Fl.* Sept. - May; *Fr.* Feb. - Aug.

*Distrib.* India: In evergreen forests of Western Ghats up to 1200 m. Assam, Maharashtra, Karnataka (Sandur hills of Bellary District), Tamil Nadu, Kerala and Andaman & Nicobar Islands (Andaman Islands).

Sri Lanka and Malesia.



**Fig. 127.** *Sterculia guttata* Roxb. : a. flowering part of branch; b. male flower; c. female flower with sepals and petals removed; d. fruit.

5. *Sterculia hamiltonii* (O. Kuntze) Adelb. in *Blumea* 5: 506. 1945 & in Backer & Bakh. f., *Fl. Java* 1: 413. 1964. *Clompanus hamiltonii* O. Kuntze, *Rev. Gen. Pl.* 1: 77. 1871. *Sterculia coccinea* Roxb., [*Hort. Beng.* 50. 1814; nom. nud.] *Fl. Ind.* 3: 151. 1832, non Jack 1822; Masters in *Fl. Brit. India* 1: 357. 1874. *Sterculia indica* Merr. in *J. Arn. Arb.* 33: 246. 1952. **Fig. 128.**

Asm.: *Nak-chepeta, Saglepapio, Komkelu*

Shrubs or small trees; bark grey, warty, thin, whitish inside. Leaves simple, 10 - 33 x 5 - 15 cm, elliptic-lanceolate, oblanceolate or narrowly oblong, tapering at base, abruptly acuminate at apex, chartaceous or subcoriaceous, glabrous above, generally with stellate and simple minute adpressed hairs beneath. Petioles 7 - 12 (- 20) cm long, terete, thickened and slightly genuculate at tip; stipules 4 - 5 cm long, subulate, rusty pubescent, caducous. Panicles 10 - 20 cm long, axillary, rarely supra-axillary, generally long peduncled, drooping, branches of panicles capillary; pedicels 3 - 5 mm long, capillary. Flowers pale, 2 - 2.5 cm in diam. Calyx tube ca 3 mm long, lobes 1.2 - 1.5 cm long, deltoid, narrowed at apex, hairy outside, densely so on slightly thickened margins, incurved, connivent or free, sometimes spreading. Male flowers: staminal column 4 - 5 mm long, curved, glabrous. Female flowers: gynandrophore 2 mm long; ovaries 2 mm long, hairy, bearing sterile anthers at base; styles 2 mm long, curved; stigmas 5-lobed. Follicles 2 - 5, 7.5 - 13 x 1.5 - 2 cm, oblong-lanceolate, beaked, thinly coriaceous, velvety outside, crimson on both surfaces. Seeds 4 - 8, ovoid, smooth.

*Distrib.* India: West Bengal, Sikkim, Assam, Meghalaya, Nagaland.

Nepal, Bhutan and Myanmar.

6. *Sterculia hyposticta* Miq., *Fl. Ind. Bat. Suppl.* 399. 1861; M.K.V. Rao in *J. Econ. Tax. Bot.* 8: 115. 1986.

Shrubs, 1 - 2 m tall. Leaves simple, 8 - 20 x 5 - 6 cm, elliptic-lanceolate or oblong, acute to subcuneate at base, acute to acuminate at apex, entire, nerves slender, somewhat distinct; petioles 1 - 1.5 cm long. Panicles erect, few-flowered; pedicels 3 - 5 mm long. Calyx ca 4 mm in diam., globose, tube and lobes 1 - 1.3 cm long, lobes linear, connivent. Male flowers: Staminal column 1 mm long. Female flowers: Ovaries ca 2 mm in diam., globose, with sterile anthers at base, velvety, gynandrophore 1 mm long; styles 1 mm long; stigmas 5-fid, recurved. Follicles 4 - 5.5 cm long, ellipsoid, acute, covered with yellowish brown hairs outside, coriaceous, smooth and shining inside, somewhat reddish towards sutures, hirtellous.

*Fl. Nov.; Fr. Feb.*



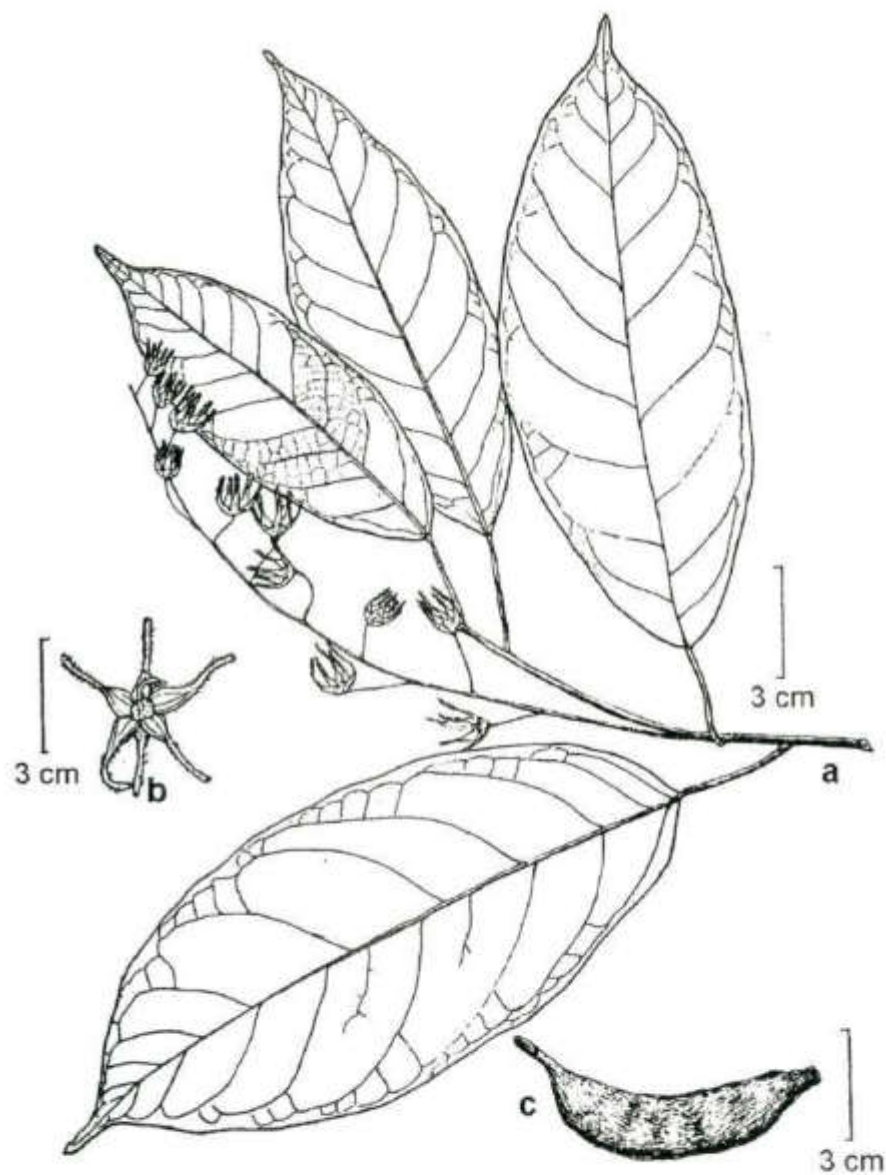


Fig. 128. *Sterculia hamiltonii* (O. Kuntze) Adelb. : a. flowering part of branch; b. male flower; c. fruit.

*Distrib.* India: Andaman & Nicobar Islands(Nicobar Islands).

Malesia.

7. *Sterculia khasiana* King ex Debbarman in Kanjilal *et al.*, Fl. Assam 1: 154. 1934.  
Fig. 129.

Trees; young parts and inflorescences ferruginous tomentose. Leaves simple, 9 - 17 x 4 - 7.5 cm, elliptic or obovate, lanceolate, somewhat narrowed towards base, shortly acuminate at apex, entire, subcoriaceous, glabrous; petioles 8 - 13 mm long; stipules 4 - 5 mm long, coriaceous, linear or lanceolate, caducous. Racemes short, terminal, lax, rather spreading; peduncles erect, delicate; pedicels 7 - 15 mm long, erecto-patent; bracts minute, ovate-lanceolate, caducous. Calyx 1 - 1.5 cm long, woolly outside, puberulous inside, tube short, lobes linear-lanceolate, trinerved. Male flowers: staminal column 2 mm long, thick, reflexed, bearing fertile anthers. Female flowers: ovaries hairy with curved style. Fruits not seen.

*Distrib.* India: Meghalaya.

Endemic.

8. *Sterculia kingii* Prain in J. Asiat. Soc. Beng. 73, n.s. 295: 192. 1904.

Nep.: *Chiwariapat*.

Small, soft-wooded trees; bark greyish. Leaves simple, 10 - 25 x 5 - 11 cm, broadly elliptic-obovate, lanceolate, rounded at base, abruptly acuminate at apex, entire, glabrescent; petioles 3 - 4 cm long, pubescent; stipules ovate, ferruginous hairy. Flowers yellow, in axillary panicles or racemes at the ends of drooping branchlets. Calyx 1.2 - 1.7 cm long, membranous, pilose; very short; lobes linear-lanceolate, hairy, spreading, margins thickened, sparsely pubescent. Male flowers: staminal column 3 - 4 mm long, curved downwards with a group of 2-loculed anthers. Female flowers: ca 2 mm long on equally long gynandrophore, hairy with 5 pairs of sterile anthers at base; styles as long as ovary, slightly curved downwards; stigmas 5-fid. Follicles 4 - 5, 6 - 11 x 1.5 - 2 cm, hairy outside.

*Fl. & Fr.* May - June.

*Distrib.* India: West Bengal (Darjeeling), Sikkim and Nagaland.

Bhutan.

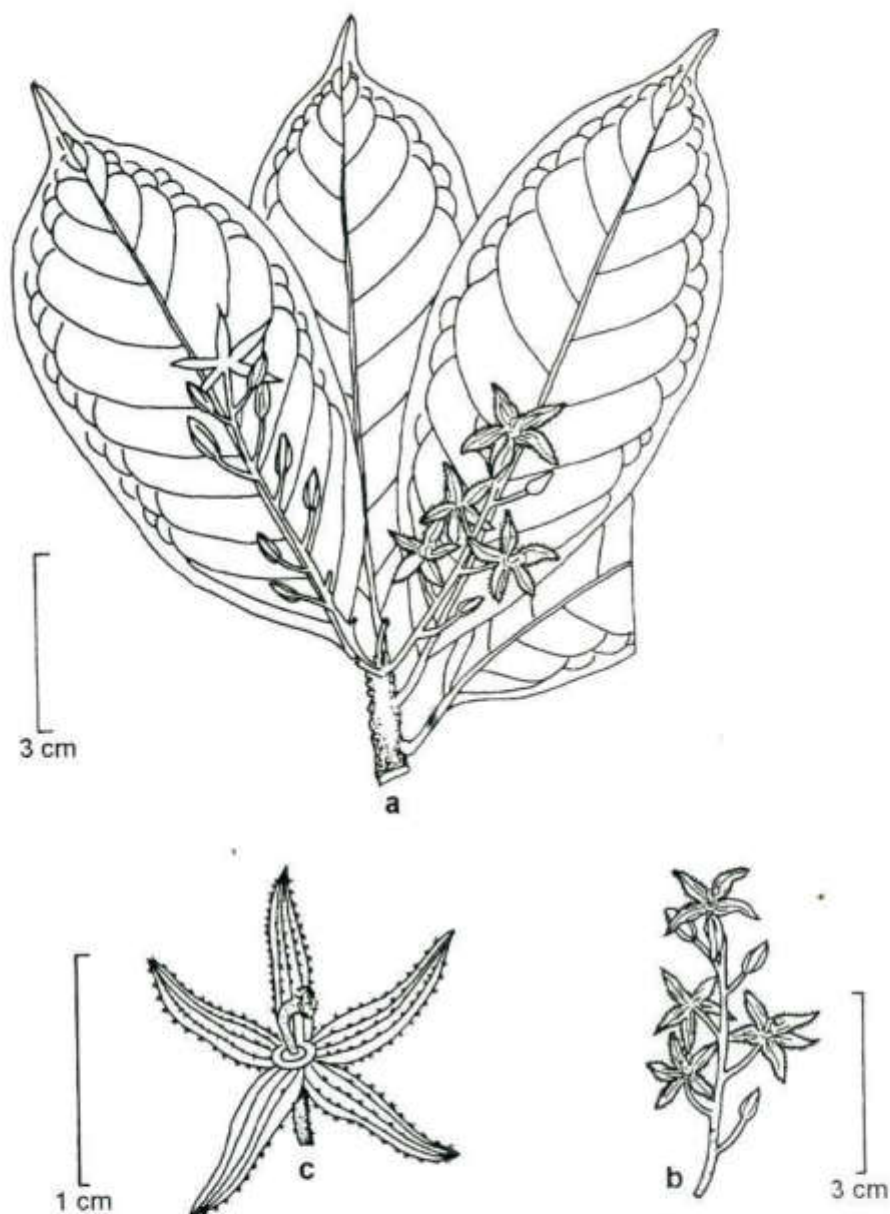


Fig. 129. *Sterculia khasiana* King ex Debbarman : a. flowering part of branch; b. inflorescence; c. flower.

**9. *Sterculia macrophylla*** Vent., Hort. Malm. 2, t. 91. 1805, in ad nota; Masters in Fl. Brit. India 1: 356. 1874.

Trees. Leaves simple, 30 - 40 x 25 - 31 cm, broadly ovate to suborbicular, deeply cordate at base, obtusely or acutely acuminate at apex, entire, glabrous above, sparsely to densely stellate-hairy beneath; petioles 3 - 15 cm long, downy. Panicles deflexed, much-branched, nearly equalling the leaves, rusty tomentose; pedicels shorter than flowers, pubescent and hispid. Calyx 3 - 4 mm long, cup-shaped, densely stellate, hairy, 5-lobed, lobes triangular, erect; tube ca 2 mm long. Male flowers: staminal column 1 - 1.5 mm long. Female flowers: ovaries on short gynandrophore, elliptic, 5-angled; styles 2 mm long, glabrous; stigmas 5-lobed. Follicles 1 - 5, 3 - 3.5 x 1.5 - 2 cm, villous. Seeds 1 - 2.

*Fl. & Fr.* May - July.

*Distrib.* India: Andaman and Nicobar Islands (Nicobar Islands).

Myanmar.

**10. *Sterculia parviflora*** Roxb., [Hort. Beng. 50. 1814, nom. nud.] Fl. Ind. 3: 147. 1832; Masters in Fl. Brit. India 1: 359. 1874; Parkinson, For. Fl. Andaman 100. 1923.

Trees with light coloured bark. Leaves simple, 10 - 20 x 5 - 10 cm, oblong, oblong-ovate or elliptic, rounded at base, acuminate at apex, entire, glabrescent above, slightly pubescent beneath, petioles 2 - 3 cm long, thickened at the top. Flowers small, yellowish brown in panicles; panicles spreading, as long as leaves, stellate-hairy. Calyx 3 - 4 mm in diam., globular, tube urceolate, 2 - 3 mm long, lobes 5, ca 1 mm long, inflexed. Male flowers: staminal column 1 mm long with 10 fertile anthers. Female flowers: ovaries 3 mm in diam., hairy; styles short; stigmas 5-fid. Follicles 3 - 5 cm long, oblong, beaked, coriaceous, downy. Seeds oblong, black.

*Fl.* Jan. - Feb.

*Distrib.* India: Andaman & Nicobar Islands (Middle and south Andaman Islands).

Bangladesh, Myanmar and Malesia.

**11. *Sterculia roxburghii*** Wallich, [Cat. No. 1124, 1830, nom. nud.] Pl. Asiat. Rar. 3: t. 262, 1832; Masters in Fl. Brit. India 1: 356. 1874. *S. lanceifolia* Roxb., Fl. Ind. 3: 150. 1832.

**Fig. 130.**

*Asm.:* Nag-phona, Nag phena; *Garó:* Mimong-omak, Misi-chik-udari.



Fig. 130. *Sterculia roxburghii* Wallich : a. flowering part of branch; b. capsules.

Trees; bark dark brown to ash grey, somewhat rough outside. Leaves simple, 10 - 22 x 4.5 - 12 cm, ovate, obovate, elliptic-oblong, lanceolate or oblanceolate, rounded to truncate at base, shortly acuminate at apex, entire, chartaceous or subcoriaceous, glabrous, main lateral nerves 6 - 11 pairs on either side of midrib; petioles 2 - 7 cm long, terete, geniculate at both ends; stipules subulate. Panicles in 5 - 10 cm long, axillary, erect; pedicels up to 1 cm long, stellate-hirsute. Calyx scarlet, 4 - 6 mm long, campanulate, 5-partite, segments 2 mm broad, oblong-lanceolate, spreading; pubescent outside; Male flowers: staminal column ca 1 mm long. Female flowers: ovary 1 mm long on equally long gynandrophore; styles ca 1.5 mm long; stigmas 5. Follicles scarlet, 2 - 5, 5 - 9 x 2 - 3 cm, lanceolate, curved, long-beaked, obscurely striate, scabrous. Seeds 4 - 8 in each follicle, 10 - 14 x 5 - 8 mm ovoid to oblong, black, shining.

*Fl.* Feb. - Sept.; *Fr.* March - June.

*Distrib.* India: Sikkim, Assam and Meghalaya.

Bhutan.

*Note.* Seeds are roasted and eaten.

**12. *Sterculia rubiginosa* Vent., Hort. Malm. 2, t. 91. 1805, in ad nota; Masters in Fl. Brit. India 1: 358. 1874; Parkinson, For. Fl. Andaman 100. 1923.**

Tall shrubs or small trees; rusty villous. Leaves simple, 15 - 27 x 6 - 11 cm, oblong to obovate-oblong, rounded or obtuse at narrowed base, acute or abruptly acuminate at apex, glabrous above, downy beneath; petioles 5 - 15 mm long, hispid; stipules 1.5 - 2.5 cm long, subulate, lanceolate. Panicles many-flowered at the apices of branchlets or in axil of fallen leaves, sparsely hispid. Calyx 1.5 - 2 cm long, deeply cleft, lobes linear, revolute, conniving, pilose inside; tube minutely pubescent inside. Male flowers: staminal column 2 - 3 mm long. Follicles 3 - 5 cm long, lanceolate, beaked, downy externally, glabrous and crimson inside. Seeds 8 - 12 mm long, black.

*Fl.* Dec. - Feb.; *Fr.* March - May.

*Distrib.* India: Andaman & Nicobar Islands (Andaman Islands).

Myanmar and Malasia.

**13. *Sterculia urens* Roxb., Pl. Corom. 1: 25, t. 24. 1795 & Fl. Ind. 3: 145. 1832; Masters in Fl. Brit. India 1: 355. 1874.**

Hindi: *Kulu, Gulu, Gular*; Mal.: *Thondi*; Mar.: *Pandruk, Kandal, Karai*; Santali: *Keonji, Karaunji, Telhec*; Tam.: *Kavalam, Senthanakku, Senthalamaram*; Tel.: *Tabasu*.

Trees; young parts more or less pubescent; trunk straight; bark white, smooth, outer papery peeling off, inner fibrous. Leaves simple, 11 - 30 cm in diam., crowded at the ends of the branchlets, digitately 3 - 5-lobed, cordate at base, lobes 5 or obscurely 2 or more, caudate-acuminate at apex, entire, glabrous or nearly so above; petioles 8 - 9.5 cm long, terete, tomentose; stipules caducous. Flowers small, yellow, 5 - 9 mm across, numerous, male and female flowers mixed in much-branched, glandular-pubescent, terminal panicles, appearing before the leaves at the ends of branchlets; bracts lanceolate, deciduous. Calyx ca 5 mm long, campanulate, hoary, tube about as long as the lobes, lobes spreading oblong-lanceolate, acute, glandular hairy inside at base. Male flowers: staminal column ca 3 mm long, with 10 - 15 anthers at the top. Female flowers: ovaries 2 mm in diam. on ca 3 mm long gynandrophore with sterile anthers at base; styles as long as ovary; stigmas radiating. Follicles 5, spreading, 3 - 4 x 1 - 1.5 cm, usually oblong or ovoid-oblong, densely pubescent, often mixed with stinging hairs. Seeds 3 - 6 in each follicle, ca 7 x 5 mm, oblong, black, glossy.

*Fl.* Oct. - March; *Fr.* Feb. - April.

*Distrib.* India: Almost throughout except Himalayas.

Sri Lanka and Malesia.

*Notes.* This species yields a colloid gum called 'Katila', used as medicine. Seeds are roasted and eaten.

**14. *Sterculia versicolor*** Wallich, *Pl. Asiat. Rar.* 1: 48, t. 59. 1830; Masters in *Fl. Brit. India* 1: 355. 1874.

*Asm.:* *Durong-phang*; *Lus.:* *Khai-pang-thing*; *Kh.:* *Star-um*.

Trees, up to 6 m tall, crown spreading; trunk straight, stout; bark grey, exfoliating; branchlets with prominent scars of fallen leaves. Leaves peltate, digitately 5 - 7-foliolate; petioles 15 - 45 cm long, dilated at apex; leaflets 18.5 - 27 x 5 - 15 cm, elliptic-lanceolate, tapering at base, acute or shortly acuminate at apex, subcoriaceous, glabrous above, puberulous or glabrescent beneath, midrib and 23 - 32 pairs of lateral nerves prominent; petiolules 8 - 15 cm long. Flowers fragrant, orange yellow or pale yellow, many, in erect panicles crowded at the ends of branchlets projecting above the leaves of current year; pedicels short. Calyx ca 1 cm long, campanulate, hairy; tube ca 5 mm long; lobes oblong, inflexed. Male flowers: staminal column ca 2 mm long, curved; filaments short; anthers 2-loculed. Female flowers: ovaries 3 - 4 mm in diam. on 4 - 5 mm long gynandrophore, 5-lobed, hairy with sterile anthers at the base; styles ca 2 mm long, villous, curved with radiating subpeltate stigma. Follicles 5, 3 - 4 x 1 - 1.5 cm, slightly compressed, obscurely ribbed, covered with dark brown urticating bristles. Seeds 7 - 15 mm long, oblong, with black shining aril and a knob at the hilum.

*Fl.* March - June.

*Distrib.* India: Assam, Meghalaya, Nagaland and Tripura.

Myanmar.

15. *Sterculia villosa* Roxb. [Hort. Beng. 50. 1814, nom. nud.] ex Smith in Rees, Cycl. 34: no. 16. 1816; Roxb., Fl. Ind. 3: 153. 1832; Masters in Fl. Brit. India 1: 355. 1874.

Asm.: *Udal, Odlā*; Beng. & Hindi: *Udal*; Kan.: *Savaya, Bilidale*; Mal.: *Vakka*; Mar.: *Sardol*; Santali: *Ganghar*; Tam.: *Muruthan*.

Trees, 10 - 15 m tall, deciduous; bark white; branches whorled, horizontal, spreading; branchlets with heart-shaped scars of fallen leaves; young parts, petioles and inflorescences brown tomentose with stellate hairs intermixed. Leaves simple, crowded at the ends of branchlets, 30 - 40 cm in long, cordate at base, 5 - 7-lobed, lobes oblong or ovate-oblong, acuminate at apex, entire, glabrescent or sparsely stellate-hairy above and tomentose beneath, nerves 5 - 7 pairs; petioles 15 - 40 cm long or nearly as long as leaves, dilated and very downy at tip; stipules lanceolate, acuminate, caducous. Flowers pinkish yellow, 1 - 1.8 cm across in much branched rusty pubescent, terminal, drooping panicles, male and female flowers intermixed. Calyx campanulate, pinkish inside, 5-lobed, hairy; lobes spreading; tube ca 3 mm long. Male flowers: staminal column 2 - 3 mm long, curved; anthers 10. Female flowers: ovaries 5 on 2 - 3 mm long gynandrophore, hairy, globose with sterile anthers at base; styles ca 2 mm long, recurved; stigmas 5-lobed. Follicles 3 - 5, 2.5 - 3.5 x 1.5 - 3 cm, oblong, spreading, rusty villous, red inside. Seeds 3 - 5 in each follicle, 7 - 10 x 5 - 7 mm, oblong, smooth, black.

*Fl.* Dec. - April; *Fr.* March - Sept.

*Distrib.* India: Throughout warmer parts of India, tropical Himalaya from Kumaon eastwards and Andaman and Nicobar Islands (Andaman Islands).

Nepal, Bhutan, Bangladesh and Myanmar.

*Note.* Bark yields fibre, used for making elephant ropes.

### 19. *Waltheria* L.

Herbs or undershrubs. Leaves simple, alternate, serrate; stipules filiform, caducous. Flowers small, in dense axillary or terminal clusters. Sepals 5, connate at base into a campanulate tube. Petals 5, oblong-spathulate, macrescent. Stamens 5, opposite petals, filaments tubular, connate at base; staminodes absent. Ovary sessile, unilocular, with 2 ascending ovules; styles excentric, fimbriate at apex; stigmas penicillate. Capsules



pilose, enclosed in calyx tube, 2-valved, 1-seeded. Seeds smooth, endospermous; embryo straight; cotyledons flat.

Predominantly tropical American, now a few pantropical weeds, ca 54 species; one in India.

*Literature.* ST. JOHN, H. (1976). Evaluation of *Waltheria indica* L. and *W. americana* L. (Sterculiaceae), Pacific Plant Studies - 28. *Phytologia* 33: 89 - 92.

*Waltheria indica* L., Sp. Pl. 673. 1753; Masters in Fl. Brit. India 1: 374. 1874. *W. americana* L., Sp. Pl. 673. 1753. Fig. 131.

Herbs or undershrubs, erect, perennial, up to 1 m high; stems terete, softly stellate-pubescent. Leaves 2.5 - 6.5 x 1.5 - 4.5 cm, ovate, elliptic, cordate-ovate or oblong, rounded to cordate or truncate at base, acute to rounded at apex, serrate-dentate, softly stellate-pubescent on both surfaces, strongly veined with veins impressed above; petioles 0.6 - 2.5 cm long, densely pubescent; stipules subulate, hairy. Flowers yellow, ca 4 mm in diam., sessile in dense axillary heads, peduncles up to 4 cm long. Involucral bracts narrowly lanceolate, villous. Calyx ca 3 mm long, campanulate, lobes 5, as long as shorter than tube, lanceolate, acute to acuminate, ciliate. Petals ca 4 mm long, spatulate, veined. Staminal cup ca 2 mm high, subconical. Ovary unilocular, pilose; styles eccentric, fimbriate at apex; stigma penicillate. Capsules ca 3 mm long, enclosed in calyx. Seeds 2 mm long, obovate, smooth.

*Fl. & Fr.* Jan. - Dec.

*Distrib.* India: Throughout in warmer parts.

Pantropical.

#### CULTIVATED SPECIES

**1. *Cola acuminata*** (P. Beauv.) Schott & Endlicher, *Melcat. Bot.* 33: 1832; Chitra in Nair & Henry, *Fl. Tamil Nadu* 1: 38. 1983. *Sterculia acuminata* P. Beauv., *Fl. Owar.* 1: 41, t. 24. 1805.

Trees with woody follicles.

Cultivated in gardens.

**2. *Dombeya acutangula*** Cav., *Diss.* 3: 123, t. 38, f. 2. 1787; Chitra in Nair & Henry, *Fl. Tamil Nadu* 1: 38. 1983.

Evergreen shrubs with showy white or pink flowers. Cultivated in gardens.



Fig. 131. *Waltheria indica* L. : a. flowering part of branch; b. flower; c. petal; d. staminal cup; e. pistil; f. fruit; g. seed.

Native of Mascarene Islands.

3. *Dombeya burgesiae* Gerr. ex Harvey in Harvey & Sander, Fl. Capensis 2: 590. 1862; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 38. 1983.

Shrubs with densely villous branches, flowers white, showy and fragrant.

Cultivated in gardens.

4. *Dombeya calantha* K. Schum. in Engler, Monogr. Afrok. Pflanzenfam. 5: 28. 1900; Bailey, Man. Cult. Pl. 669. 1958.

Shrubs. Leaves 8 - 35 x 7 - 18 cm, 3 - 5-lobed, cordate at base, acuminate at apex, coarsely dentate, pubescent on both surfaces, 7-nerved. Flowers pinkish-white, faintly fragrant in axillary, pendulous corymbs, bracteate and bracteolate; pedicels short, slender, pubescent. Sepals 10 x 3 mm, linear-lanceolate, acute, pubescent, persistent. Petals 15 x 10 mm, obliquely obovate, persistent. Stamens 15, alternating with 5 staminodes, basally persistent, 5-locular, ovules many in each locule; stigmas 5-fid, reflexed. Capsules loculicidally dehiscent.

*Fl. & Fr.* Throughout the year.

Cultivated throughout India in gardens for its showy flowers.

Native of Tropical Africa.

5. *Dombeya mastersii* Hook. f. in Bot. Mag. t. 5639. 1867; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 38. 1983.

Evergreen shrubs with white or pinkish-white flowers.

Cultivated in gardens.

6. *Dombeya mollis* Hook., in Bot. Mag. t. 4578. 1851; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 38. 1983.

Evergreen shrubs,

Cultivated in gardens.

7. *Dombeya platanifolia* Bojer in Ann. Sci. Nat. Bot. ser. 2, 18: 190. 1842; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 39. 1983.

Evergreen shrubs.

Cultivated in gardens.

**8. *Dombeya spectabilis*** Bojer in Ann. Sci. Nat. Bot. ser, 2, 18: 191. 1842; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 39. 1983.

Shrubs.

Cultivated in gardens.

**9. *Dombeya wallichii*** (Lindley) K. Shumann in Engler & Prantl, Pflanzenfam. 3, 4: 78. 1890; Chitra in Nair & Henry, Fl. Tamil Nadu 1: 39. 1983. *Astrapaea wallichii* Lindley, Coll. Bot. t. 14. 1821.

Large shrubs or small trees with flowers scarlet to pink in dense clusters.

Cultivated in gardens.

Native of Madagascar.

**10. *Theobroma cacao*** L., Sp. Pl. 752. 1753; Bailey, Man Cult. Pl. 668. 1958.

Small evergreen trees, 3 - 5 m tall; bark brown. Leaves 10 - 35 x 6 - 10 cm, elliptic-oblong or obovate-oblong, abruptly acuminate at apex, entire, coriaceous; petioles short with distinctly swollen ends. Flowers yellowish or pink, small, cauliflorous; pedicels distinct. Petals hooded at base. Staminal tube short with 2 - 3 sessile anthers; staminodes 5, elongated. Ovary sessile, 5-locular, ovules many in each locule; stigmas 5-lobed. Fruit a large woody drupe ca 30 cm long, elliptic-ovoid, reddish-yellow, smooth or ribbed, 5-locular. Seeds almond-like in 2 rows in each locule, embedded in white, pinkish or brownish mucilaginous aromatic pulp.

*Fl.* Nov. - Jan.; *Fr.* March - May.

Cultivated as a cash crop in coastal districts of Karnataka and Kerala.

Native of tropical America, widely cultivated in the tropics.

*Notes.* The cocoa extracted from roasted and fermented beans (seeds) is used in the manufacture of Cocoa, chocolates and soft drinks. Cocoa is a good source of essential fatty acids; phospholipids and fat soluble vitamins.

## TILIACEAE

(P. Daniel and M. Chandrabose)

Trees, shrubs, undershrubs, herbs or woody climbers, with stellate or simple hairs or lepidote. Leaves simple, alternate, rarely opposite, stipulate, rarely exstipulate, petiolate, usually palmately nerved, occasionally pinnately nerved, entire or dentate, rarely lobed. Inflorescences axillary, terminal or leaf-opposed cymes or panicles, rarely flowers solitary. Flowers bracteate, bisexual, very rarely unisexual or both, mostly 4 - 5-merous, actinomorphic, hypogynous. Sepals 4 - 5, free or partly united, valvate, rarely imbricate, occasionally persistent and accrescent. Petals 4 - 5, free, contorted, imbricate or valvate, sometimes sepaloid, rarely absent. Stamens 5 - many, free or shortly connate at base, or in 5 or 10 bundles, inserted on receptacle or androphore; staminodes present or absent; anthers 2-loculed, opening by a longitudinal slit or an apical and rarely a basal pore. Carpels 2 - 5 (-10), rarely more, syncarpous, rarely free; ovary superior, rarely inferior, sessile, 2 - 10-loculed; ovules 1-numerous in each locule; placentation usually axile, rarely parietal; style usually simple and divided at apex; stigma rarely sessile. Fruit drupaceous, nut-like, or a capsule and variously dehiscent; seeds 1 - many in each locule, rarely arillate, occasionally pilose, mostly endospermous; embryo usually straight; cotyledons foliaceous.

Tropical and temperate regions but more abundant in the former, chiefly in S.E. Asia and Brazil, with ca 50 genera and 450 species; 8 genera and 53 species in India.

*Literature:* BURRETT, M. (1926). Beitrage zur Kenntnis der Tiliaceen. Notizbl. Bot. Gart. Berlin-Dahlem 9: 592 - 880. GHAFUOR, A. (1974). Tiliaceae. In: NASIR, E. & S.I. ALI, Fl. W. Pakistan 75: 1 - 33. ROBYNS, A. & W. MEIJER, (1991) Tiliaceae. In: DASSANAYAKE, M.D. & F.R. FOSBERG, Rev. Handb. Fl. Ceylon 7: 402 - 437.

### KEY TO THE GENERA

- |  |                       |
|--|-----------------------|
| 1a. Fruit a drupe  | 6. <i>Grewia</i>      |
| b. Fruit a capsule   | 2                     |
| 2a. Capsules echinate  | 3                     |
| b. Capsules not echinate   | 4                     |
| 3a. Trees; capsules triangular, angles winged, echinate on faces   | 5. <i>Erinocarpus</i> |
| b. Shrubs or herbs; capsules not triangular, wingless, echinate all over   | 8. <i>Triumfetta</i>  |
| 4a. Capsule cocci winged; wings more than 1 cm long  | 5                     |
| b. Capsules not winged (only angles winged, wings much less than 1 cm long in <i>Corchorus aestuans</i> )                    | 6                     |
| 5a. Wings 2 - 5; seeds without bristles  | 3. <i>Colona</i>      |
| b. Wings 5 - 8; seeds with bristles  | 1. <i>Berrya</i>      |
| 6a. Shrubs or herbs; leaves usually with filiform processes at base; capsules usually elongate, rarely subglobose to globose | 4. <i>Corchorus</i>   |
| b. Trees; leaves without filiform processes at base; capsules neither elongate nor subglobose to globose                     | 7                     |

- 7a. Leaves palmately nerved; capsules orbicular-reniform, compressed contrary to septum; seeds pilose 7. *Trichospermum*  
 b. Leaves pinnately nerved; capsules pyriform; seeds not pilose 2. *Brownlowia*

### 1. *Berrya* Roxb. ("*Beria*"), orth. et nom. cons.

Trees. Leaves alternate, cordate, 5 - 7-nerved. Panicles axillary and terminal, leafy at base. Calyx campanulate. Petals 5. Stamens numerous. Ovary 3 - 4-lobed; style subulate; stigma lobed. Fruit a capsule; seeds 1 - 2 in each locule; endosperm fleshy.

Distributed in Indo-Malaya, the Philippine Islands and Tahiti, ca 8 species; one in India.

*Berrya cordifolia* (Willd.) Burret in Notizbl. Bot. Gart. Berlin - Dahlem 9: 606. 1926. *Espera cordifolia* Willd. in Ges. Naturf. Freunde Berlin Neue Schriften 3: 450. 1801. *Berrya ammonilla* Roxb. [Hort. Beng. 42. 1814, nom. nud.], Pl. Corom. 3: 60, t. 264. 1819 & Fl. Ind. 2: 639. 1832; Masters in Fl. Brit. India 1: 383. 1874. *Hexagonotheca cordifolia* (Willd.) Turcz. in Bull. Soc. Imp. Nat. Moscou 19: 505. 1846.

**Fig. 132.**

Tam.: *Chavandalai*, *Thiriconamalai venthekku*; Tel.: *Sarala-devadaru*; Eng.: Trincomali wood.

Trees, up to 35 m tall. Leaves simple, 12 - 25 x 4 - 14 cm, ovate-oblong, cordate at base, acuminate at apex, undulate, stellate-pubescent when young, glabrous when mature; petioles 3.5 - 5 cm long, glabrous below, slightly stellate-pubescent above; stipules 1 - 1.5 cm long, linear-setaceous, caducous. Flowers numerous, lax; buds globular; pedicels pubescent. Calyx 3 - 5-lobed; lobes 3 - 5 mm long, obtuse, pubescent. Petals white or pink, 6 - 8 mm long, oblong, obtuse, ultimately reflexed; Stamens inserted on a short receptacle; filaments 4 - 5 mm long; anthers didymous; lobes divergent, opening lengthwise. Ovary 3(- 4)-loculed; locules 4-ovuled; style ca 3 mm long, slightly papillose at base; stigma peltate, 3-lobed. Capsules with persistent calyx, 1 - 1.3 cm across, globose, pubescent with 6 - 8, horizontally spreading, blunt, thin wings; wings 2.5 - 3 x 0.7 - 1 cm, stellate-pubescent; seeds 1 - 4 in each locule. Seeds ca 6 x 3 mm, clothed with brown to yellow, caducous bristles.

*Fl.* March - April; *Fr.* Sept. - Nov.

*Distrib.* India: Andhra Pradesh, Karnataka, Tamil Nadu and Kerala(cultivated) and Andaman & Nicobar Islands(Andaman Islands).

Sri Lanka, Myanmar, Thailand, Cambodia, Vietnam and Malesia.

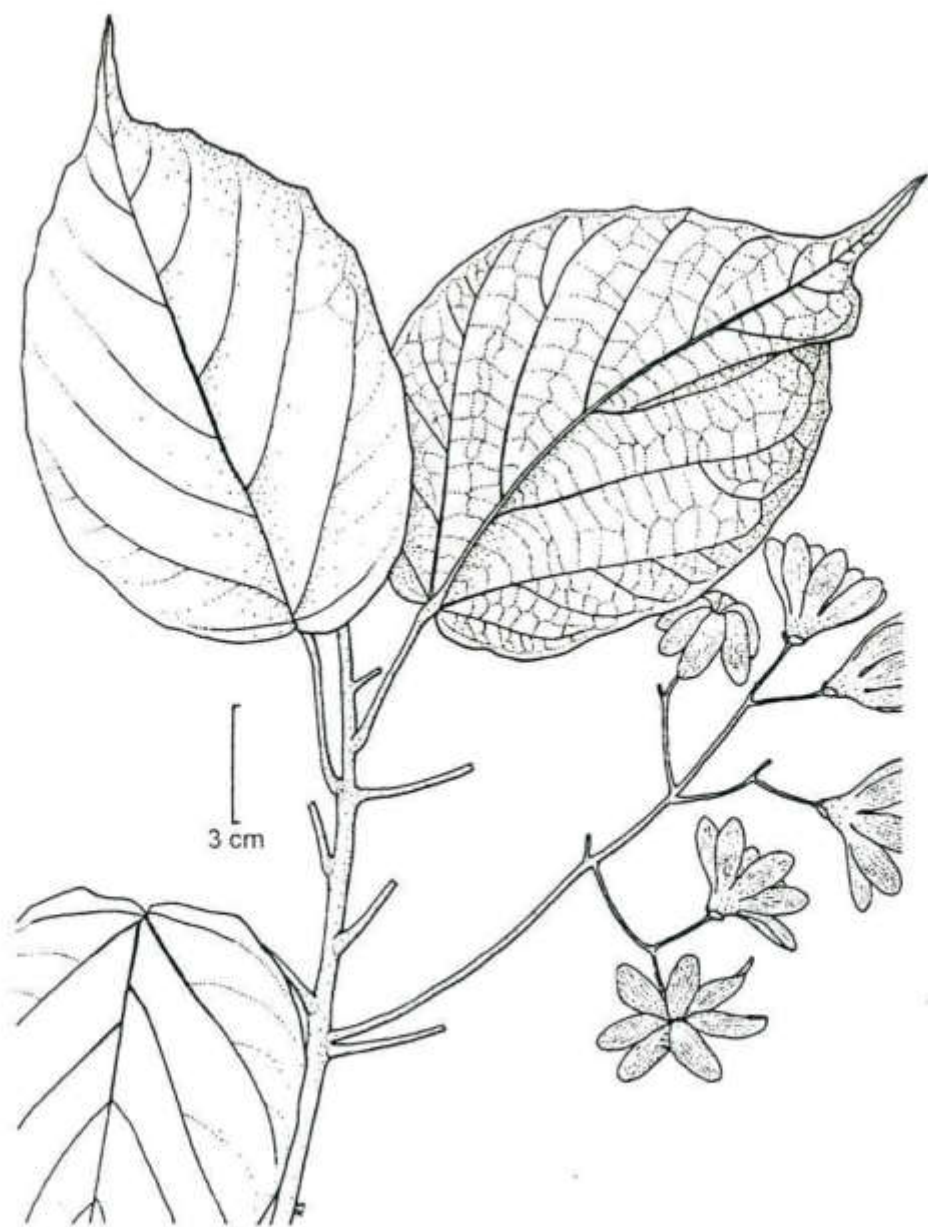


Fig. 132. *Berrya cordifolia* (Willd.) Burret

## 2. *Brownlowia* Roxb., nom. cons.

Trees, covered with lepidote or stellate hairs. Leaves alternate, pinnate, sometimes peltate; stipules sometimes large and foliaceous. Flowers numerous, small, in large, terminal panicles or smaller in axils of upper leaves. Calyx campanulate, 3-5-fid. Petals 5. Stamens numerous; anthers subglobose; staminodes 5, within stamens opposite petals, linear and subpetaloid. Ovary 5-loculed; locules 2-ovuled. Carpels ultimately separating, mature ones subglobose, thick, 2-valved, 1-seeded. Seeds nonendospermous; cotyledons thick, fleshy.

S.E. Asia through Malaysia and the Philippine Islands to New Guinea and the East Pacific Islands, ca 30 species; one in India.

***Brownlowia tersa* (L.) Kosterm.** in *Penerbitan Majd. Pengetahuan Indonesia* 1: 73. 1959. *Glabraria tersa* L., *Mant. Alt.* 276. 1771. *Brownlowia lanceolata* Benth. in *J. Linn. Soc., Bot.* 5, Suppl. 2: 57. 1861; Masters in *Fl. Brit. India* 1: 381. 1874. **Fig. 133.**

Beng.: *Bola sundri, Kedar sundri.*

Shrubs or small trees; branchlets slender, lepidote, greyish. Leaves 14 - 16 x 3.5 - 5 cm, lanceolate, rounded at base, acuminate at apex, entire, glabrous above, silvery greyish beneath, pinnately nerved; petioles up to 8 mm long, slightly thickened at apex. Panicles terminal and axillary, 5 - 6 cm long. Calyx campanulate; lobes ca 3 mm long, lanceolate, acute, lepidote. Petals ca 5 mm long, narrowly obovate. Anthers didymous; lobes slightly divergent; connectives thick; staminodes linear-lanceolate, petaloid, sometimes with rudimentary anthers. Ovary 4-lobed; locules 2-ovuled; style simple; stigma 4-lobed. Capsules ca 1.5 cm long, pyriform, truncate, widest at apex, crumpled.

*Fl.* May - June; *Fr.* Aug. - Sept.

*Distrib.* India: Bihar, West Bengal, Orissa and Andaman & Nicobar Islands (Andaman Islands).

Myanmar and Malesia.

*Notes.* Occurs in tidal forests and saltwater creeks forming dense thickets along banks, almost submerged during high tides.

## 3. *Colona* Cav.

(*Columbia* Pers.)

Trees, covered with stellate hairs. Leaves simple, usually oblique; stipules often foliaceous and persistent, sometimes oblique. Flowers small, clustered; clusters in



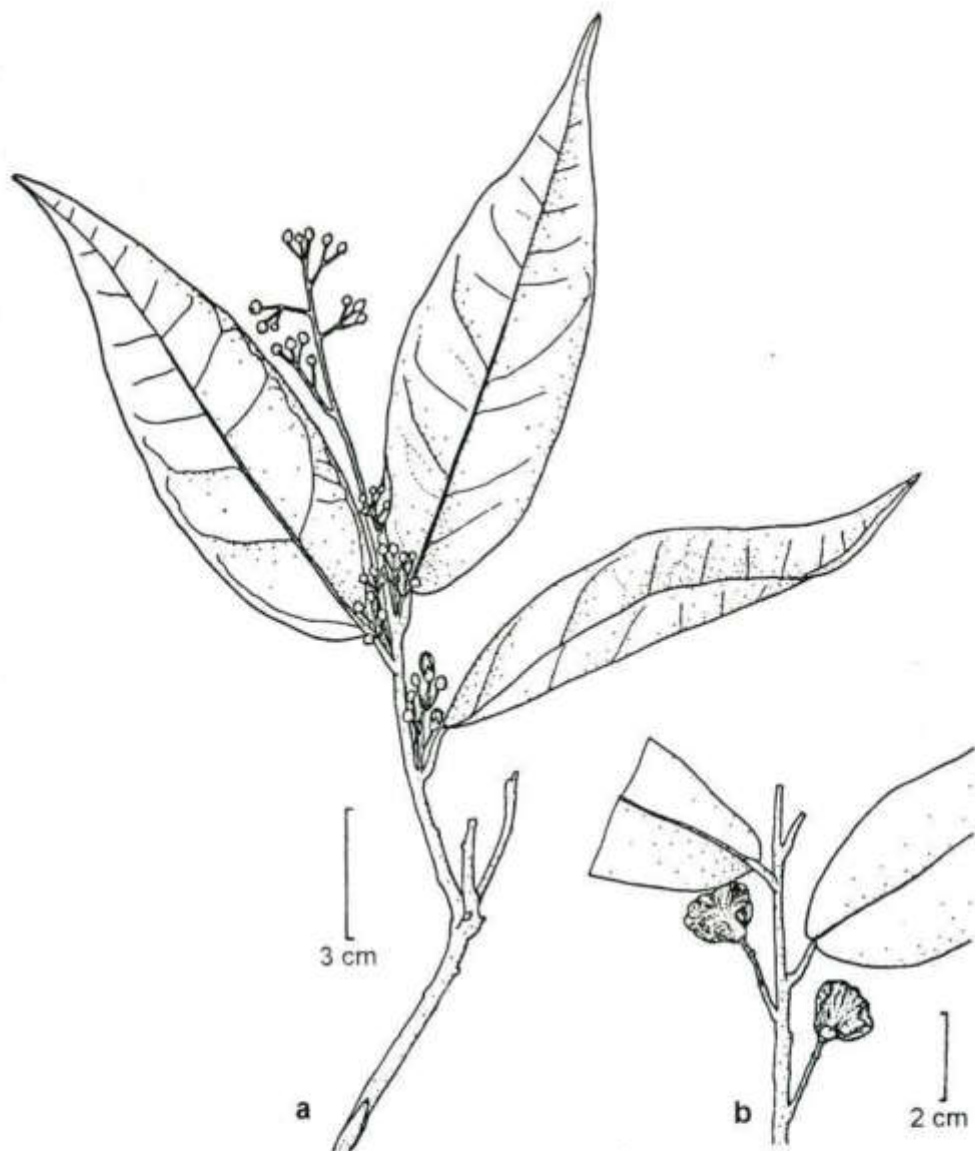


Fig. 133. *Brownlowia tersa* (L.) Kosterm. : a. flowering of branch; b. fruiting part of branch.

terminal panicles. Sepals 5, free. Petals 5, free, glandular within the base. Stamens numerous, free, arising from a raised receptacle. Ovary 2 - 5-loculed; locules 2 - 4-ovuled; style subulate. Capsules roundish; cocci 2 - 5, vertically winged, indehiscent, 1-seeded. Seeds endospermous; cotyledons flat.

China through Malaysia and the Philippine Islands to New Guinea and the East Pacific Islands, ca 30 species; 2 in India.

#### KEY TO THE SPECIES

- |  |                          |
|--|--------------------------|
| 1a. Leaves ovate-lanceolate, not lobed, 3-nerved at base                       | 1. <i>C. flagrocarpa</i> |
| b. Leaves rotundate-ovate or ovate-oblong, shortly lobed, 3 - 7-nerved at base | 2. <i>C. floribunda</i>  |

1. *Colona flagrocarpa* (C.B. Clarke ex Brandis) Craib, Fl. Siam. Enum. 1(1): 189. 1925; Deb, Fl. Tripura 1: 273. 1981. *Columbia flagrocarpa* C.B. Clarke ex Brandis, Indian Trees 101. 1906.

Trees, 12 - 15 m tall, with umbrageous crowns; branchlets softly tomentose. Leaves simple, 12 - 20 x 5 - 7 cm, ovate-lanceolate, oblique and subcordate at base, acuminate at apex, denticulate, softly tomentose beneath, 3-nerved at base, tertiary veins subparallel; petioles up to 1.5 cm long, stout, pubescent. Flowers in terminal and axillary panicles. Sepals oblong. Petals ca 2 mm long, oblong. Stamens glabrous. Ovary globose, hairy. Capsules ca 2.5 cm across, ovoid or obovoid, 3 - 5-winged, seed-bearing portion covered with stellate bristles.

*Fl. & Fr.* June - Dec. (- May).

*Distrib.* India: Tripura.

Bangladesh, Myanmar, Thailand, Laos and Vietnam.

2. *Colona floribunda* (Kurz) Craib in Bull. Misc. Inform. 1925: 21. 1925 & Fl. Siam. Enum. 1(1): 188. 1925. *Columbia floribunda* Kurz in J. Asiat. Soc. Beng. 42: 63. 1873 & For. Fl. Brit. Burma 1: 156. 1877; Masters in Fl. Brit. India 1: 393. 1874. **Fig. 134.**

*Asm.*: Larubanda; *Nep.*: Khasre.

Trees, deciduous, up to 15 m tall; young parts stellate-hairy, scabrid. Leaves simple, 10 - 15 x 7 - 17.5 cm, rotundate-ovate or ovate-oblong, often shortly lobed, cordate at base, acute or acuminate at apex, irregularly gland-toothed, subcoriaceous, rugulose and scabrous on both surfaces, minutely punctate beneath; petioles 2 - 5 cm long, swollen at apex, scabrid. Flowers small, in few-flowered clusters; clusters arranged in lax, terminal, greyish pubescent panicles or on shorter peduncles in the axils of upper leaves; pedicels slender, ca 2 mm long, pubescent; bracts leaf-like. Sepals 5, ca 3.5 mm long, red inside,

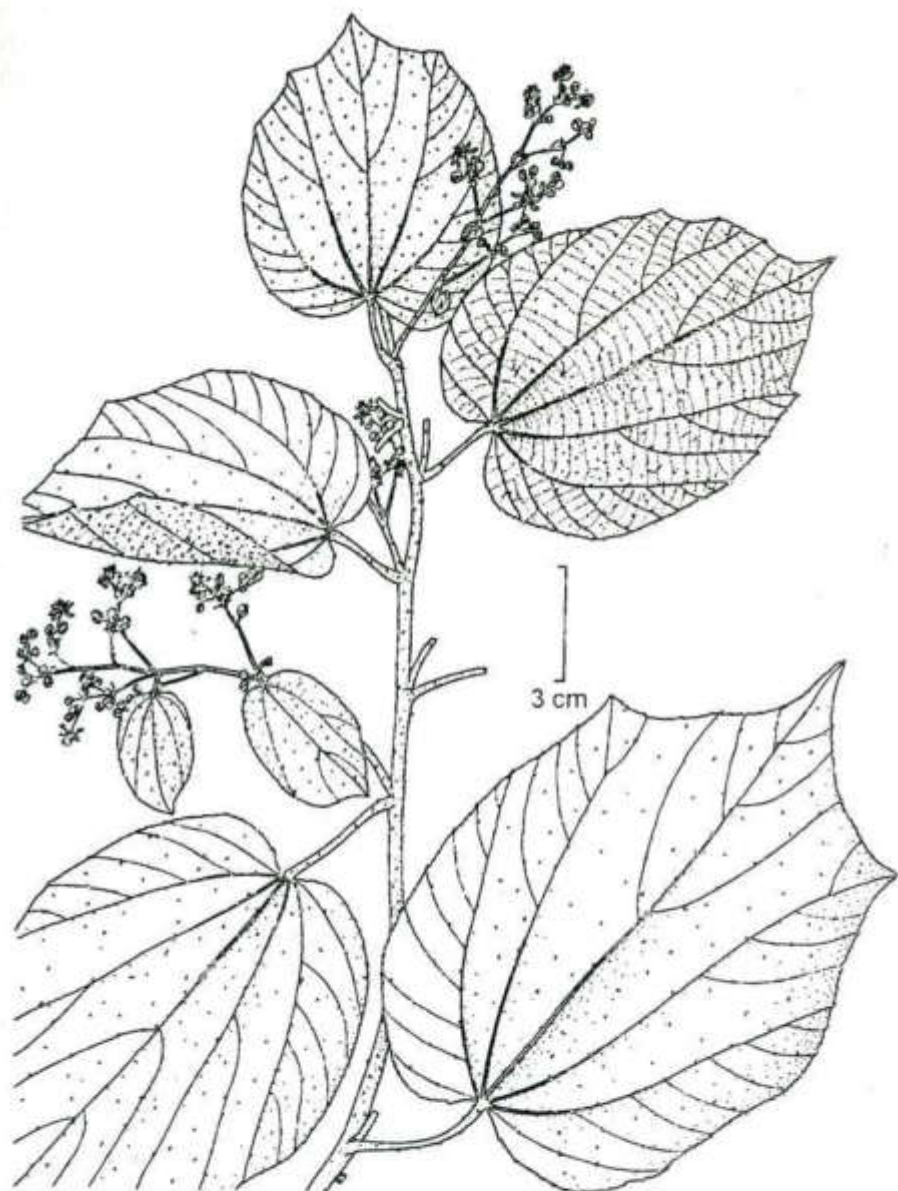


Fig. 134. *Colona floribunda* (Kurz) Craib.

hoary outside. Petals 5, as long as or longer than sepals, oblong-spathulate, yellow with scarlet dots, with a minute, glandular cavity at base. Stamens numerous, free. Ovary 3 - 5-loculed; locules 2 - 4-ovuled; style stellate-hairy. Capsules 1.5 - 2.5 cm across, ellipsoid; cocci 3 - 5, indehiscent, winged, stellate-puberulous, 1-seeded.

*Fl.* June - Aug.; *Fr.* Nov. - Jan.

*Distrib.* India: Assam, Nagaland, Mizoram and Manipur.

Myanmar, China, Thailand and Vietnam.

#### 4. *Corchorus* L.

(*Antichorus* L.)

Herbs, undershrubs or shrubs, covered with simple and stellate hairs. Leaves alternate, petiolate, serrate; stipules filiform. Inflorescences axillary or leaf-opposed, pedunculate, 1 - few-flowered cymes. Flowers small, bracteate, subsessile or shortly pedicellate. Sepals 5 or 4, free, valvate. Petals 5 or 4, free, mostly imbricate, yellow. Stamens 5 - many, or rarely twice as many as sepals, free; anthers dehiscing lengthwise. Carpels 2 - 5, syncarpous; ovary superior, 2 - 5-loculed; ovules many in each locule; style short; stigma simple, undulate or crenate, papillate. Capsules long to short and subglobose, loculicidally 2 - 5-valved, transversely septate between seeds or aseptate. Seeds pendulous or horizontal, endospermous, often with an incurved embryo; cotyledons foliaceous.

Tropics and subtropics of the world, ca 100 species; 8 in India.

#### KEY TO THE SPECIES

- |   |                           |
|---|---------------------------|
| 1a. Plants prostrate; capsules 4-loculed                            | 3. <i>C. depressus</i>    |
| b. Plants erect or suberect; capsules 3 - 5-loculed                 | 2                         |
| 2a. Capsules globose to subglobose                                  | 2. <i>C. capsularis</i>   |
| b. Capsules elongate  | 3                         |
| 3a. Capsules terminating into 3, 2-fid, spreading tips              | 4                         |
| b. Capsules not terminating into 3, 2-fid, spreading tips           | 5                         |
| 4a. Stamens 12 - 30; capsules 6-angled, 3 angles prominently winged | 1. <i>C. aestuans</i>     |
| b. Stamens 10 - 15; capsules cylindric, not winged                  | 6. <i>C. tridens</i>      |
| 5a. Capsules subcylindric, 10-ribbed, 5-loculed                     | 5. <i>C. olitorius</i>    |
| b. Capsules 3-angled, 3-loculed                                     | 6                         |
| 6a. Capsules falcate, strigose; seeds wrinkled                      | 8. <i>C. urticifolius</i> |
| b. Capsules neither falcate nor strigose; seeds not wrinkled        | 7                         |

- 7a. Stamens 5 - 10; capsules pubescent; seeds wedge-shaped, truncate at one end and obliquely produced at other 4. *C. fascicularis*
- b. Stamens 15 - 20; capsules scabrous-tuberculate; seeds trigonous, truncate at both ends 7. *C. trilocularis*

1. *Corchorus aestuans* L., Syst. Nat. ed. 10, 2: 1079. 1759. *C. acutangulus* auct. non Forsskal 1755: Masters in Fl. Brit. India 1: 398. 1874. *C. fuscus* Roxb., Fl. Ind. 2: 582. 1832.

Beng.: *Tilapat*; Hindi: *Hade-ka-khet*.

Herbs, annual, much branched, suberect or spreading, 10 - 60 cm high; stems pilose, often purple. Leaves 2 - 10 x 1 - 5 cm, lanceolate to ovate, more or less rounded at base, acute at apex, serrate, basal most serrations prolonged into filiform processes or not, glabrous above, pilose with conspicuously raised nerves beneath, 3 - 5-nerved; nerves hairy to almost glabrous; petioles 0.5 - 4 cm long, pilose, grooved, purple; stipules 5 - 10 mm long, setaceous, sparsely hairy, purplish green. Flowers 2 - 3 in leaf-opposed, shortly pedunculate cymes, ca 1 cm across; pedicels ca 2 mm long, jointed near apex; bracts 4 - 6 mm long, filiform, purple. Sepals 3 - 4 mm long, linear-oblong, hooded and apiculate, purple-dotted inside, green outside, glabrous. Petals 3 - 5 mm long, obovate, obtuse with a glandular claw, hairy at base, yellow. Stamens 12 - 30. Carpels 3; ovary ca 2 mm long, cylindrical, pubescent, 3-loculed; style 3-fid, ca 1.5 mm long; stigma 2-lobed. Capsules solitary or paired, 10 - 30 x 4 - 6 mm, 6-angled, 3 of the angles winged, truncate with 3, 2-fid, 3 - 7 mm long, diverging, glabrous beaks at top, 3-loculed, locules transversely septate or aseptate. Seeds numerous, truncate at both ends, dark brown.

*Fl. & Fr.* Aug. - Feb.

*Distrib.* India: Common throughout, in moist situations.

Pantropical.

2. *Corchorus capsularis* L., Sp. Pl. 529. 1753; Masters in Fl. Brit. India 1: 397. 1874.

*Asm.*: *Marasaq*, *Tita-mura-pat*; *Beng.*: *Nalita*, *Nalitapat*, *Narcha Pat*; *Hindi*: *Narcha*; *Kan.*: *Senabu*; *Sans.*: *Kalasaka*; *Tam.*: *Chanai*; *Eng.*: *Jute*.

Herbs, annual, erect, much branched, robust, 1 - 2.5 m high, glabrous. Leaves 5 - 15 x 1.5 - 8 cm, oblong, ovate-lanceolate or linear-lanceolate, rounded at base, acute to acuminate at apex, serrate, basal most serrations prolonged into filiform processes; petioles up to 4 cm long, pubescent; stipules 6 - 10 mm long, linear. Flowers 1 or 2 in axillary or leaf-opposed cymes, subsessile, 8 - 10 mm across; bracts 2 - 3 mm long, linear-ovate. Sepals 4 - 5 mm long, linear-oblong. Petals 3 - 5 mm long, obovate, notched

at apex, yellow. Stamens 20 - 30. Carpels 5; ovary subglobose, glabrous, 5-loculed. Capsules ca 1 cm across, globose to subglobose, truncate and depressed at apex, longitudinally grooved, scabrous, wrinkled, muciculate or tuberculate, 5-loculed; locules aseptate; seeds ca 3 x 1 mm, cuneiform, glabrous, brown.

*Fl. & Fr.* July - Nov.

*Distrib.* India: Throughout.

*Notes.* Cultivated in most tropical countries for the jute of commerce.

3. *Corchorus depressus* (L.) Vicary in J. Asiat. Soc. Bengal 16: 1160. 1847. *Antichorus depressus* L., Mant. Pl. 64.1767. *Corchorus antichorus* Raeusch., Nomencl. Bot. ed 3, 158. 1797; Masters in Fl. Brit. India 1: 398. 1874. *C. humilis* Munro, Hort. Agrens. 35. 1844, non A. St. Hil. 1825; Wight, Icon. Pl. Ind. Orient. t. 1073. 1846.

Guj.: *Bahuphali*, *Bethibahuphali*, *Chickni*; Hindi: *Bamphuli*; Mar.: *Bahuphali*; Sans.: *Bedari*, *Kshudra*, *Shunaka-chanchuka*.

Herbs, perennial, woody, prostrate, branched; branches many from thick woody rootstock; young branches sparsely hairy, older ones glabrous. Leaves 1 - 4 x 0.7 - 1.5 cm, narrowly to broadly elliptic, obtuse at base and apex, crenate-serrate, without basal filiform processes, glabrous except for sparsely hairy nerves, 3-nerved; petioles 1.5 - 2.5 cm long, minutely hairy; stipules ca 3 mm long, subulate. Flowers 2 - 4, in leaf-opposed, subsessile cymes, 6 - 8 mm across; pedicels ca 1 mm long; bracts ca 1.5 mm long, linear-lanceolate. Sepals 3 - 4 mm long, linear-oblong, apiculate, reddish green. Petals as long as sepals, ovate-spathulate, obtuse, yellow. Stamens 8 - 10. Carpels 4; ovary cylindric, ca 1 mm long; style minute; stigma 4-lobed. Capsules 7 - 22 mm long, cylindric, often curved, glabrescent, 4-loculed, transversely septate between seeds, beaked; beak 1.5 - 2 mm long; seeds ca 1.5 mm long, roughly triangular, obliquely truncate, black.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Jammu & Kashmir, Himachal Pradesh, Haryana, Delhi, Uttar Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh and Tamil Nadu.

W. Asia, Pakistan and Tropical Africa.

4. *Corchorus fascicularis* Lam., Encycl. 2: 104. 1786; Masters in Fl. Brit. India 1: 398. 1874. *C. brachycarpus* Guillemin *et al.*, Fl. Seneg. Tent. 89. 1831.

Beng.: *Binalita*, *Jangli-pat*; Guj.: *Chunhkadi*, *Ubhibahuphali*; Hindi: *Bamkosta*, *Ke-tapat*; Mar.: *Kirankuri*, *Motibahuphali*; Sans.: *Bhirupatrika*, *Chanchupatra*, *Diaghapatri*, *Kalabhi*, *Kshestra-sambhava*, *Sushaka*.

Herbs, annual, suberect, 40 - 60 cm high, glabrous; stems woody with scaly bark. Leaves 1.5 - 8 x 0.5 - 2 cm, lanceolate or elliptic-oblong, obtuse at apex, serrate, basal most serrations not prolonged into filiform processes, glabrous to subglabrous, 3-nerved; petioles 3 - 10 mm long, hirsute; stipules ca 5 mm long, subulate. Flowers in 2 - 5(-8)-flowered, leaf-opposed, shortly pedunculate cymes. Sepals 1.5 - 2.5 mm long, linear-oblong, apiculate. Petals as long as sepals, oblong to obovate. Stamens 5 - 10. Carpels 3; ovary oblong-ovoid to linear, hairy, 3-loculed; style short; stigma capitate. Capsules in fascicles of 2 - 5(-8), 1 - 1.5 cm long, more or less triangular, shortly stalked, pubescent, shortly beaked, 3-loculed; locules septate between seeds. Seeds 1 - 1.5 mm long, wedge-shaped, truncate at one end and obliquely produced at the other, black.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Punjab, Uttar Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu.

Sri Lanka, Africa and Australia.

5. *Corchorus olitorius* L., Sp. Pl. 529. 1753; Masters in Fl. Brit. India 1: 397. 1874. *C. decemangularis* Roxb., Fl. Ind. 2: 582. 1832.

Beng.: *Bogi, Koshta, Mithapat, Pat, Jute*; Guj.: *Chehuncho*; Hindi: *Changhas, Rajaan, Sonpat*; Kan.: *Senabu*; Mar.: *Chunch, Motichunch*; Or.: *Jhoto, Kaunria*; Sans.: *Brihat-chanchu, Dirghupatri, Divyagandha, Kalasa*; Tam.: *Peratti, Punaku*; Tel.: *Parinta, Parintakura*; Eng.: *Tossa Jute, Jew's mallow*.

Herbs, annual or biennial with a woody base, erect, stout, branched, up to 1.5 m high, glabrous to subglabrous. Leaves 4 - 15 x 3 - 5 cm, lanceolate to ovate-lanceolate, slightly rounded at base, acute at apex, serrate, basal most serrations prolonged into filiform processes, glabrous except sparsely hairy nerves, 3 - 5-nerved; petioles 2 - 3 cm long, pubescent; stipules 8 - 12 cm long, subulate, glabrous. Flowers 1 or 2, in leaf-opposed, shortly pedunculate cymes, subsessile, 12 - 15 mm across; bracts 4 - 5 mm long, subulate. Sepals 5 - 7 mm long, linear-oblong, apiculate. Petals yellow, 5 - 7 mm long, oblong-spathulate, obtuse. Stamens many, somewhat united at base. Carpels 5; ovary cylindric, sparsely hairy, 5-loculed; style short; stigma 5-lobed, minutely papillate. Capsules 1 or 2 together, 2 - 7 cm long, subcylindric, 10-ribbed, glabrous, 5-loculed; locules septate between seeds; beak entire, 4 - 8 mm long. Seeds ca 2 x 1.5 mm, trigonous, inconspicuously verrucose, black.

*Fl. & Fr.* July - Jan.

*Distrib.* India: Throughout. Often found in moist situations.

Pantropical.

6. *Corchorus tridens* L., Mant. Alt. 566. 1771; Masters in Fl. Brit. India 1: 398. 1874. *C. trilocularis* auct. non L. 1767: Burm. f., Fl. Ind. 125. t. 37, f. 2. 1768. *C. burmanni* DC., Prodr. 1: 505. 1824.

Herbs, annual, erect or somewhat suberect, 30 - 60 cm high, glabrous. Leaves 1.5 - 12 x 0.4 - 2.2 cm, oblong-lanceolate to linear-lanceolate, acute at apex, serrate, basal most serrations prolonged into filiform processes or not, glabrous except for sparsely hairy nerves, 3 - 4-nerved; petioles up to 18 mm long, hairy; stipules 3 - 4 mm long, setaceous. Flowers 1 - 4, in leaf-opposed, shortly pedunculate cymes, subsessile, ca 1 cm across; bracts 3 - 4 mm long, subulate. Sepals 4 - 5 mm long, linear-oblong, apiculate. Petals yellow, 3 - 4 mm long, oblong, obtuse. Stamens 10 - 15. Carpels 3; ovary cylindrical, hairy, 3-loculed; style short; stigma sparsely papillate. Capsules 1.5 - 4 cm long, ca 3 mm across, cylindrical, often curved, terminating into 3, 2-fid, spreading tips, glabrous, 3-loculed; locules aseptate between seeds. Seeds angular, obliquely truncate at both ends, black.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Throughout the country.

Pantropical.

7. *Corchorus trilocularis* L., Mant. Pl. 77. 1767; Masters in Fl. Brit. India 1: 397. 1874. *C. serratifolius* DC., Prodr. 1: 504. 1824.

Guj.: *Kadvichuchdi*; Hindi: *Kagli*, *Karaka*, *Tambakhu*; Kan.: *Tandassir*; Mar.: *Kadunchuch*; Sans.: *Dirghachanchu*, *Kaunti*.

Herbs, annual, erect or suberect, much branched, 30 - 150 cm high, pubescent. Leaves 1.3 - 10 x 0.4 - 3.5 cm, narrowly oblong-lanceolate to broadly oblong-elliptic, obtuse at apex, crenate-serrate, basal most serrations prolonged into filiform processes or not, sparsely hairy on both surfaces, distinctly hairy along nerves, 3 - 5-nerved; petioles 4 - 12 mm long, pilose; stipules 4 - 5 mm long, setose. Flowers 1 - 3, in leaf-opposed, shortly pedunculate cymes, ca 1.2 cm across; pedicels ca 2.5 mm long, glabrous; bracts ca 3 mm long, linear-lanceolate, caudate. Sepals 4 - 5 mm long, linear-oblong, acuminate. Petals yellow, 5 - 6.5 mm long, somewhat pandurate, obtuse. Stamens 15 - 20. Carpels 3; ovary cylindrical, hairy, 3-loculed; style short; stigmas 3, capitate. Capsules 2 - 7 cm long, ca 2.5 mm across, 3-angular, straight, sometimes curved, scabrous-tuberculate, 3-loculed, transversely septate between seeds; beak ca 2.5 mm long, undivided. Seeds 1 - 1.2 mm long, black.

*Fl. & Fr.* Almost throughout the year.



*Distrib.* India: Himachal Pradesh, Haryana, Delhi, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Paleotropics.

**8. *Corchorus urticifolius*** Wight & Arn., Prodr. 73. 1834 '*urticaefolius*'; Masters in Fl. Brit. India 1: 397. 1874.

Guj.: *Adbau, Chunchadi, Khetrau, Surval.*

Herbs, annual, erect, up to 1 m high, pubescent. Leaves 4.5 - 8 x 1.7 - 4.5 cm, ovate-lanceolate, obtuse or truncate at base, acute at apex, serrate, basal most serrations not prolonged into filiform processes, thinly pilose, 3 - 5-nerved; petioles 0.8 - 2 cm long, hairy; stipules ca 5 mm long, linear, hairy. Flowers 2 - 4, in leaf-opposed, shortly pedunculate cymes; bracts ca 2 mm long, subulate. Sepals ca 4 mm long, oblong, acuminate, hairy. Petals yellow, ca 3 mm long, ovate-spathulate, obtuse. Stamens ca 15. Ovary 3-loculed. Capsules 2 - 3.5 cm long, falcate, 3-angular, strigose, 3-loculed, transversely septate between seeds; beak entire, short. Seeds ca 1.5 mm long, trigonous, wrinkled.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Gujarat, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Myanmar, Malay Peninsula and E. Africa.

#### EXCLUDED SPECIES

***Corchorus deccanensis*** H.B. Singh & Viswanathan in Taxon 39: 341. 1990. = *C. velutinus* Pardeshi in Ind. Bot. Rep. 1: 63. 1982, non Willd 1957. In the absence of a specimen this species is excluded.

#### 5. *Erinocarpus* Nimmo ex Graham

Trees; branchlets stellate-hairy. Leaves shallowly lobed, cordate, palmately nerved. Flowers large, in terminal panicles and leaf-opposed cymes; pedicels jointed; bracts elliptic, subfoliaceous. Sepals 5, free, hooded. Petals 5, free, clawed, pitted-glandular at base. Stamens many, arising from a raised receptacle, free; filaments undulate above. Ovary 3 - 5-loculed, ovules 2 in each locule; style filiform; stigma minute. Fruits woody, indehiscent, often 4-loculed, triquetrous, winged, prickly on the faces. Seeds pendulous, one each locule.

Endemic to the Northern Western Ghats in India, monotypic.

**Erinocarpus nimmonii** Graham, Cat. Pl. Bombay 21. 1839; Masters in Fl. Brit. India 1: 394. 1874 '*nimmoanus*'. Fig. 135.

Kan.: *Adavi-bende, Cavara, Chawra, Haladi, Jangali-bende, Kadu-bende*; Kon.: *Hiluo*; Mar.: *Chaora, Cher, Chira, Janglibhendi*.

Trees, 5 - 6 m high, clothed with stellate hairs. Leaves simple, up to 25 x 35 cm, cordate, shallowly 3 - 5-lobed, cordate at base, cuspidate at apex, dentate, almost glabrous above, distinctly pubescent beneath, 5 - 7-nerved; petioles pubescent. Flowers 5 - 7 cm across, lax, in terminal panicles and leaf-opposed cymes; buds oblong, fulvous-pubescent, 2 or 3 enclosed together by broadly ovate, acute bracts; bracts up to 10 x 8 mm, velvety tomentose on both surfaces, caducous. Sepals 5, free, up to 3 x 0.35 cm, oblong, hooded and acute at apex, fulvous-pubescent outside. Petals 5, yellow, free, up to 2.7 x 0.8 cm, obovate-spathulate, clawed, pitted-glandular at base. Receptacle up to 3.5 mm long. Stamens many, arising from raised receptacle; filaments undulate above, more or less united at base and pubescent. Ovary hairy, 3 - 5 loculed; ovules 2 in each locule; style filiform; stigma minute. Capsules up to 5.5 x 3.5 cm, triquetrous with winged angles, cordate at base, woody, indehiscent, often 4-loculed, faces covered with straight or curved prickles arising from broad bases. Seed one in each locule, pendulous, ca 6 mm long, oblong.

*Fl.* Aug. - Sept.; *Fr.* Oct. - May

*Distrib.* India: Common in semievergreen and deciduous forests; Maharashtra, Goa and Karnataka.

Endemic.

*Notes.* Bark used for making ropes.

## 6. *Grewia* L.

(*Microcos* L.)

Small trees, shrubs or climbers, stellate-pubescent. Leaves alternate, stipulate, petiolate, serrate, dentate or entire along margins, sometimes lobed, somewhat coriaceous. Inflorescences axillary, leaf-opposed or terminal, solitary or clustered, pedunculate, umbellate cymes or panicles. Flowers bracteate, pedicellate, bisexual, 5-merous. Sepals 5, free, valvate, coriaceous, usually coloured, mostly glabrous inside. Petals 5, free, much shorter, clawed with a gland inside, rarely absent. Receptacle raised or not, densely pubescent. Stamens numerous, free, inserted on more or less elevated receptacle or androphore; anthers dorsifixed, dorsally curved, dehiscing longitudinally. Ovary superior, on top of androphore, 2 - 4-loculed with 2 or more superposed ovules in each locule; style subulate; stigma 2 - 4-lobed or penicillate. Drupes entire or 2 - 4-lobed,

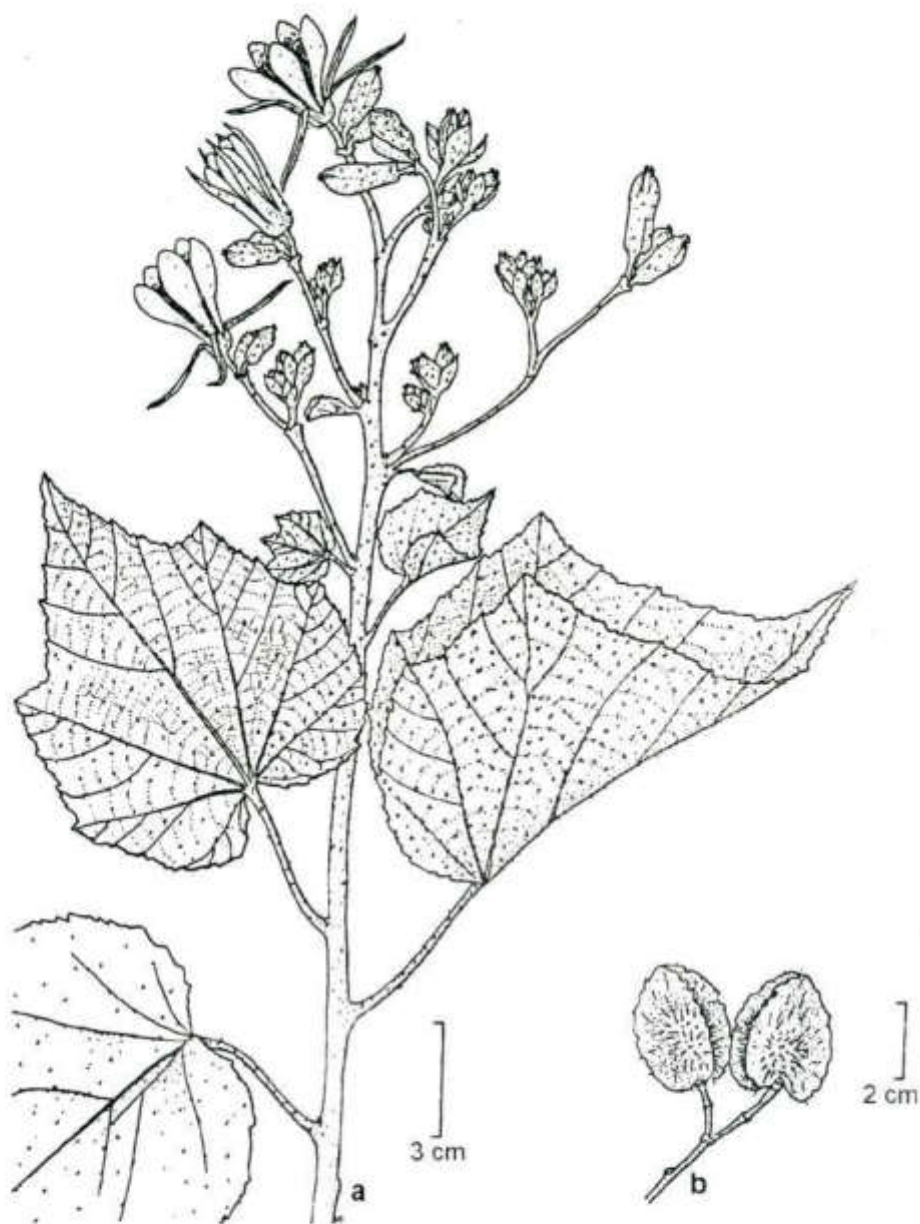


Fig. 135. *Erinocarpus dimmonii* Graham : a. flowering part of branch; b. fruits.

fleshy or fibrous with 1 - 4 pyrenes; each stone 1- or 2-seeded. Seeds suberect or horizontal, endospermous; embryo straight.

ca 150 species in the tropics and subtropics, rare in temperate regions; 31 in India.

*Notes.* Common in deciduous and evergreen forests.

*Literature.* NARAYANASWAMI, V. & R.S. RAO (1950). A preliminary note on the Indo-Burmese species of *Grewia* Linn. *J. Indian Bot. Soc.* 29: 177 - 190.

#### KEY TO THE SPECIES

- |  |                             |
|--|-----------------------------|
| 1a. Flowers solitary   | 14. <i>G. indandamanica</i> |
| b. Flowers many in panicles or cymes   | 2                           |
| 2a. Inflorescences paniculate, terminal and/or axillary  | 3                           |
| b. Inflorescences cymose, terminal or leaf-opposed (rarely terminal in <i>G. umbellifera</i> and <i>G. rhamnifolia</i> ) | 4                           |
| 3a. Leaves subentire or serrulate; petals white or yellow; drupes globose, 8 - 10 mm across, purple                      | 16. <i>G. nervosa</i>       |
| b. Leaves entire; petals pink; drupes obovoid, 1.3 - 2.3 cm across, orange-yellow  | 5. <i>G. calophylla</i>     |
| 4a. Peduncles capillary, 1 - 2-flowered  | 28. <i>G. tenax</i>         |
| b. Peduncles not capillary, 3 - many-flowered  | 5                           |
| 5a. Peduncles much shorter than or as long as petioles   | 6                           |
| b. Peduncles much longer than petioles   | 10                          |
| 6a. Flower buds more than 1 cm long  | 7                           |
| b. Flower buds less than 0.8 cm long   | 8                           |
| 7a. Leaves oblong, ovate-oblong or ovate-elliptic; petals yellow   | 9. <i>G. flavescens</i>     |
| b. Leaves rotund-ovate, obovate or obcordate; petals white   | 26. <i>G. sclerophylla</i>  |
| 8a. Stipules auriculate  | 29. <i>G. tillifolia</i>    |
| b. Stipules not auriculate   | 9                           |
| 9a. Leaves rounded to abruptly acuminate at apex, villous beneath; flower buds ellipsoid                                 | 31. <i>G. villosa</i>       |
| b. Leaves acute to acuminate at apex, scabrous above; flower buds ovoid or oblong  | 1. <i>G. abutilifolia</i>   |
| 10a. Leaves 5 - 7-nerved (3 - 5-nerved in <i>G. pandaica</i> )   | 11                          |
| b. Leaves 3(-4)-nerved   | 15                          |
| 11a. Stipules auriculate   | 12                          |
| b. Stipules linear or lanceolate   | 13                          |
| 12a. Leaves regularly crenate; petioles more than 6 mm long  | 3. <i>G. asiatica</i>       |
| b. Leaves coarsely double-serrate; petioles up to 6 mm long  | 25. <i>G. sapida</i>        |
| 13a. Leaves orbicular, broadly elliptic or obovate, finely grey tomentose beneath  | 19. <i>G. orbiculata</i>    |
| b. Leaves ovate, ovate-oblong, elliptic, elliptic-oblong or lanceolate, pubescent beneath                                | 14                          |
| 14a. Leaves coarsely crenate, 3 - 5-nerved; flower buds ovoid-oblong   | 21. <i>G. pandaica</i>      |
| b. Leaves crenate-serrate, 5 - 6-nerved; flower buds globose to ovoid  | 8. <i>G. eriocarpa</i>      |
| 15a. Leaves glaucous beneath   | 16                          |
| b. Leaves not glaucous beneath   | 17                          |

16a. Peduncles slender, more than 1.5 cm long; drupes not lobed	24. <i>G. rothii</i>
b. Peduncles stout, up to 1.5 cm long; drupes 2-lobed	6. <i>G. damine</i>
17a. Plants with bisexual and unisexual flowers	18
b. Plants with bisexual flowers only	19
18a. Leaves oblique; stamens more than 40; drupes densely hirsute or hispid	13. <i>G. hirsuta</i>
b. Leaves not oblique; stamens 16 - 20; drupes sparsely hirsute or glabrescent	11. <i>G. helicterifolia</i>
19a. Leaves rhomboid or rhomboid-obovate, less than 1.5 cm broad	22. <i>G. piscatorum</i>
b. Leaves neither rhomboid nor rhomboid-ovate, more than 1.5 cm broad	20
20a. Leaves glabrous or glabrescent	21
b. Leaves scabrid, pubescent or tomentose	27
21a. Inflorescences axillary	22
b. Inflorescences axillary or terminal	26
22a. Drupes glabrescent when mature	23
b. Drupes pilose, tomentose or bristly when mature	24
23a. Leaves crenate-serrate; drupes obscurely 4-lobed or not	2. <i>G. acuminata</i>
b. Leaves sharply serrate; drupes 2-lobed	27. <i>G. serrulata</i>
24a. Flower buds ovoid or ovoid-oblong; petals reflexed; drupes rusty pubescent	4. <i>G. bracteata</i>
b. Flower buds conical or cylindrical; petals not reflexed; drupes bristly or pilose	25
25a. Leaves obliquely cordate at base; sepals oblong; drupes bristly	20. <i>G. orientalis</i>
b. Leaves narrowed at base; sepals linear-lanceolate; drupes pilose	15. <i>G. lanceaefolia</i>
26a. Climbing shrubs; peduncles up to 3 cm long; drupes purple, subglabrous	30. <i>G. umbellifera</i>
b. Erect shrubs; peduncles up to 1.5 cm long; drupes yellow, brown-tomentose	23. <i>G. rhamnifolia</i>
27a. Peduncles solitary	18. <i>G. optiva</i>
b. Peduncles more than one	28
28a. Petals emarginate at apex	17. <i>G. oppositifolia</i>
b. Petals acute to obtuse at apex	29
29a. Peduncles more than 2.5 cm long; drupes glabrescent	12. <i>G. heterotricha</i>
b. Peduncles up to 2.5 cm long; drupes hispid or pubescent	30
30a. Petals ovate, ca 5 mm long; drupes 2-lobed	7. <i>G. denticulata</i>
b. Petals oblong-lanceolate, ca 8 mm long; drupes 4-lobed	10. <i>G. gamblei</i>

1. *Grewia abutilifolia* Vent. ex A. L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 92. 1804; Masters in Fl. Brit. India 1: 390. 1874. *G. aspera* Roxb. [Hort. Beng. 42. 1814, nom. nud.], Fl. Ind. 2: 591. 1832; Dunn in Gamble, Fl. Pres. Madras 119. 1915. *G. macrophylla* auct. non G. Don 1831; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 187. 1950.

Kan.: *Karakele, Kowri*; Kh.: *Soh-eit-blang*; Mal.: *Pampukonta*; Mar.: *Kharphulsa*; Or.: *Bhamola, Ryna*; Tam.: *Kaviya*; Tel.: *Guvuadada, Peddatadaki, Potucamanti*.

Shrubs or small trees. Leaves 3.5 - 20 x 2 - 16 cm, elliptic-ovate, ovate or broadly oblong, subcordate at base, acute or acuminate at apex, irregularly serrate, sometimes obscurely lobed, scabrous above, stellate-tomentose beneath, 5-nerved; petioles 0.5 - 4.5 cm long. Flowers in axillary, umbellate cymes; peduncles 1 - 3 together, up to 1 cm long;

buds 5 - 8 x 4 mm, ovoid or oblong; pedicels ca 2 mm long. Sepals 8 - 12 mm long, narrowly oblong or lanceolate, acute, woolly outside. Petals white, 2 - 4 x 1 - 1.5 mm, oblong, obtuse, ciliate at base; glands subglobose, ca 2 mm across, densely ciliate. Receptacle ca 1 mm long, 5-angled, glabrous. Stamens many; filaments ca 5 mm long. Ovary ca 1.5 x 1 mm, subglobose, villous; stigma laciniate. Drupes 0.8 - 1.5 cm across, subglobose, fleshy, obscurely 4-lobed, tomentose.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Common in moist deciduous forests; Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Manipur, Meghalaya, Tripura, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Bangladesh, Myanmar, Indonesia and Malaysia.

2. *Grewia acuminata* A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 91. t. 48. 1804. *G. odorata* Blume ex Walp., Repert. Bot. Syst. 4: 361. 1847. *G. scabrida* Wallich ex Kurz in J. Asiat. Soc. Beng. 42: 63. 1873; Masters in Fl. Brit. India 1: 389. 1874.

Climbing shrubs. Leaves 10 - 15 x 5 - 7 cm, elliptic, elliptic-oblong or ovate-lanceolate, rounded at base, acuminate at apex, crenate-serrate, glabrescent, 3-nerved; petioles up to 1.2 cm long. Flowers in axillary cymes; peduncles 1 - 2.5 cm long; buds 1.2 - 1.5 cm long, cylindrical-oblong, ribbed, tomentose; pedicels 5 - 10 mm long. Sepals 1 - 1.5 cm long, oblong-lanceolate, pilose. Petals white or yellow, 8 - 10 mm long, entire or crose. Receptacle longer than glands, angular, sulcate, villous. Androgynophore ca 4 mm long, tomentose. Stamens many; filaments ca 1 cm long, glabrous. Ovary ca 2.5 mm across, globose, pilose; stigma lobed. Drupes ca 1.6 cm across, subglobose, 4-lobed, purple, glabrescent.

*Fl.* May - Sept.; *Fr.* Aug. - Dec.

*Distrib.* India: Assam and occasional along edges of coastal forests in the Andaman & Nicobar Islands.

Myanmar to Malacca, Malaysia and E. & W. Tropical Africa.

3. *Grewia asiatica* L., Mant. Pl. 122. 1767; Masters in Fl. Brit. India 1: 386. 1874, excl. var. *vestita*. *G. subinaequalis* DC., Prodr. 1: 511. 1824; Dunn in Gamble Fl. Pres. Madras 18. 1915. *G. hainesiana* Hole in Ind. For. 43: 126. 1917.

Beng.: *Phalsa*, *Shukri*; Guj.: *Phalsa*; Hindi: *Dhamin*, *Kara*, *Parusha*, *Phalsa*, *Phar-sa*, *Sukri*; Kan.: *Buttiyudippe*, *Jana*, *Thadasal*; Mar.: *Phalsi*; Or.: *Pharosakoli*; Sans.:

*Alpasthi, Dhanvanchhada, Giripilu, Nilacharma, Parishaka*; Tam.: *Palicca, Tadachi, Unnu*; Tel.: *Nalajana, Peddajana, Phutiki*.

Small trees or shrubs. Leaves 5 - 19 x 4 - 15 cm, broadly ovate or suborbicular, obliquely cordate or rounded at base, acute or acuminate at apex, crenate, scabrous above, tomentose beneath, 5 - 7-nerved; petioles up to 1.8 cm long. Flowers in axillary, umbellate cymes; peduncles up to 3.5 cm long; buds 6 - 11 x 4 - 5 mm, oblong-obovoid, ribbed, tomentose; pedicels up to 1 cm long. Sepals 6 - 12 x 2 - 3 mm, oblong-lanceolate or oblanceolate, tomentose. Petals yellow, 3 - 7 x 1.5 - 3 mm, oblong-obovate or linear-oblong, obtuse; glands ca 1 x 0.7 mm, obovoid. Stamens numerous; filaments 4 - 6 mm long. Ovary 1.5 - 2.5 x 1 - 1.5 mm, ovoid, villous; stigma 4-lobed. Drupes 7 - 12 mm across, subglobose, obscurely lobed, red or purple, pilose.

*Fl.* Nov. - Aug.; *Fr.* Jan. - Sept.

*Distrib.* India: Common in deciduous and semievergreen forests. Himachal Pradesh, Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu; also cultivated.

Bangladesh and Sri Lanka.

4. *Grewia bracteata* Roth, Nov. Pl. Sp. 243. 1821; Masters in Fl. Brit. India 1: 389. 1874. *G. obtusa* Wallich ex Dunn in Gamble, Fl. Pres. Madras 117. 1915. *G. wightiana* J.R. Drumm. ex Dunn in Gamble, Fl. Pres. Madras 115. 1915.

Tam.: *Accu, Kullai, Pandripiduku*.

Small trees or shrubs. Leaves 2 - 12 x 1.5 - 7 cm, broadly ovate, ovate-lanceolate or orbicular, subcordate at base, subacute, acuminate or rounded at apex, irregularly crenate-serrate, glabrous excepting the nerves beneath, 3-nerved; petioles 2 - 16 mm long; stipules ovate, sparsely pubescent. Cymes axillary, few-flowered; peduncles up to 7 mm long; buds 10 - 15 x 5 mm, ovoid or ovoid-oblong, tomentose; pedicels 4 - 10 mm long. Sepals 1.5 - 2.3 x 0.3 cm, ovate-lanceolate to lanceolate, pilose. Petals white or yellow, 4 - 6 x 2 - 2.5 mm, ovate or oblong, obtuse, ciliate at base; glands ca 2.5 mm long. Receptacle ca 1.5 mm long, angular, glabrous. Androgynophore ca 1 mm long, woolly. Stamens ca 1.2 cm long. Ovary ca 2 mm across, globose, strigose; stigma clavate, lacinate. Drupes 1.5 - 2 cm across, broadly ovoid or depressed-globose, obscurely or distinctly 4-lobed, rusty pubescent.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: In dry deciduous forests, occasional. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

**5. *Grewia calophylla*** Kurz ex Masters in Fl. Brit. India 1: 392. 1874. *Microcos calophylla* (Kurz ex Masters) Burret in Notizbl. Bot. Gart. Berlin-Dahlem 9: 729. 1929.

Trees, 6 - 14 m tall. Leaves 15 - 19 x 3 - 9 cm, ovate-lanceolate, ovate-elliptic or oblong-elliptic, rounded or subacute at base, acuminate at apex, entire, coriaceous, glabrous, 3-nerved; petioles 0.5 - 1 cm long. Flowers in terminal panicles; buds 0.8 - 1 cm long, obovoid, tomentose; pedicels up to 1.2 cm long. Sepals ca 1.8 cm long, linear-oblong or linear-spathulate. Petals pink, 6 - 8 mm long, linear-oblong, acute. Androgynophore ca 1.2 mm long, glabrous in lower half, tomentose in upper half. Stamens many; filaments 8 - 10 mm long, glabrous. Ovary ca 2 mm across, subglobose, puberulous; stigma lobed. Drupes orange-yellow, 2 - 4.5 x 1.3 - 2.3 cm, obovoid, tapering at base, glabrous, woody with a sticky exudate.

Fl. April - July; Fr. Aug. - Dec.

*Distrib.* India: Frequent in semideciduous and coastal forests. Andaman & Nicobar Islands.

Malaysia.

**6. *Grewia damine*** Gaertn., Fruct. Sem. Pl. 2: 113. t. 106, f. 9. 1790; Dunn in Gamble, Fl. Pres. Madras 118. 1915. *G. salvifolia* Heyne ex Roth, Nov. Pl. Sp. 239. 1821; Masters in Fl. Brit. India 1: 386. 1874, p.p.

Kan.: *Udikke*; Or.: *Dhatoki, Kola*; Tam.: *Cavatalunnu, Naroduppi, Savandilunam*; Tel.: *Adivipagari, Jara, Kondacipuru, Manickolupu, Narabudama, Uppidi*.

Small trees or shrubs, 2 - 5 m high. Leaves 1.5 - 9 x 1 - 3.5 cm, ovate, elliptic or lanceolate, rounded or oblique at base, obtuse or subacute at apex, subentire or minutely serrate, appressed tomentose beneath, 3-nerved; petioles 2 - 4 mm long. Flowers in axillary cymes; peduncles up to 1.5 cm long; buds 5 - 7 mm long, ovoid-oblong, tomentose; pedicels up to 1.2 cm long. Sepals 8 - 12 mm long, linear to oblong, tomentose. Petals yellow, 3.5 - 6 mm long, elliptic-oblong, retuse; glands ca 2 mm long, hairy. Receptacle ca 1.5 mm long, obscurely angled, glabrous. Stamens many; filaments 3 - 4.5 mm long. Ovary ca 1.5 mm across, subglobose, hirsute; stigma 4-lobed. Drupes 8 - 10 mm across, globose, distinctly 2-lobed, sparsely pubescent.

Fl. July - Sept.; Fr. Aug. - Nov.

*Distrib.* India: Frequent in scrub jungles. Punjab, Haryana, Bihar, West Bengal, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.



Nepal, Pakistan and Tropical Africa.

7. *Grewia denticulata* Wallich ex Prain in Ann. Roy. Bot. Gard. Calc. 9: 10. t. 12. 1901; Kanjilal *et al.*, Fl. Assam 1: 167. 1934. *G. nagensium* Prain in J. Asiat. Soc. Beng. 69: 168. 1900.

Small trees or straggling shrubs. Leaves 10 - 18 x 3 - 8 cm, ovate-lanceolate or oblong-lanceolate, rounded at base, acuminate at apex, serrate, sparsely pubescent above, densely pubescent beneath, 3-nerved; petioles up to 6 mm long. Flowers in axillary or leaf-opposed umbellate cymes; peduncles up to 2.5 cm long; buds oblong, tomentose; pedicels up to 2 cm long. Sepals ca 1.2 cm long, lanceolate, tomentose. Petals white or pale yellow, ca 5 mm long, ovate; glands ca 2.5 mm long. Androgynophore appressed-villose. Ovary ca 2 mm across, subglobose, pubescent; stigma lobed. Drupes 8 - 16 mm across, subglobose or distinctly 2-lobed, rugose, stellate-hispid.

Fl. May - Sept.; Fr. Dec. - Feb.

Distrib. India: Arunachal Pradesh, Assam and Nagaland.

Myanmar.

8. *Grewia eriocarpa* A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 93. 1804. *G. elastica* Royle, Ill. Bot. Himal. Mts. 1: 104. t. 22. 1834. *G. vestita* Wallich ex Brandis, For. Fl. N.W. India 40. 1874. *G. asiatica* L. var. *vestita* (Wallich ex Brandis) Masters in Fl. Brit. India 1: 387. 1874. *G. elastica* Royle subsp. *vestita* (Wallich ex Brandis) Haines, Bot. Bihar & Orissa 93. 1921. *G. mesopoda* Burret in Notizbl. Bot. Gart. Berlin-Dahlem 9: 633. 1926; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950.

Asm.: *Man-bijal*; Beng.: *Dhamni*; Hindi: *Bimla*, *Dhaman*, *Dhamni*, *Pharsia*; Kh.: *Dien-soh-langhri-that*; Nep.: *Siyal phusra*, *phalba*, *Sial phorsa*; Or.: *Mirgi-chara*.

Trees, up to 20 m tall. Leaves 7 - 14 x 5 - 11 cm, obliquely ovate, oblong-ovate or elliptic, rounded or subcordate at base, acuminate at apex, crenate-serrate, hispid above, tomentose beneath, 5 - 6-nerved; petioles up to 1 cm long. Flowers in axillary cymes; peduncles up to 1.5 cm long; buds ca 3 mm across, globose to ovoid, tomentose; pedicels up to 1 cm long. Sepals 5 - 12 mm long, linear-oblong, hirsute. Petals yellow, ca 3.5 mm long, oblong or oblong-obovate; glands ca 1.5 x 0.7 mm, oblong. Stamens numerous; filaments ca 4 mm long. Ovary ca 2 mm across, globose, villous; stigma lobed. Drupes 5 - 10 mm across, globose, obscurely 2 - 4-lobed, black, sparsely pubescent.

Fl. Feb. - Aug.; Fr. May - Nov.

Distrib. India: Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Meghalaya, Madhya Pradesh, Maharashtra and the Western Ghats.

Nepal, Bangladesh, Bhutan and Myanmar.

9. *Grewia flavescens* A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 91. 1804. *G. pilosa* auct. non Lam. 1789: Masters in Fl. Brit. India 1: 388. 1874. *G. carpinifolia* sensu Masters in Fl. Brit. India 1: 387. 1874, non A.L. Juss. 1804. *G. commutata* DC., Prodr. 1: 511. 1824.

Hindi: *Chaperandhavi*; Kan.: *Chikkagarakele, Karakele, Sannagarakele*; Or.: *Kulnoi*; Tam.: *Cencadacci*; Tel.: *Cipurutada, Kukkabudda, Madekava, Nalli, Tadikamullu*.

Trees, up to 6 m high. Leaves 1.5 - 13 x 1 - 7 cm, ovate-elliptic, oblong or ovate-oblong, subcordate or rounded at base, usually acute, rarely obtuse at apex, serrate, scabrous above, tomentose beneath, 3-nerved; petioles up to 7 mm long. Flowers in short, axillary cymes; peduncles 1 - 3 together; buds 1.2 - 1.7 cm long, oblong, obtuse, slightly dilated, tomentose; pedicels 2 - 5 mm long. Sepals 1.2 - 1.7 cm long, linear-lanceolate, acute, tomentose outside, glabrous inside. Petals yellow, 5 - 10 mm long, spatulate or linear-oblong, usually 2-fid; glands ca 3 mm long, oblong. Receptacle 1.5 - 2 mm long, obconical, obscurely angular, glabrous, crenulate at apex. Stamens ca 1 cm long. Ovary ca 2 x 0.5 mm, subglobose or ovoid, pilose; stigma 2-fid. Drupes 0.7 - 1 x 0.7 - 1.5 cm, 2 - 4-lobed, globose when not lobed, yellowish brown, stellate-tomentose.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Common in scrub and dry deciduous forests. Delhi, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Tropical Africa.

10. *Grewia gamblei* J. R. Drumm. ex Dunn in Gamble, Fl. Pres. Madras 117. 1915 (Repr. 1: 84. 1957). Fig. 136.

Scandent shrubs. Leaves 4 - 9 x 2 - 4 cm, ovate-elliptic or ovate-oblong, subacute at base, acute or shortly acuminate at apex, rounded or crenate-dentate, scabrid above, tomentose beneath, 3-nerved; petioles up to 9 mm long. Flowers in axillary or leaf-opposed umbellate cymes; peduncles up to 2.5 cm long; buds 1 - 1.4 cm long, oblong or ovoid-oblong, tomentose; pedicels up to 1.3 cm long. Sepals 1 - 1.4 cm long, oblong-lanceolate, tomentose. Petals ca 8 mm long, oblong-lanceolate; glands ca 3 x 2 mm, ovoid. Androgynophore well-developed. Ovary ca 2 mm across, subglobose, hirsute; stigma 4-lobed. Drupes ca 2 cm across, deeply 4-lobed, sparsely pubescent.

*Fl.* April - Aug.; *Fr.* July - Nov.



Fig. 136. *Grewia gamblei* J. Drumm. ex Dunn : a. flowering part of branch; b. fruits.

*Distrib.* India: Fairly common in moist deciduous and evergreen forests. Tamil Nadu and Kerala.

Endemic.

**11. *Grewia helicterifolia*** Wallich ex G. Don, Gen. Hist. 1: 548. 1831. *G. hirsuta* Vahl var. *helicterifolia* (Wallich ex G. Don) Haines, For. Fl. Chota Nagpur 196. 1910. *G. hirsuta* Vahl forma *helicterifolia* (Wallich ex G. Don) Haines, Bot. Bihar & Orissa 90. 1921. *G. polygama* auct. non Roxb. 1832: Masters in Fl. Brit. India 1: 391. 1874. *G. hirsuta* Vahl forma *polygama* sensu Haines, Bot. Bihar & Orissa 90. 1921, non *G. polygama* Roxb. 1832. *G. viminea* Wallich ex Burret in Notizbl. Bot. Gart. Berlin-Dahlem 9: 711. 1926; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950.

Tel.: *Cinnacipuru, Jibilika.*

Small trees or shrubs. Leaves 3 - 15 x 0.5 - 3 cm, oblong-lanceolate, rounded or subacute at base, acute at apex, irregularly serrate, hispid or glabrescent above, densely tomentose beneath, 3-nerved; petioles 3 - 6 mm long. Flowers in axillary, umbellate cymes; peduncles 5 - 17 mm long; buds ca 5 mm across, ovoid-oblong or subglobose, densely pubescent; pedicels up to 8 mm long. Sepals 5 - 6 mm long, oblong-lanceolate, pilose. Petals white, ca 2.5 mm long, oblong, rounded or subacute; glands ca 1.2 mm across, subglobose. Receptacle up to 1 mm long. Stamens 16 - 20; filaments 2 - 3 mm long. Ovary ca 1.5 mm across, globose, pilose; stigma laciniate. Drupes 8 - 20 mm across, obscurely 4-lobed, sometimes 2-lobed, brown, glabrescent or sparsely hirsute.

*Fl.* May - Oct.; *Fr.* Aug. - Feb.

*Distrib.* India: In deciduous and evergreen forests. Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Bangladesh, Pakistan, Myanmar, Sri Lanka and Australia.

**12. *Grewia heterotricha*** Masters in Fl. Brit. India 1: 385. 1874. *G. ritchiei* Masters in Fl. Brit. India 1: 389. 1874. *G. umbellata* auct. non Roxb. 1832: Masters in Fl. Brit. India 1: 385. 1874, p.p. *G. lawsoniana* J.R. Drumm. ex Dunn in Gamble, Fl. Pres. Madras 117. 1915.

Kan.: *Kadujane, Kaluvame*; Tam.: *Accangodi.*

Scandent shrubs. Leaves 5 - 13 x 2.5 - 7.5 cm, elliptic, elliptic-ovate, elliptic-oblong, ovate-lanceolate or ovate-oblong, obtuse or rounded at base, acute to acuminate at apex, crenate-serrate, scabrid on both surfaces, sometimes harshly tomentose beneath, 3-nerved; petioles up to 1.3 cm long. Flowers in axillary or leaf-opposed, umbellate cymes;

peduncles 2.5 - 11 cm long; buds 1.5 - 1.8 cm long, oblong, acute, brown-tomentose; pedicels 1 - 2.5 cm long. Sepals 1.5 - 1.8 cm long, linear-oblong, densely pubescent. Petals white, 7 - 9 mm long, oblong-lanceolate, acute; glands ca 3 mm long. Receptacle ca 9 mm long, villous. Androgynophore up to 1.2 cm long. Ovary ca 1.5 mm across, subglobose, pilose; stigma obscurely 4 - 5-lobed. Drupes 1 - 2 cm across, 4-lobed, fleshy, purple-black, glabrescent.

*Fl.* April - Jan.; *Fr.* Dec. - March.

*Distrib.* India: Common in deciduous and semievergreen forests; Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

13. *Grewia hirsuta* Vahl, *Symb. Bot.* 1: 34. 1790; Masters in *Fl. Brit. India* 1: 391. 1874. *G. roxburghii* G. Don, *Gen. Hist.* 1: 548. 1831, excl. syn. *G. tomentosa* auct. non A.L. Juss. 1804; Naray. & R. Rao in *J. Ind. Bot. Soc.* 29: 179. 1950.

*Asm.*: *Huktapata*; *Hindi*: *Gurusukri, Kukur-bicha*; *Kan.*: *Cikkudippe, Jana, Udippe*; *Kh.*: *Soh-synting*; *Mar.*: *Govli*; *Or.*: *Kulo, Sonaranga*; *Tam.*: *Kalunnu, Tavidu*; *Tel.*: *Bidaracipura, Budda, Cipuru, Cittijana, Nuvalcu, Tellajana*; *Urdu*: *Kakarundehrumi*.

Shrubs, 3 - 6 m high. Leaves 1 - 12 x 0.7 - 4.5 cm, ovate, lanceolate, ovate-lanceolate or ovate-elliptic, subcordate or subobtusate at base, acute or acuminate or sometimes subobtusate or rounded at apex, serrate, pubescent above, densely tomentose beneath, 3(-4)-nerved; petioles up to 7 mm long. Flowers polygamous, in axillary, umbellate cymes; peduncles 1 - 3 together, up to 1 cm long; buds globose; pedicels 2 - 5 mm long. Sepals ca 8 mm long, elliptic-lanceolate, hirsute. Petals white, ca 3 mm long, oblong, rounded; glands ca half the length of petals. Receptacle short, subterete, dilated at apex, glabrous. Stamens more than 40. Ovary ca 2 mm across, globose, densely villous; stigma 5-lobed; lobes fringed. Drupes ca 1.2 cm across, subglobose, obscurely 4-lobed, fleshy, wrinkled, densely hirsute or hispid.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Fairly common in deciduous forests. Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka and Tamil Nadu.

Bangladesh and Sri Lanka.

14. *Grewia indandamanica* J.L. Ellis & L.N. Ray in *Candollea* 46: 341, f.1. 1991.

Shrubs or undershrubs, up to 1 m high; branches greyish, sparsely stellate-hairy when young; bark wrinkled. Leaves up to 7 x 2.8 cm, ovate-elliptic, rounded and cordate at base, shortly acuminate at apex, crenate-serrate, chartaceous to slightly coriaceous; lateral nerves 5, arcuate; reticulations often parallel, nerves and nervules prominent on both surfaces; petioles darkish in colour, ca 5 mm long, pubescent when young; stipules ca 1 mm long. Flowers ca 1 cm long, solitary, axillary; peduncles up to 1 cm long, jointed in the middle and slightly thickened; buds ca 1 cm long, faintly stellate-tomentose; pedicels up to 9 mm long, sparsely puberulous; bracts ca 2 mm long; bracteoles ca 1 mm long. Sepals ca 10 x 15 mm, linear-ovate, spatulate, cucullate, obtuse to truncate at base, puberulous outside, brown and glabrous inside, incurved along margins, stellate-tomentose. Petals ca 0.25 x 1 mm, ovate-oblong, entire, glabrous outside; gland more than 1/3rd the petal, glabrous. Receptacle ca 2 mm long, glabrous in the lower half and stellate-pubescent in the upper half. Stamens numerous; filaments ca 6 mm long, filiform, glabrous; anthers innate, reniform. Ovary globose, densely pubescent, 4-loculed with 1 ovule in each; style ca 6 mm long, slender, 4-angled. Drupes ca 1 cm across, 2-lobed, generally unequally so, globose or slightly flattened or angled, wrinkled, sparsely hairy, woody. Seed 1 in each locule, glabrous.

*Fl. & Fr.* Sept. - Oct.

*Distrib.* India: In stunted evergreen hill-top forests; Andaman & Nicobar Islands (North Andaman Saddle Peak).

15. *Grewia lanceaefolia* Roxb., Fl. Ind. 2: 586. 1824; Dunn in Gamble, Fl. Pres. Madras 118. 1915. *G. diplocarpa* Thwaites, Enum. Pl. Zeyl. 31. 1858; Masters in Fl. Brit. India 1: 390. 1874.

Small trees or shrubs. Leaves 4 - 12.5 x 1.5 - 6 cm, ovate-lanceolate or elliptic-lanceolate, narrowed at base, acuminate at apex, crenate-serrate, glabrous or glabrescent, 3-nerved; petioles 0.2 - 2 cm long. Flowers in axillary cymes; peduncles 1 - 3 cm long; buds 10 - 13 mm long, cylindric; pedicels 1 - 2 cm long. Sepals 1.3 - 1.5 cm long, linear-lanceolate, hirsute. Petals white, ca 3.5 x 2 mm, ovate, obtuse, pilose along margins. Ovary ca 2 mm across, subglobose, hirsute; stigma 4-lobed. Drupes ca 1.4 cm across, distinctly 4-lobed, sparsely pilose.

*Fl.* May - Sept.; *Fr.* July - Feb.

*Distrib.* India: Occasional in moist deciduous and evergreen forests. Tamil Nadu and Kerala.

Pakistan and Bangladesh.

16. *Grewia nervosa* (Lour.) Panigr. in Taxon 34: 702. 1985. *Fallopia nervosa* Lour., Fl. Cochinch. 336. 1790. *Microcos paniculata* L., Sp. Pl. 514. 1753, non *Grewia paniculata*

Roxb. ex DC. 1824. *Grewia microcos* L., Syst. Nat. ed. 12, 2: 602. 1767, nom. illeg.; Masters in Fl. Brit. India 1: 392. 1874.

Asm.: *Pisoli*; Beng.: *Asar*; Kan.: *Abhrangu Biliyabhranga, Majjigesoppu*; Kh.: *Dieng-soh-dhkhar, Dieng-soh-lieng-hadem*; Mal.: *Kotta, Kottaka*; Mani.: *Heitup*; Tam.: *Kadam-bu, Visalam*.

Small trees or shrubs. Leaves 9 - 23 x 4 - 10.5 cm, elliptic-oblong, lanceolate or ovate-lanceolate, more or less oblique, rounded or cordate at base, acute or acuminate at apex, subentire or serrulate, glabrous or pubescent beneath, 3 - 5-nerved; petioles up to 1 cm long. Flowers in axillary and terminal panicles; buds 5 - 7 mm long, obovoid or subglobose, tomentose; pedicels ca 1 mm long. Sepals 5 - 7 mm long, oblong-obovate, tomentose. Petals white or yellow, ca 2 mm long, ovate, acute, pubescent at base; glands ca half the length of petals, sparsely ciliate. Receptacle ca 1 mm long, ciliate at apex. Stamens many; filaments 3 - 4 mm long, hairy at base. Ovary ca 1 mm across, globose, glabrous; stigma 2-fid, minute. Drupes 8 - 10 mm across, globose or subglobose, purple, glabrous, wrinkled.

*Fl.* March - Dec.; *Fr.* June - March.

*Distrib.* India: Common in semievergreen and evergreen forests. West Bengal, Assam, Meghalaya, Tripura, Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands (Andaman Islands).

Tropical Asia.

17. *Grewia oppositifolia* Buch.-Ham. ex D. Don, Prodr. 227. 1825; Masters in Fl. Brit. India 1: 384. 1874. *G. emarginata* Wight & Arn., Prodr. 79. 1834; Masters in Fl. Brit. India 1: 384. 1874. *G. carpinifolia* Roth, Nov. Pl. Sp. 245. 1821, p.p.

Tam.: *Panipidungikai*

Small trees or shrubs. Leaves 3.5 - 9 x 2 - 5.5 cm, ovate, elliptic or elliptic-ovate, obtuse or subcordate at base, abruptly acute or obtuse at apex, double serrate or crenate, stellate-pubescent above, woolly beneath, 3-nerved; petioles 5 - 10 mm long. Flowers in leaf-opposed, axillary or terminal cymes; peduncles up to 4.5 cm long; buds 1 - 1.4 cm long, ovoid-oblong, tomentose; pedicels 1.3 - 2 cm long. Sepals 1.2 - 1.6 cm long, lanceolate, pubescent. Petals white, ca 6 x 2.5 mm, ovate-lanceolate, emarginate; glands ca 3 mm across, rotund. Receptacle ca 7 mm long, 5-angled, glabrous. Androgynophore ca 1.5 mm long, tomentose. Stamens ca 1 cm long. Ovary elongate, strigose; stigma lacinate. Drupes 1 - 1.5 cm across, deeply 4-lobed, black and sparsely pilose when mature.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Common in scrub or dry deciduous forests. Jammu & Kashmir, Himachal Pradesh, Punjab, Karnataka and Tamil Nadu.

Nepal.

**18. *Grewia optiva*** J.R. Drumm. ex Burrett in Notizbl. Bot. Gart. Berlin-Dahlem 9: 962. 1926; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950.

Hindi: *Bhimal, Biul, Biung*; Lep.: *Taglar*.

Small trees; bark grey. Leaves 3 - 16 x 2 - 8 cm, ovate or ovate-elliptic, rounded or obtuse at base, acuminate at apex, crenate-serrate, pubescent, 3-nerved; petioles 5 - 10 mm long. Flowers in axillary or leaf-opposed cymes; peduncles up to 3.5 cm long; buds ca 10 x 6 mm, elliptic, ribbed, tomentose; pedicels up to 2 cm long. Sepals 1 - 1.2 cm long, tomentose. Petals white or pale yellow, 5 - 9 mm long, ovate. Stamens many; filaments 6 - 10 mm long. Ovary ca 2 mm across, ovoid, hirsute; stigma lobed. Drupes 2 - 2.5 cm across, 2 - 4-lobed, greenish black.

*Fl.* April - Sept.; *Fr.* June - Nov.

*Distrib.* India: Common in moist deciduous and evergreen forests. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh and Sikkim.

Pakistan, Nepal and Bhutan.

**19. *Grewia orbiculata*** Rottler in Ges. Naturf. Freunde Berlin Neue Schr. 4: 205. 1803; Masters in Fl. Brit. India 1: 386. 1874. *G. rotundifolia* A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 92. t. 50, f. 3. 1804; Dunn in Gamble, Fl. Pres. Madras 118. 1915. *G. orbicularis* G. Don, Gen. Hist. 1: 550. 1831. Fig. 137.

Hindi: *Kala dhaman*; Kan.: *Jana, Karijana*; Or.: *Mirgachara*; Tam.: *Neyccitti, Udupai, Valukunnu*; Tel.: *Jana, Nulitada*.

Trees, 4 - 8 m high. Leaves 0.6 - 9 x 2 - 7 cm, orbicular, broadly elliptic or obovate, obliquely cordate or subcordate at base, obtuse to acuminate at apex, irregularly crenate-serrate, grey tomentose beneath, 5-nerved; petioles 0.3 - 1.2 cm long. Flowers in axillary or leaf-opposed, umbellate cymes; peduncles up to 3 cm long; buds 6 - 10 mm long, oblong or elliptic-oblong; pedicels 7 - 10 mm long. Sepals 6 - 10 mm long, lanceolate, woolly outside. Petals orange-yellow, 4 - 6 mm long, oblong. Receptacle 0.5 - 1 mm long, angular, glabrous, pubescent at apex. Stamens ca 4 mm long. Ovary ca 2.5 x 1.5 mm, obovoid, furrowed, pilose; stigma 4-lobed; lobes lacinate. Drupes 5 - 8 mm across, subglobose, obscurely 2-lobed, glaucous-tomentose.

*Fl. & Fr.* March - Oct.



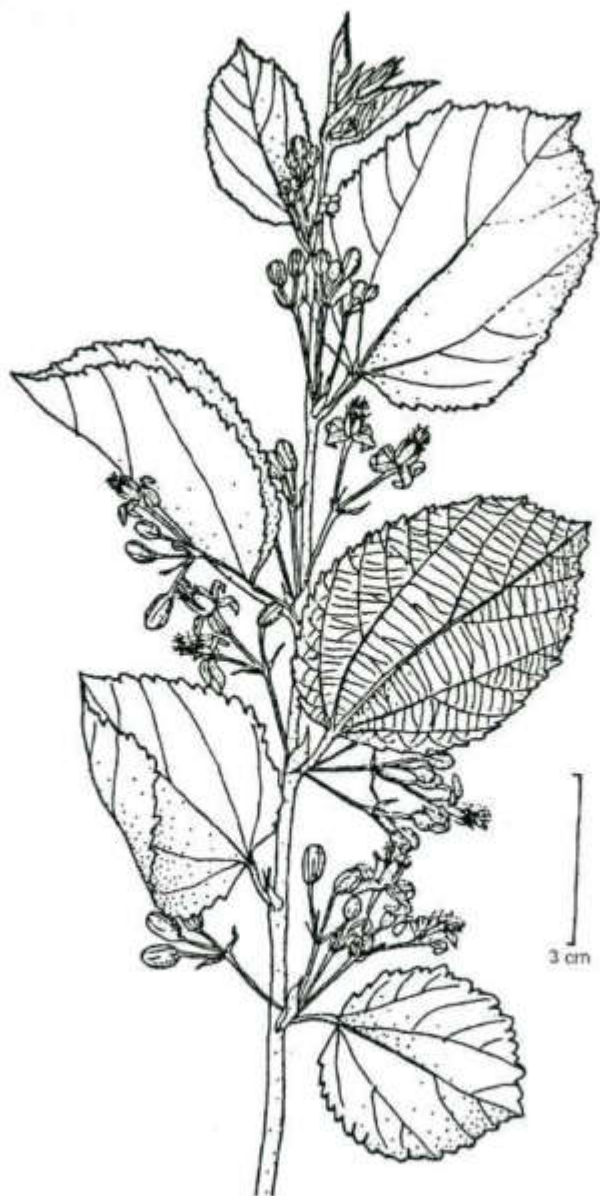


Fig. 137. *Grewia orbiculata* Rottler

*Distrib.* India: Common in dry deciduous forests. Bihar, West Bengal, Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

**20. *Grewia orientalis* L., Sp. Pl. 964. 1753; Masters in Fl. Brit. India 1: 384. 1874, excl. syn. *G. rhamnifolia* Roth. *G. columnaris* Smith in Rees, Cycl. 17: no. 5. 1811; Masters in Fl. Brit. India 1: 383. 1874, incl. syns.**

Kan.: *Udippeballi*; Mal.: *Payippala*; Tam.: *Andikkullai, Panrippidukkan, Tavidilai*; Tel.: *Bodeputika, Peyyarotta, Tegali*.

Small trees or shrubs. Leaves 3.5 - 13 x 1.8 - 6 cm, ovate-elliptic, ovate-lanceolate or elliptic-oblong, obliquely cordate at base, acute or acuminate at apex, crenate-serrate, glabrescent, 3-nerved; petioles up to 7 mm long. Flowers in axillary, 1 - 3-flowered cymes; peduncles up to 5 mm long; buds conical, brown-tomentose; pedicels up to 1 cm long. Sepals 1.5 - 2.5 cm long, oblong, acute, pubescent. Petals white, 5 - 8 mm long, ovate-lanceolate; glands half the length of petals. Receptacle ca 6 mm long, angled, softly villous. Ovary globose, pilose; stigma 5-lobed. Drupes 1 - 1.5 cm across, subglobose, 4-lobed, yellow, bristly with stiff hairs.

*Fl. & Fr.* May - Jan.

*Distrib.* India: In deciduous and semievergreen forests, fairly common. West Bengal, Madhya Pradesh, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Malaysia, Indonesia and Tropical Africa.

**21. *Grewia pandaica* J.R. Drumm. ex Dunn in Gamble, Fl. Pres. Madras 116. 1915 (Repr. 1: 85. 1957).**

Trees, ca 20 m tall. Leaves 2.5 - 15 x 1.5 - 7.5 cm, ovate-oblong, ovate-lanceolate or elliptic-oblong, obtuse or rounded at base, acuminate at apex, irregularly and coarsely crenate, pubescent, 3 - 5-nerved; petioles up to 1 cm long. Flowers in axillary cymes; peduncles up to 1 cm long; buds ca 3.5 mm long, ovoid-oblong; pedicels ca 5 mm long. Sepals ca 3.5 mm long, oblong, acute, tomentose. Petals ca 2.5 x 1 mm, oblong, subacute. Androgynophore short, glabrous. Stamens many; filaments ca 2.5 mm long, glabrous. Ovary ca 1 mm across, globose, villous; stigma 2-fid. Drupes not seen.

*Fl.* May - June.

*Distrib.* India: In evergreen forests of the Western Ghats. Tamil Nadu(Tirunelveli Hills); rare.

Endemic.

22. *Grewia piscatorum* Hance in Ann. Sci. Nat. Bot. 5, 5: 208. 1866; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950.

Small trees or shrubs, up to 3 m high. Leaves 0.6 - 2 x 0.4 - 1.5 cm, rhomboid or rhomboid-obovate, narrowed at base, rounded to obtuse at apex, serrate or dentate, scabrous, 3-nerved; petioles 1 - 1.5 mm long. Flowers in leaf-opposed or rarely axillary, umbellate cymes; peduncles up to 3.5 mm long; buds ca 3 mm across, globose, grooved; pedicels ca 3 mm long. Sepals 4.5 - 5.5 x 1.5 mm, elliptic-lanceolate, acuminate, tomentose. Petals 1.5 - 2 x 0.5 - 0.7 mm, oblong-obovate, glandular inside, glabrous outside. Androgynophore short. Stamens numerous; filaments slender, 1 - 3.5 mm long. Ovary ca 3 mm across, ovoid, ciliate; stigma 2 - 4-lobed. Drupes 5 - 8 mm across, 2 - 4-lobed; lobes oblate, glabrous, 2-seeded.

*Fl.* May - June; *Fr.* Sept. - Nov.

*Distrib.* India: In evergreen forests. Assam and Meghalaya; rare.

China.

23. *Grewia rhamnifolia* Heyne ex Roth, Nov. Pl. Sp. 244. 1821; Dunn in Gamble, Fl. Pres. Madras 117. 1915. *G. orientalis* auct. non L. 1753; Masters in Fl. Brit. India 1: 384. 1874, p.p.

Shrubs, up to 3 m high. Leaves 2 - 14 x 1.5 - 7 cm, ovate, rhomboid-ovate or lanceolate, subcordate or rounded at base, acute or acuminate at apex, crenate-serrate, glabrous, 3-nerved; petioles 4 - 10 mm long. Flowers in axillary or terminal, umbellate cymes; peduncles up to 1.5 cm long; buds 1 - 1.5 cm long, ovoid-oblong or conical, ribbed, tomentose; pedicels 1 - 2.2 cm long. Sepals 1.2 - 2 cm long, lanceolate, woolly tomentose. Petals 5 - 7 mm long, ovate-lanceolate; glands ca 3 mm long. Receptacle ca 1 mm long, angled, glabrous. Androgynophore ca 2 mm long, grooved, woolly. Stamens many; filaments 6 - 8 mm long. Ovary 1 - 1.5 mm across, globose, pilose; stigma 4-lobed. Drupes 1.2 - 1.5 cm across, subglobose, obscurely 2 - 4-lobed, yellow, brown-tomentose.

*Fl.* May - Sept.; *Fr.* Aug. - Feb.

*Distrib.* India: In dry deciduous forests, fairly common. Bihar, Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh and Tamil Nadu.

Sri Lanka.

24. *Grewia rothii* DC., Prodr. 1: 509. 1824; Dunn in Gamble, Fl. Pres. Madras 118. 1915. *G. excelsa* auct. non Vahl 1790; Masters in Fl. Brit. India 1: 385. 1874, excl. syns.

Or.: *Honolopoto, Kulo, Miri-chara, Phulari*; Tam.: *Angolam*; Tel.: *Cipuru, Jana, Jibilike, Peddacipuru, Putiki*.

Small trees or shrubs. Leaves 3 - 16.5 x 1 - 5.5 cm, ovate-oblong or ovate-lanceolate, obtuse or subacute at base, acute or acuminate at apex, serrulate, densely tomentose beneath, 3 - 4-nerved; petioles ca 5 mm long. Flowers in axillary, clustered cymes; peduncles 1.5 - 3.5 cm long; buds 3.5 - 5 mm across, subglobose, tomentose; pedicels 8 - 10 mm long. Sepals ca 6 mm long, elliptic-oblong or elliptic-lanceolate, tomentose. Petals ca 3 mm long, ovate-lanceolate; glands ca 1 mm long, elliptic. Stamens many; filaments 3 - 4 mm long, glabrous. Ovary ca 1.5 mm across, globose, tomentose; stigma 4-lobed. Drupes ca 5 mm across, globose, tomentose, edible.

*Fl.* April - Oct.; *Fr.* June - Dec.

*Distrib.* India: Occasional in deciduous and evergreen forests. Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamil Nadu.

Bangladesh and Tropical Africa.

25. *Grewia sapida* Roxb. ex DC., Prodr. 1: 512. 1824; Masters in Fl. Brit. India 1: 387. 1874. *G. pumila* Buch.-Ham. ex D. Don, Prodr. 227. 1825.

Asm.: *Chuhura, Thaura-guti*

Shrubs. Leaves 1.5 - 10 x 1 - 7.5 cm, ovate, broadly elliptic or suborbicular, subacute or rounded at base and apex, coarsely double-serrate, scabrid above, tomentose beneath, 5 - 7-nerved; petioles up to 6 mm long. Flowers in axillary cymes; peduncles slender, 2 - 3 cm long; buds 6 - 8 x 5 mm, obovoid or oblong-obovoid, tomentose; pedicels 7 - 10 mm long. Sepals 8 - 12 mm long, oblong or oblanceolate, tomentose. Petals yellow. Receptacle glabrescent. Stamens many; filaments 5 - 6 mm long, glabrous. Ovary ca 3 x 1.5 mm, elliptic-oblong, hirsute; stigma lobed. Drupes ca 8 mm across, subglobose or broadly obovoid, obscurely 2-lobed, hirsute.

*Fl.* Feb. - June; *Fr.* April - Sept.

*Distrib.* India: Common in deciduous and evergreen forests. Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Tripura, Orissa and Andhra Pradesh.

Pakistan, Nepal, Bhutan and Myanmar.

26. *Grewia sclerophylla* Roxb. ex G. Don, Gen. Hist. 1: 550. 1831; Prain, Bengal Pl. 283. 1903. *G. scabrophylla* Roxb., Fl. Ind. 2: 584. 1832; Masters in Fl. Brit. India 1: 387. 1874.

Beng.: *Phalsa*; Lep.: *Taglar*

Shrubs. Leaves 7 - 19 x 5 - 12.5 cm, rotund-ovate, obovate or obcordate, rounded or subacute at base, rounded, emarginate or acuminate at apex, serrate, tomentose, 3 - 5-nerved; petioles ca 1.2 cm long. Flowers in axillary cymes; peduncles 2 - 8 mm long; buds 1 - 1.3 cm long, ovoid-oblong, ribbed, tomentose; pedicels 0.5 - 1.2 cm long. Sepals 1.2 - 1.5 cm long, lanceolate, densely pubescent outside. Petals white, ca 6 x 2.2 mm, oblong-obovate, obtuse, notched at apex. Receptacle short, hispid. Androgynophore ca 4 mm long, glabrous excepting at apex. Ovary ca 2 x 4 mm, depressed-globose, hirsute; stigma 2-lobed. Drupes 1.2 - 1.8 cm across, globose, stellate-tomentose.

Fl. April - Sept.; Fr. June - Jan.

*Distrib.* India: Common in deciduous and evergreen forests. Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam and Orissa.

Bangladesh and Myanmar.

27. *Grewia serrulata* DC., Prodr. 1: 510. 1824; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950. *G. laevigata* auct. non Vahl 1790: Masters in Fl. Brit. India 1: 381. 1874, incl. syns. *G. multiflora* auct. non A.L. Juss. 1804: Masters in Fl. Brit. India 1: 388. 1874, incl. syn. *G. sepiaria* G. Don 1831. *G. disperma* auct. non Rottler ex Sprengel 1825: Dunn in Gamble, Fl. Pres. Madras 118. 1915. *G. glabra* Blume, Bijdr. 115. 1825; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950. *G. barberi* J.R. Drumm. ex Dunn in Gamble, Fl. Pres. Madras 118. 1915.

Fig. 138.

Asm.: *Kukur-huta*; Beng.: *Pani-sara*; Hindi: *Kath bimla*, *Pansaura*; Kan.: *Javani-gale*, *Karagele*, *Murige*; Kh.: *Dieng-tiewser*, *Dieng-tyrbhong*; Nep.: *Chiple*, *Kuail*; Or.: *Kath bimla*, *Kulokathri*; Tam.: *Pirunnu*, *Thavannu*, *Uduppai*; Tel.: *Allipayaru*, *Kotirike*, *Potireke*.

Trees or shrubs. Leaves 1 - 18 x 1.5 - 7 cm, lanceolate, ovate-lanceolate, elliptic-ovate or obovate, rounded or narrowed at base, acute or acuminate, sometimes obtuse at apex, sharply serrate, glabrous or glabrescent, 3-nerved; petioles up to 1.5 cm long. Flowers in axillary, umbellate cymes; peduncles 1 - 2 together, 1.5 - 2.5 cm long; buds 8 - 15 x 5 - 8 mm, ovoid, ovoid-oblong or subglobose, tomentose; pedicels up to 2.5 cm long. Sepals 9 - 16 x 3 - 5 mm, oblong or lanceolate, tomentose. Petals greenish white, ca 3.5 x 1.5 mm, ovate or obovate, usually notched, sometimes acuminate at apex; glands slightly shorter than petals. Receptacle 2 - 3 mm long, grooved, pubescent in upper half. Stamens numerous; filaments 4 - 5 mm long, glabrous. Ovary ca 2.5 x 1.5 mm, ovoid,



Fig. 138. *Grewia serrulata* DC.

pilose; stigma 5-lobed; lobes laciniate. Drupes 5 - 15 mm across, 2-lobed, globose when not lobed, dry black, glabrous when old.

*Fl.* April - Dec.; *Fr.* June - March.

*Distrib.* India: Common in moist deciduous and evergreen forests. Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Meghalaya, Tripura, Orissa, Madhya Pradesh, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands (Andaman Islands).

Pakistan, Nepal, Bhutan, Myanmar, Indo-china, Australia, Malesia and Tropical Africa.

**28. *Grewia tenax*** (Forsskal) Fiori in Agric. Colon. 5: Suppl. 23. 1912; Naray. & R. Rao in J. Ind. Bot. Soc. 29: 179. 1950. *Chadara tenax* Forsskal, Fl. Aegypt.-Arab. 105. 1775. *Grewia populifolia* Vahl, Symb. Bot. 1: 33. 1790; Masters in Fl. Brit. India 1: 385. 1874. *G. betulaeifolia* A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 92. t. 2. 1804; Dunn in Gamble, Fl. Pres. Madras 117. 1915.

Fig. 139.

Tam.: *Accu*; Tel.: *Gundukadira, Kadadarai, Kattokolupu*.

Shrubs, 2 - 3 m high. Leaves 0.5 - 4 x 0.5 - 2.5 cm, broadly ovate, rotund or elliptic, rounded or obtuse at base, obtuse at apex, coarsely dentate, scabrid above, glabrous or sparsely hairy beneath, 3-nerved; petioles up to 1 cm long. Flowers in axillary or leaf-opposed cymes; peduncles up to 1.5 cm long; buds 8 - 10 mm long, oblong, tomentose; pedicels up to 5 mm long. Sepals 1.2 - 1.8 cm long, linear-oblong, tomentose outside. Petals white, ca 6.5 mm long, linear-oblong, obtuse, usually notched at apex, ciliate at base; glands ca 2 mm long. Receptacle ca 2.5 mm long, ribbed, glabrous, pilose at apex. Androgynophore ca 0.5 mm long. Stamens many; filaments ca 5 mm long. Ovary ca 2.5 mm across, subglobose, 4-lobed, hirsute; stigma 4 - 5-lobed. Drupes 6 - 10 mm across, 2-parted, each half didymous, orange-yellow, glossy, glabrescent.

*Fl. & Fr.* May - Feb.

*Distrib.* India: Occasional in scrub jungles. Jammu & Kashmir, Himachal Pradesh, Delhi, Assam, Rajasthan, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Pakistan, Sri Lanka, Mauritius, Afghanistan, W. Asia and Tropical Africa.

**29. *Grewia tiliifolia*** Vahl, Symb. Bot. 1: 35. 1790; Masters in Fl. Brit. India 1: 386. 1874, '*tiliaefolia*'. *G. arborea* Roth, Nov. Pl. Sp. 24. 1821. *G. leptopetala* Brandis, Indian Trees 180. 1906. *G. tiliifolia* Vahl var. *leptopetala* (Brandis) T. Cooke, Fl. Pres. Bombay

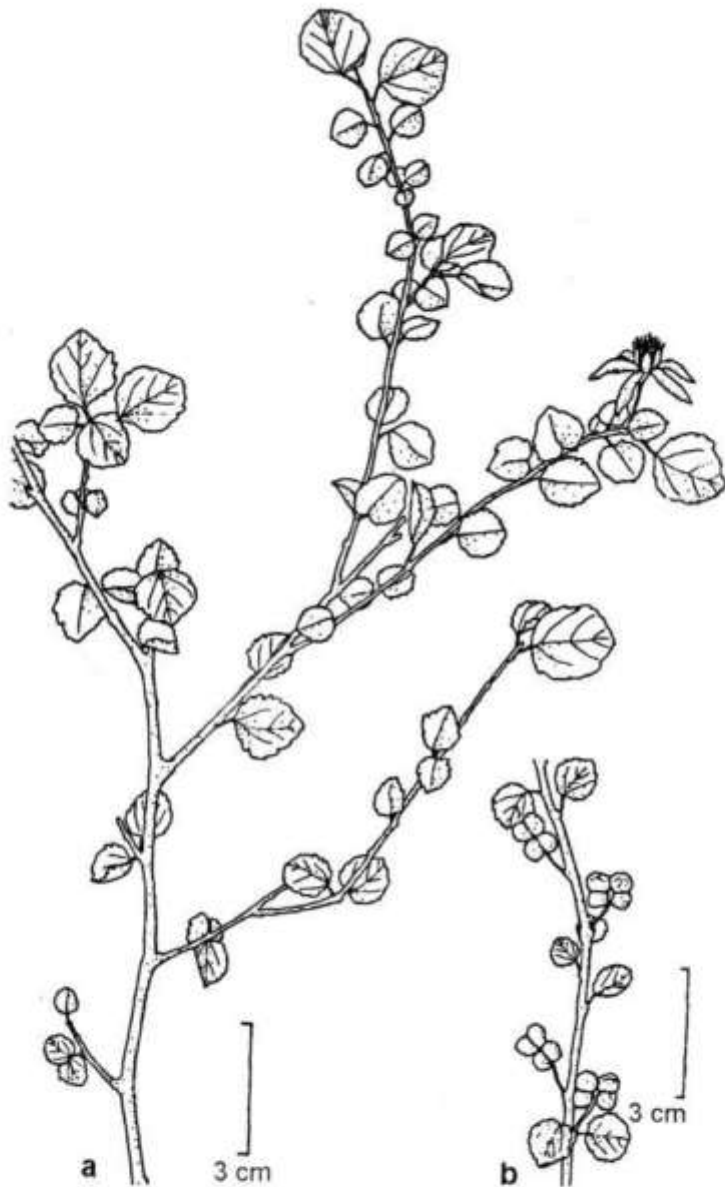


Fig. 139. *Grewia tenax* (Forsskal) Fiori : a. flowering part of branch; b. fruiting part of branch.



142. 1901. *G. tiliifolia* Vahl var. *argentea* Burret in Notizbl. Bot. Gart. Berlin-Dahlem 9: 659. 1926; Naray. & R. Rao in J. Indian Bot. Soc. 29: 179. 1950. **Fig. 140.**

Hindi: *Dhamin, Jujhana, Phalsa*; Kan.: *Buttele, Jana, Tadacali, Thadsal*; Mal.: *Catacci, Chadicha*; Or.: *Bhangia, Dhaman, Dhamono*; Sans.: *Dhanuvrikhsha, Dharmanna*; Tam.: *Cadacci, Sadachi, Thadachi, Unnu*; Tel.: *Charachi, Jana, Nulijana, Tada, Tada-jana*.

Trees, 6 - 15 m tall; bark peeling off. Leaves 1.7 - 36 x 1 - 24 cm, elliptic, elliptic-ovate, ovate or ovate-rotund, obliquely cordate at base, acuminate or rounded at apex, serrate to crenate-serrate, glabrescent above, sparsely pubescent or tomentose beneath, 5-nerved; petioles up to 4 cm long. Flowers 3 - 6, in axillary cymes; peduncles 1 - 2 cm long; buds 3 - 6 mm long, subglobose or obovoid-oblong, tomentose; pedicels 4 - 13 mm long. Sepals 5 - 8 x 3 mm, elliptic or lanceolate, subacute, tomentose outside. Petals yellow, 3 - 4.5 x 1.5 mm, elliptic-oblong or spatulate, obtuse, notched at apex, sparsely ciliate at base; glands ca 0.5 mm long. Receptacle minute, glabrous excepting at apex. Stamens many; filaments ca 4 mm long. Ovary ca 1.2 mm across, globose, sparsely hirsute; stigma 4-lobed. Drupes 2.5 - 5 x 7 - 10 mm, black, distinctly 2-lobed; lobes globose, sparsely hirsute.

*Fl.* Jan. - Sept.; *Fr.* May - Oct.

*Distrib.* India: Common in moist and dry deciduous, and semievergreen forests, up to 1400 m. Himachal Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka and Tropical E. Africa.

30. *Grewia umbellifera* Beddome, For. Man. Bot. 37. 1871; Masters in Fl. Brit. India 1: 393. 1874, in adnota.

Kan.: *Bilisuri*

Climbing shrubs. Leaves 9 - 15 x 6 - 8.5 cm, elliptic or elliptic-ovate, rounded or subacute at base, acute or acuminate at apex, glandular-serrate, sparsely pubescent, glabrous when old, 3-nerved; petioles up to 1 cm long. Flowers few, in axillary or terminal, umbellate cymes; peduncles up to 3 cm long; buds 8 - 15 x 2.5 - 3 mm, narrowly conical, grooved, pubescent; pedicels 1 - 2 cm long. Sepals 1.3 - 1.8 cm long, narrowly lanceolate, acute, pubescent. Petals white, 7 - 10 mm long, ovate-oblong, subacute; glands ca 4 mm long, oblong. Receptacle ca 4 mm long, pubescent throughout. Androgynophore cylindrical, tomentose. Stamens many. Ovary ca 1.5 mm across, subglobose, hirsute; stigma 5-lobed. Drupes 1 - 2 cm across, distinctly 4-lobed, fleshy, purple, subglabrous.

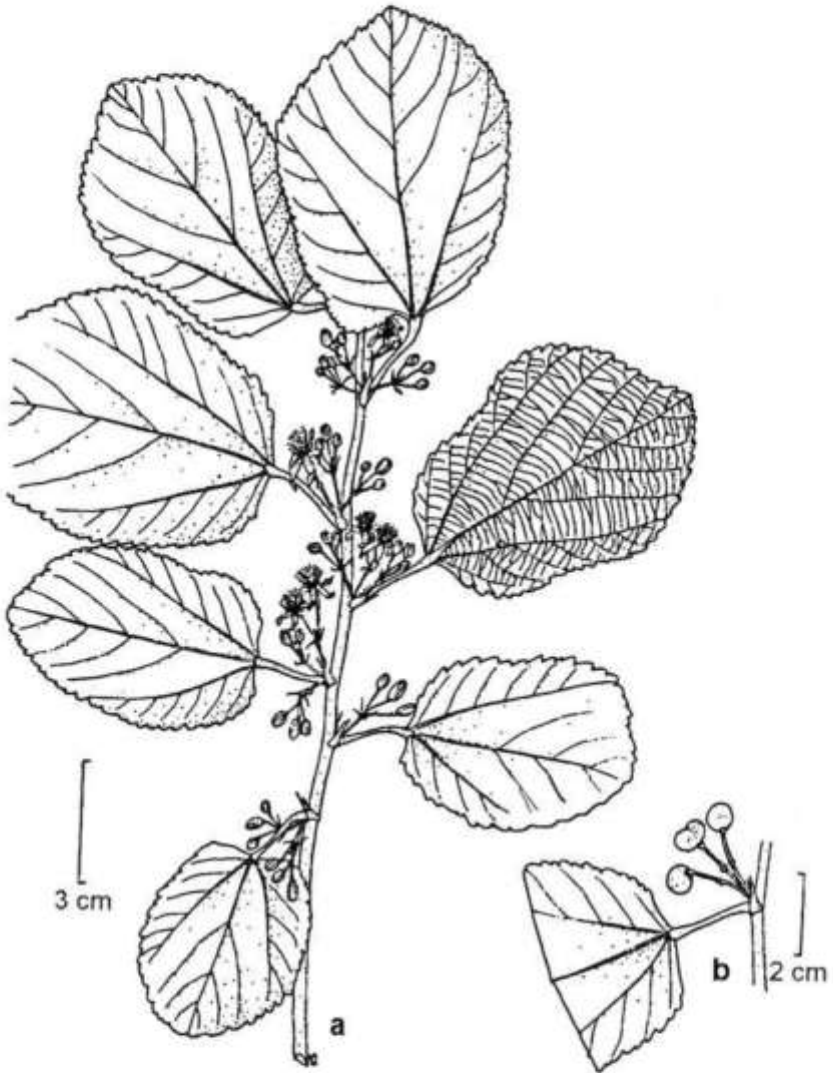


Fig. 140. *Grewia tiliifolia* Vahl : a. flowering part of branch; b. fruits and a leaf.

*Fl.* April - Nov.; *Fr.* June - Feb.

*Distrib.* India: Common in moist deciduous and semievergreen forests, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

31. *Grewia villosa* Willd. in Ges. Naturf. Freunde Berlin Neue Schr. 4: 205. 1803, in anmerkungen; Masters in Fl. Brit. India 1: 388. 1874. *G. orbiculata* G. Don, Gen. Hist. 1: 551. 1831. *G. corylifolia* A. Rich. in Guillemin *et al.*, Fl. Seneg. Tent. 95. t. 20. 1831. **Fig. 141.**

Guj.: *Padekhado, Parekhado*; Kan.: *Buttigaragale, Garakale, Sunnudippe*; Mar.: *Kharnati*; Tam.: *Kullai*; Tel.: *Banta, Cenula*.

Small trees or shrubs, 3 - 5 m high. Leaves 3 - 15 x 3 - 12 cm, rotund-ovate, orbicular or cordate, cordate at base, rounded to abruptly acuminate at apex, crenate or serrulate, scabrous above, villous beneath, 5-nerved; petioles up to 4 cm long. Flowers in axillary or leaf-opposed cymes; peduncles 1 - 5 mm long; buds ca 10 x 3 mm, ellipsoid, pilose; pedicels 2 - 5 mm long. Sepals ca 1 cm long, lanceolate, pilose. Petals dull yellow, ca 1 mm long, spatulate, emarginate; glands ca 1.5 mm long, obovoid. Receptacle ca 1 mm long, angular, glabrous, ciliate along toothed-rim. Stamens many; filaments ca 5 mm long. Ovary ca 2 mm across, subglobose, densely villous; stigma laciniate. Drupes 1.2 - 1.5 cm across, subglobose, obscurely 4-lobed, yellowish red, villous.

*FL. & Fr.* Almost throughout the year.

*Distrib.* India: Occasional in scrub and dry deciduous forests. Punjab, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan, W. Asia and Tropical Africa.

### 7. *Trichospermum* Blume

Trees, stellate-hairy. Leaves simple, alternate, crenate-serrate, strongly 3-nerved at base; axils of primary nerves often bearded beneath; stipules caducous. Cymes axillary and terminal, 2- or 3-chotomous. Flowers bisexual and unisexual; pedicels often involucrate with small bracts. Sepals 5, free. Petals 5, free, often glandular at base. Stamens numerous, free, on a crenate disc; anthers suborbicular or oblong, versatile. Ovary pilose, 1- or 2-loculed; ovules 2-seriate, many in each locule. Capsules much compressed on both sides contrary to septum, usually acute or mucronate at tip, dehiscing loculicidally; valves persistently united at base. Seeds oblong, densely pilose on margins.

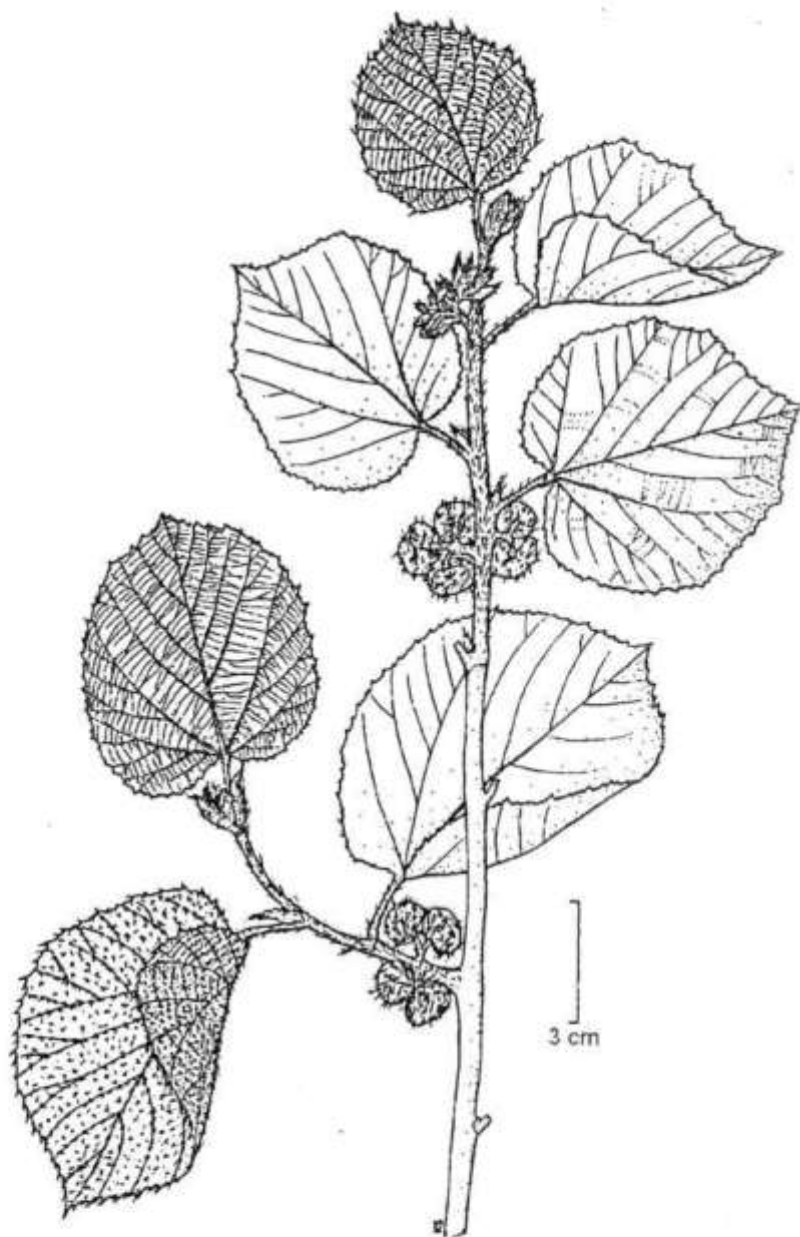


Fig. 141. *Grewia villosa* Willd.

Tropical America and Asia, ca 25 species; one in India.

*Trichospermum javanicum* Blume, Bijdr. 57. 1825. *Bixagrewia nicobarica* Kurz in J. Bot. 13: 325. t. 169. 1875. *Trichospermum kurzii* King in J. Asiat. Soc. Beng. 60: 119. 1891. *Colona javanica* auct. non (Blume) Burret 1926: Balakr. & M.K.V. Rao in Jain & R.R. Rao, Assessm. Threat. Pl. India 200. 1983.

Trees, up to 20 m tall; young parts sparsely stellate-tomentose. Leaves 6 - 23 x 2.5 - 12 cm, ovate to ovate-oblong, rounded or subcordate at base, acute at apex, serrulate, glabrescent above, sparsely and minutely stellate-puberulous beneath, strongly 3-nerved; petioles 1 - 2.5 cm long, glabrescent to sparsely stellate-puberulous. Flowers in axillary, many-flowered cymes; peduncles 1 - 7.5 cm long; buds ovate; pedicels up to 1 cm long. Sepals 1 - 1.5 cm long, oblong, stellate-pubescent on both surfaces, green, red-spotted or not. Petals pale green, ca 1 cm long, oblong-spathulate, pubescent on both surfaces. Ovary globose, hairy. Capsules 1 - 2 x 2.5 - 3 cm, orbicular-reniform, compressed contrary to septum, often shortly acuminate at apex, glabrescent. Seeds oblong, subtruncate at both sides, pilose.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Andaman & Nicobar Islands (Camorta Islands in the Nicobars).

Malay Peninsula, Thailand and Indonesia.

*Notes.* It was included by Balakrishnan & Rao (*l.c.*) based on the report of Kurz (J. Bot. 13: 325. t. 169. 1875). It has not been re-collected since Kurz.

## 8. *Triumfetta* L.

(*Bartramia* L.)

Shrubs, undershrubs or herbs, stellate-hairy. Leaves simple, alternate, petiolate, entire or 3 - 5-lobed, serrate, basal serrations mostly glandular; stipules persistent, rarely fugaceous. Inflorescences axillary or leaf-opposed, dense fascicles of 3-flowered dichasia. Flowers pedicellate, 5-merous, bisexual or female. Sepals 5, free, often hooded, valvate. Petals 5, free, mostly ciliate and pitted-glandular at base, rarely petals absent. Stamens many, or rarely twice as many as sepals, free, inserted above 5-angular receptacle; anthers dehiscing lengthwise. Carpels 2 - 5, syncarpous; ovary usually with uncinat hairs, 2 - 5-loculed; locules 2-ovuled; style filiform; stigma 2 - 5-lobed. Capsules indehiscent or separating into cocci, echinate or setose, rarely tuberculate all over, bristles often hooked at apex, 2 - 5-loculed; locules 1- or 2-seeded. Seeds ovoid to obovoid, endospermous; embryo straight; cotyledons flat, foliaceous.

Tropical and subtropical regions of the world; 160 species; 8 in India.

## KEY TO THE SPECIES

- |  |                           |
|--|---------------------------|
| 1a. Woody creepers   | 5. <i>T. repens</i>       |
| b. Erect shrubs, undershrubs or herbs  | 2                         |
| 2a. Stems glabrous except for an alternating line of hairs on internodes; capsules and spines on capsules glabrous | 1. <i>T. annua</i>        |
| b. Stems hairy all around; capsules pubescent or tomentose; spines on capsules glabrous or hairy                   | 3                         |
| 3a. Spines glabrous  | 6. <i>T. rhomboidea</i>   |
| b. Spines pubescent or tomentose   | 4                         |
| 4a. Spines straight  | 5                         |
| b. Spines uncinata   | 6                         |
| 5a. Leaves ovate-oblong; stamens 10 - 12; capsules more than 10 mm across  | 2. <i>T. obliqua</i>      |
| b. Leaves ovate-lanceolate to orbicular; stamens 5 - 7; capsules less than 10 mm across                            | 8. <i>T. tomentosa</i>    |
| 6a. Capsules more than 6 mm across   | 4. <i>T. pilosa</i>       |
| b. Capsules up to 5 mm across  | 7                         |
| 7a. Lower leaves rhomboid-ovate, 3-lobed or entire; stamens 5 - 10; spines with a line of hairs                    | 3. <i>T. pentandra</i>    |
| b. Leaves obovate to orbicular; stamens 10 - 25; spines pubescent all over   | 7. <i>T. rotundifolia</i> |

**1. *Triumfetta annua* L.**, Mant. Pl. 73. 1767; Masters in Fl. Brit. India 1: 396. 1874. *T. triclada* Link, Enum. Hort. Berol. Alt. 2: 5. 1822. *T. trichoclada* DC., Prodr. 1: 507. 1824. *T. schimperi* Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 83. 1847.

Herbs, erect, up to 1 m high, nearly glabrous; stems glabrous except for a single line of hairs on one side alternating at each node. Leaves 5.5 - 12 x 2 - 5.5 cm, ovate-lanceolate, cuneate at base, acute to acuminate at apex, irregularly serrate, sparsely hairy on both surfaces, 3 - 5-nerved; petioles up to 4 cm long, hairy on upper surface; stipules ca 5 mm long, subulate, hairy. Cymes leaf-opposed, 3-flowered, pedunculate. Flowers ca 8 mm across; pedicels ca 2 mm long. Sepals ca 4 mm long, lorate, cucullate, awned. Petals orange, nearly as long as sepals, spatulate, obtuse. Stamens 10. Carpels 4; ovary globose, hairy, 4-loculed; style as long as stamens; stigma 4-lobed. Capsules 5 - 8 mm across, globose, glabrous, covered with conical, uncinata, 4 - 5 mm long, glabrous spines.

*Fl. & Fr.* Aug. - March.

*Distrib.* India: Almost throughout.

Malesia to Tropical Africa.

**2. *Triumfetta obliqua* Roth**, Nov. Pl. Sp. 224. 1821. *T. cana* Blume, Bijdr. 116. 1825; Masters in Fl. Brit. India 1: 396. 1874.

Herbs, suffruticose, 0.5 - 1.5 m high, densely stellate-tomentose. Leaves 2 - 12 x 1 - 5 cm, ovate-oblong, subcordate to subobtusate at base, acuminate at apex, unequally serrate, especially densely stellate-tomentose beneath, 3 - 5-nerved; petioles up to 3 cm long, tomentose; stipules ca 4 mm long, subulate, hairy. Flowers in dense, axillary and leaf-opposed fascicles. Sepals 5 - 6 mm long, awned, tomentose. Petals orange or yellowish, 5 - 7 mm long, oblong-spathulate. Stamens 10 - 12. Ovary oblong. Capsules 12 - 15 mm across, oblong to globose, densely pubescent; spines ca 5 mm long, hispid with a transparent, straight point. Seeds oblong-ovate, black.

*Fl. & Fr.* June - Dec.

*Distrib.* India: Assam, Meghalaya, Nagaland and Manipur.

Bangladesh, Malesia and Hongkong.

**3. *Triumfetta pentandra*** A. Rich. in Guillemin *et al.*, Fl. Seneg. Tent. 93. t. 19. 1831. *T. neglecta* Wight & Arn., Prodr. 75. 1834; Masters in Fl. Brit. India 1: 396. 1874. *T. rhomboidea* Jacq. var. *pentandra* (A. Rich.) J.L. Ellis in Bull. Bot. Surv. India 24: 209. 1983.

Herbs, annual, erect, much-branched, 20 - 60 cm high; stems stellate-hairy. Leaves 3 - 10 x 3 - 8 cm; basal leaves rhomboid-ovate, entire or palmately 3-lobed; upper ones ovate-lanceolate, unlobed, cuneate at base, acute or acuminate at apex, crenate-serrate, simple-hairy above, stellate-hairy beneath, 3 - 5-nerved; petioles up to 5.5 cm long, densely pubescent; stipules 5 - 6 mm long, subulate, ciliate and hispid-glandular along margins. Flowers in leaf-opposed, shortly pedunculate, cymose clusters forming interrupted racemes, shortly pedicellate, 4 - 5 mm across; bracts 2 - 3 mm long, linear, hairy. Sepals ca 2.5 mm long, lorate, cucullate, awned, stellate-pubescent. Petals yellow, as long as sepals, spathulate, obtuse, pubescent at base. Stamens 5 (rarely up to 10). Carpels 2; ovary ovoid, pubescent, 2-loculed; stigma 2-fid. Capsules 4.5 - 6 x 3 - 4 mm, ovoid to oblong-ellipsoid, tomentose; spines uncinat, 1.5 - 2 mm long with a line of spreading hairs on upper side. Seeds 4, somewhat trigonous, smooth, brown.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Almost throughout except N.E. region.

Pakistan, Sri Lanka, Taiwan, Cape Verde Islands and Africa.

**4. *Triumfetta pilosa*** Roth, Nov. Pl. Sp. 223. 1821; Masters in Fl. Brit. India 1: 394. 1874. *T. oblongata* Link, Enum. Hort. Berol. Alt. 2: 5. 1822. *T. guazumaefolia* Bojer in Rapp. Annuel Trav. Soc. Hist. Nat. Ile Maurice 12: 18. 1842 & in Ann. Sci. Nat. Bot. 2, 20: 101. 1843.

Kh.: *Soh-bythrid*; Tam.: *Masukanni*; Tel.: *Tigebenda*

Herbs, basally woody, erect, ca 1.5 m high, hispid with bulbous-based stellate or simple hairs. Leaves 5 - 13.5 x 1.5 - 7.5 cm, ovate-oblong to elliptic-lanceolate, cordate or rounded at base, acute or acuminate at apex, coarsely serrate, stellate-hairy, 3 - 5-nerved; petioles 1 - 3 (-5) cm long, pilose; stipules ca 8 mm long, linear-lanceolate, pilose. Flowers in many-flowered, axillary or leaf-opposed, shortly pedunculate cymes, ca 1 cm across; pedicels 2 - 3 mm long, hairy. Sepals 9 - 10 mm long, lorate, apiculate, hairy. Petals yellow, 7 - 8 mm long, narrowly oblanceolate, obtuse, dentate at apex, ciliate at base. Stamens 10. Carpels 4; ovary globose, hairy, 4-loculed; style subulate; stigma 4-lobed. Capsules 6 - 10 mm across, subglobose, tomentose; spines 6 - 8 mm long, uncinatate with patent hairs around except the extreme apical region. Seeds ca 2.5 mm long, planoconvex, dark brown to black, shiny.

*Fl. & Fr.* Almost throughout the year.

*Distrib.* India: Almost throughout.

Sri Lanka, Nepal, Bhutan, China, Malay Peninsula and Tropical Africa.

5. *Triumfetta repens* (Blume) Merr. & Rolfe in Philipp. J. Sci. 3: 111. 1908; Dagar & T. Chakrab. in Ind. J. For. 10: 68. 1987. *Porpa repens* Blume, Bijdr. 118. 1825.

Woody creepers, profusely rooting; stems stellate-hairy. Leaves up to 3 x 2 cm, elliptic to ovate-orbicular, broadly rounded to acute at base, rounded-obtuse at apex, shallowly dentate-serrate, chartaceous to coriaceous, densely stellate-pubescent on both surfaces; larger leaves 3 - 5-lobed, blackish green when dry; petioles 2 - 13 mm long, densely stellate-hairy. Flowers in 2 - 3-flowered, leaf-opposed cymes; peduncles 5 - 10 mm long, stellate-hairy; pedicels stellate-hairy. Sepals 5 - 6, 8 - 10 mm long, linear, recurved. Petals yellow, 5 - 6, 6 - 7 mm long, spatulate-oblanceolate, bearded near the base. Stamens many (28 - 36). Ovary ca 1.5 mm across; style ca 7 mm long, filiform, 3 - 4-fid. Capsules 1 - 1.5 cm across, globose, densely echinate, glabrous, black or dark brown when dry, 3 - 4-loculed; spines straight, glabrous.

*Fl.* April - May; *Fr.* Oct. - Nov.

*Distrib.* India: Occurs on sandy beaches. Andaman & Nicobar Islands (Car and Great Nicobar Islands).

Thailand, Cambodia, Malesia, N.E. Australia and Madagascar.

6. *Triumfetta rhomboidea* Jacq., Enum. Syst. Pl. 22. 1760; Masters in Fl. Brit. India 1: 395. 1874. *T. bartramia* L., Syst. Nat. ed. 10, 2: 1044. 1759, nom. illeg. *Bartramia indica* L., Sp. Pl. 378. 1753, non *Triumfetta indica* Lam. 1792. *T. angulata* Lam., Encycl. 3: 421.



1792; Wight & Arn., Prodr. 74. 1834. *T. trilocularis* Roxb., Fl. Ind. 2: 462. 1832. *T. tungarensis* Billore in J. Econ. Tax. Bot. 3: 621. 1982.

Asm.: *Akra*; Beng.: *Ban-okra*; Guj.: *Thipato*; Hindi: *Chikti, Chiryari*; Kan.: *Kadubende*; Kh.: *Soh-byr-thit*; Mar.: *Thinjhira*; Nep.: *Bolnghas*; Or.: *Bojoromulu, Jotojit*; Sans.: *Thinjiharita*; Tam.: *Ottarai, Ottupullu, Paramutti*; Tel.: *Ciruccitrika, Tatturu-benda*.

Herbs or undershrubs, erect, much-branched, 0.5 - 1 m (or more) high, pubescent. Leaves 3 - 9.5 x 2.5 - 8 cm, generally rhomboid-ovate, palmately 3-lobed or entire, rounded to cuneate at base, acute or acuminate at apex, irregularly serrate, stellate-pubescent to glabrescent, 3 - 7-nerved; petioles up to 5 cm long, pubescent; stipules 3 - 4 mm long, subulate, pubescent. Flowers in terminal or leaf-opposed cymes, shortly pedicellate, 5 - 6 mm across; buds oblong, club-shaped. Sepals ca 5 mm long, oblong, apiculate, hairy. Petals yellow, equal to or a little shorter than sepals, oblong-obovate, hairy at base. Stamens 8 - 15. Carpels 2 - 3; ovary subglobose, hairy, 2 - 3-loculed; style subulate; stigma 2 - 3-lobed. Capsules 3.5 - 4 mm across, globose or subglobose, albido-tomentose; spines 1.5 - 2 mm long, uncinat, glabrous.

*Fl. & Fr.* Aug. - Jan.

*Distrib.* India: Throughout.

Pantropical.

*Notes.* M.Almeida (*J. Econ. Tax. Bot.* 12: 498. 1988) and Koshy (*Ibid.* 12: 400. 1988) independently reduced *T. tungarensis* Billore to a synonym of *T. rhomboidea* Jacq.

7. *Triumfetta rotundifolia* Lam., Encycl. 3: 421. 1792; Masters in Fl. Brit. India 1: 395. 1874. *T. suborbiculata* DC., Prodr. 1: 506. 1824.

Hindi: *Lapta, Mandhi*; Or.: *Jotyā*; Tam.: *Adayoti*; Tel.: *Bankitutturi*.

Herbs, suffruticose, up to 50 cm high with spreading branches; young branches densely hairy, roughish. Leaves 1 - 4.2 x 1 - 4.2 cm, obovate to orbicular, obtuse at base, acute at apex, irregularly serrate, coriaceous, sparsely stellate-hairy, rugose and green above, densely stellate-hairy and cream-coloured beneath, 3-5-nerved; petioles 0.5 - 3.5 cm long, pubescent; stipules ca 4 mm long, subulate, pubescent. Flowers in leaf-opposed cymes arranged in interrupted racemes, subsessile, ca 6 mm across; bracts ca 1.5 mm long, linear. Sepals 5 - 7 mm long, lorate, apiculate, albido-tomentose. Petals yellow, 4 - 5 mm long, spatulate, emarginate at apex, ciliate at base. Stamens 10 - 25, as long as petals. Capsules 6 - 7 x 3 - 5 mm, ovoid-subglobose to globose, pubescent; spines ca 2 mm long, uncinat, pubescent. Seeds ca 2.5 mm long, black.

*Fl. & Fr.* July - Dec.

*Distrib.* India: Central and Peninsular India.

Myanmar.

8. **Triumfetta tomentosa** Bojer in Rapp. *Annuel Trav. Soc. Hist. Nat. Ile Maurice* 12: 19. 1842 & in *Ann. Sci. Nat. Bot. ser. 2*, 20: 103. 1843; Masters in *Fl. Brit. India* 1: 394. 1874.

Herbs, suffruticose, 1 - 2 m high, strongly foetid, hispid. Leaves 2 - 12 x 1 - 7 cm, ovate-lanceolate to orbicular, rounded or cordate at base, acuminate at apex, crenate-serrate, stellate-hairy especially beneath, 5 - 7-nerved; petioles up to 6 cm long; stipules lanceolate. Flowers fasciculate in upper axils forming interrupted racemes, shortly pedicellate. Sepals 4 - 5 mm long, lorate, apiculate, densely stellate-hairy. Petals orange, 4 - 6 mm long, oblong, acute. Stamens 5 - 7. Capsules 5 - 10 mm across, globose, hispid; spines 4 - 6 mm long, ciliate all along except the fine tip.

*Fl. & Fr.* June - Dec.

*Distrib.* India: West Bengal (Darjeeling), Sikkim, Assam and Meghalaya.

Bangladesh, Bhutan, Sri Lanka, Mauritius, Madagascar and Africa.

#### EXCLUDED SPECIES

**Triumfetta glabra** Sprengel, *Mant. Prim. Fl. Hal.* 41. 1807; Wight & Arn., *Prodr.* 75. 1834; Masters in *Fl. Brit. India* 1: 395. 1874.

Endemic to Sri Lanka.

The description in *The Flora of British India* so little agrees with the plant . . . . .  
.. the locality is also there given as "Canara" instead of Ceylon (Trimen, *Handb. Fl. Ceylon* 1: 180. 1893; also *vide* Robyns & Meijer in Dassan. & Fosb., *Rev. Handb. Fl. Ceylon* 7: 434. 1991).

#### CULTIVATED SPECIES

##### **Tilia** L.

Trees, deciduous, with simple or stellate hairs and large, obtuse buds. Leaves alternate, petiolate, entire, obliquely cordate or truncate at base, serrate or denticulate. Flowers in axillary or terminal cymes, fragrant, basal half of peduncle adnate to a large, membranous bract. Sepals 5, free, caducous. Petals 5, free, yellowish or whitish.

Stamens many, free or in 5, antipetalous fascicles; staminodes sometimes present. Carpels 5, syncarpous; ovary 5-loculed; locules 2-ovuled; style slender; stigma 5-lobed. Fruits obovoid, indehiscent, nut-like, often 3 - 5-ribbed, pubescent, 1-loculed, 1 - 3-seeded.

North temperate regions, southern North America as far as the highlands of Mexico; ca 80 species; 3 introduced in India.

#### KEY TO THE SPECIES

- |   |                           |
|---|---------------------------|
| 1a. Fruits strongly ribbed  | 2. <i>T. platyphyllos</i> |
| b. Fruits smooth or faintly ribbed                                | 2                         |
| 2a. Tertiary nerves of leaves prominent; cymes pendulous          | 3. <i>T. x vulgaris</i>   |
| b. Tertiary nerves of leaves not prominent; cymes obliquely erect | 1. <i>T. cordata</i>      |

1. *Tilia cordata* Mill., Gard. Dict. ed. 8, no. 1. 1768; R. Parker, For. Fl. Punjab 56. 1918.

Trees, up to 30 mm tall, with large, spreading crowns; branchlets glabrous or subglabrous. Leaves 3 - 9 x 2 - 8 cm, suborbicular, cordate at base, acuminate at apex, acutely and finely serrate, glabrous except for tufts of reddish brown hairs in the axils of nerves beneath. Cymes 4 - 15-flowered. Fruits ca 6 mm across, globose; pericarp membranous.

*Fl. & Fr.* June - Oct.

Cultivated in Himachal Pradesh.

Native of Europe except the extreme north and south.

2. *Tilia platyphyllos* Scop., Fl. Carniol. ed. 2, 1: 373. 1772; R. Parker, For. Fl. Punjab 56. 1918.

Trees, up to 40 m tall; branchlets pubescent. Leaves 6 - 12 x 6 - 11 cm, broadly ovate, cordate at base, acuminate at apex, serrate, teeth not aristate, glabrous or sparsely pubescent above, pubescent beneath with simple hairs and pale tufts in axils of nerves. Cymes pendulous, 3 - 5-flowered; bracts glabrous. Fruits 7 - 9 mm across, subglobose to pyriform; pericarp strongly 3 - 5-ribbed, woody, tomentose.

*Fl. & Fr.* June - Oct.

Cultivated in Himachal Pradesh.

Native of Europe.

3. *Tilia x vulgaris* Hayne, Getreue Darstell. Gew. 3: t. 47. 1813; R. Parker, For. Fl. Punjab 57. 1918 (*T. cordata x platyphyllos*). *T. europea* L., Sp. P. 514. 1753, p.p.

Trees, up to 40 m tall; branchlets sparsely hairy to glabrous. Leaves 5 - 7.5 x 3.5 - 5.5 cm, broadly ovate, cordate or somewhat truncate at base, acuminate at apex, serrate, dull green above, paler beneath, glabrous except for the tufts of whitish hairs in axils of nerves. Cymes 5 - 10-flowered; bracts glabrous. Fruits ca 8 mm across, ovoid or subglobose, rounded at ends; pericarp woody, tomentose.

*Fl. & Fr.* May - Oct.

Cultivated in Himachal Pradesh.

Native of Europe.

## PLAGIOPTERACEAE

(P. Daniel)

Scandent shrubs, stellate-pubescent. Leaves opposite, simple, stipulate, pinnately nerved, conduplicate in vernation. Flowers small, actinomorphic, in axillary and terminal pedunculate panicles. Sepals (3 -) 4 (- 5), small, united at base. Petals (3 -) 4 (- 5), revolute, valvate. Stamens many, more or less biseriate, on a disk; filaments filiform; anthers dehiscing transversely. Gynoecium 3-carpellary, syncarpous; ovary superior, 3-loculed with 2 erect ovules in each locule; placentation basal; style subulate. Fruit a turbinate septicial capsule with 3 spreading wings ultimately separating into 3 cocci.

One genus and 2 species.

*Notes.* Following Baas *et al.* (1979) the genus *Plagiopteron* is kept in the family Plagiopteraceae.

### Plagiopteron Griffith

Scandent shrubs, brown or rusty stellate-pubescent. Leaves opposite, simple, petiolate, ovate-oblong, elliptic to obovate, acute to acuminate, entire, pinnately nerved. Panicles pedunculate, terminal or axillary. Flowers small, actinomorphic, in dense clusters, fragrant or not. Bracts linear. Sepals (3 -) 4 (- 5), small, shortly united at base. Petals (3 -) 4 (- 5), revolute, valvate, pubescent. Stamens many, slightly united at base; filaments filiform. Gynoecium 3-carpellary, syncarpous; ovary superior, pubescent, 3-loculed with 2 ovules in each locule; style subulate. Capsules turbinate with 3 spreading wings, ultimately separating into 3 cocci.

Confined to India, Bangladesh, Myanmar, China and Thailand, with 2 species; one in India, restricted to the Khasi and Jaintia hills in Meghalaya.

*Literature.* BAAS, P., R. GEESINK, W.A. VAN HEEL & J. MULLER (1979) The affinities of *Plagiopteron suaveolens* Griff. (Plagiopteraceae). Grana 18: 69 - 89. fig. 1 a - k. DANIEL, P. (1991) The alternative names of the type of *Plagiopteron* (Plagiopteraceae). Taxon 40: 619 - 620.

**Plagiopteron suaveolens** Griffith in Calcutta J. Nat. Hist. 4: 244. 1843; P. Daniel in Taxon 40: 619. 1991. *P. fragrans* Griffith in Calcutta J. Nat. Hist. 4: t. 13, ff. 1 - 15. 1843, nom. alt.; Masters in Fl. Brit. India 1: 399. 1874. **Fig. 142.**

Shrubs, large, scandent, woody; young parts rusty stellate-pubescent. Leaves opposite, simple, ca 10 x 5 cm, elliptic to obovate, rounded or subcordate at base, entire along margins, acute at apex, membranous, almost glabrous above except puberulous nerves, stellate-pubescent with prominent nerves beneath, pinnately nerved; petioles 0.5 - 1 cm long, pubescent; stipules 2, minute, linear, caducous. Flowers small, in axillary or

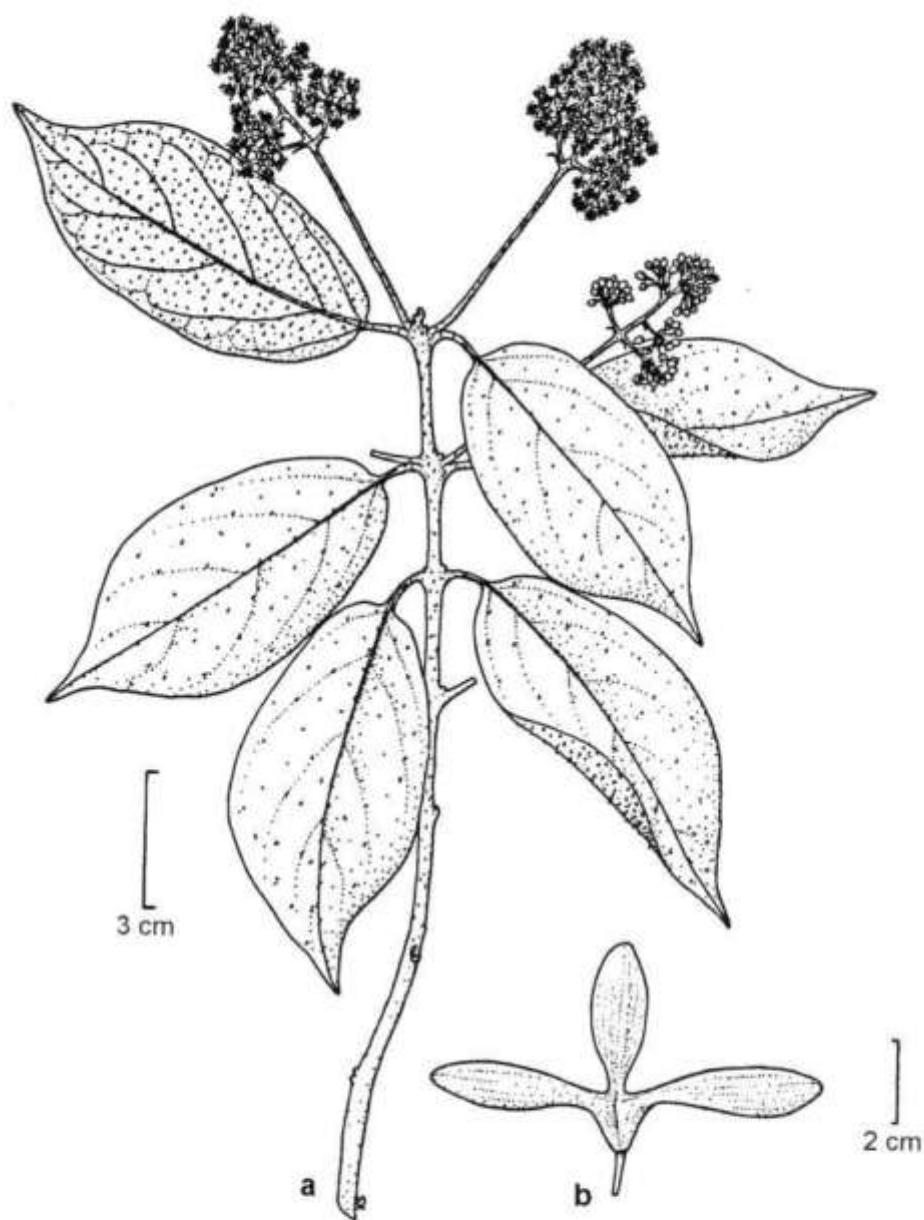


Fig. 142. *Plagiopteron suaveolens* Griffith : a. flowering part of branch; b. fruit.

terminal panicles of dense clusters, greenish, very fragrant; peduncles 6 - 9 cm long, pubescent; bracteoles linear, ca 2 mm long. Sepals (3 -) 4 (- 5), subulate, ca 1 mm long, valvate, pubescent outside. Petals (3 -) 4 (- 5), ovate-oblong, revolute, ca 2.5 mm long, valvate, sepaloid, pubescent outside. Stamens many, on a disk, slightly united at base, much longer than petals; filaments filiform, slightly dilated above; anthers subglobose, 4-loculed, dehiscent by an apical horizontal slit. Ovary superior, pubescent, 3-loculed with 2 basal erect ovules in each locule; style subulate, simple; stigma minutely 3-lobed. Capsules turbinate, expanded at apex into 3 spreading wings and ultimately separating into 3 cocci; wings spathulate, 2 - 4.5 cm long, unequal with subparallel veins; seeds not seen.

*Fl. & Fr.* Dec.

*Distrib.* India: Meghalaya (Khasi and Jaintia hills).

Bangladesh, Myanmar and Thailand.

# ELAEOCARPACEAE

(S.K. Murti)

Large to small trees, occasionally buttressed at base. Leaves simple, alternate, rarely opposite, often crowded at the tips of branchlets; stipules caducous. Inflorescences axillary racemes, cymes or flowers solitary, paired or fascicled. Flowers often fragrant, regular, bisexual, rarely polygamous. Sepals free, valvate, rarely shortly connate, hairy or glabrous. Petals free, usually valvate, hairy or glabrous, margins entire or laciniate, sometimes petals sepaloid or absent. Stamens many, arising from inside of disc; filaments free, hairy or glabrous; anthers simple, awned or bearded, 2-loculed, opening by terminal pores or slits. Disc nectariferous, lobed or cushion-shaped or glanduliform. Ovary superior, rarely semi-inferior, 2-7-loculed, ovules 2-many in each locule, hairy or glabrous; styles glabrous or hairy at base; stigmas simple. Fruits a drupe, capsule or berry, smooth or wrinkled, setose or spiny, dehiscent or indehiscent. Seeds smooth, rugose or tubercled, arillate or not, pendulous from axile placenta; testa crustaceous or bony; endosperm fleshy; cotyledons flat.

Tropics and subtropics of the world; ca 9 genera and 400 species; 2 genera and 33 species in India.

*Literature.* COODE, M.J.E. (1978). A conspectus of Elaeocarpaceae in Papuaia. *Brunonia* 1: 131 - 302. MOORE, H.E. Jr. (1953). Some notes on cultivated Elaeocarpaceae. *Baileya* 1: 112 - 113. SCHLECHTER, R. (1916). Die Elaeocarpaceae Papuasiens. *Bot. Jahrb.* 54: 92 - 155. SCHUMANN, K. (1890 & 1897). Elaeocarpaceae In: ENGLER, A. & K. PRANTL, *Nat. Pflanzenfam.* 3, 6: 1 - 8. 1890; Nachtr. 230. 1897.

## KEY TO THE GENERA

- 1a. Flowers in racemes; ovules 2 in each locule; fruit a drupe **1. Elaeocarpus**
- b. Flowers solitary or fascicled; ovules many in each locule; fruit a capsule or berry **2**
- 2a. Flowers solitary; petals laciniate; ovary superior; capsules echinate or setose, locules 1-seeded **2. Sloanea**
- b. Flowers fascicled or in pairs; petals entire; ovary semiinferior; berries smooth, locules many-seeded **Muntingia** (Cultivated)

## 1. *Elaeocarpus* L.

Large to medium-sized trees. Leaves alternate, often crowded at ends of branchlets, entire or crenate-serrate, pinnately veined, occasionally gland-dotted. Flowers pedicelled, often fragrant, in few to many-flowered racemes. Sepals usually 5, rarely 4 or 6, valvate, inserted on annular disc, deciduous. Petals 5, rarely 4 or 6, valvate, fimbriate or toothed with 10 - 60 more or less linear divisions. Stamens many, sometimes subaggregated into groups opposite petals and alternating with disc-lobes; filaments long or short;



anthers innate, linear or oblong, awned or not, comose. Disc flat, cushion-shaped, thickened, often pitted, glabrous or villous, often 5-lobed, rarely glanduliform. Ovary superior, sessile, 2 - 5-locular, rarely 1-locular or more; ovules pendulous; styles long or short, subulate, sometimes twisted; stigmas entire. Drupes with a woody, rugose or tubercled pyrene; pyrenes 1 - 5, or rarely more-loculed, locules usually 1-seeded.

Asia, Australia and Pacific regions, ca 200 species; 29 in India.

*Literature.* COODE, M.J.E. (1984). *Elaeocarpus* in Australia and New Zealand. *Kew Bull.* 39: 509 - 586. CORNER, E.J.H. (1939). *Elaeocarpus* in Notes on the systematy and distribution of Malayan Phanerogams - III. *Gard. Bull. Str. Settlem.* 10: 239 - 329. KRISHNAMURTY, T. (1964). A note on Rudraksha, *Elaeocarpus sphaericus* (Gaertn.) K. Schum. *Ind. For.* 90: 774 - 776. MERRILL, E.D. (1951). Notes on *Elaeocarpus* Linnaeus *J. Arn. Arb.* 32: 157-200. MERRILL, E.D. (1952). Reductions in *Elaeocarpus*. *Proc. Roy. Soc. Queensland* 62: 49 - 50. TIREL, C. (1978). A propos du genre *Elaeocarpus* en Nouvelle-Caledonie. *Adansonia* II, 17: 441 - 454. TIREL, C. and J. RAYNOL (1980). Recherches bibliographiques sur trois especes d' *Elaeocarpus* (Elaeocarpaceae). *Adansonia* II, 20: 169 - 177. WEIBEL, R. (1972). Deux especes nouvelles du genre *Elaeocarpus* provenant des montagnes du sud del' Inde. *Condollea* 27(1): 15 - 19. (1968). Morphologie de l' embryon et de la graine des *Elaeocarpus*. *Candollea* 23: 101 - 108.

*Notes.* In India the species of *Elaeocarpus* are confined mostly to North eastern and Southern India and a few to Andaman & Nicobar Islands. Six species viz., *E. blascoi*, *E. gausseii*, *E. glandulosus*, *E. munroii*, *E. recurvatus* and *E. venustus* are endemic to southern Peninsular Indian region. A few species show restricted distribution in the subcontinent viz., *E. amoenus* to India and Sri Lanka. *E. acuminatus* and *E. prunifolius* to India and Bangladesh. *E. braceanus*, *E. bracteatus*, *E. grandifolius* and *E. helferi* to India and Myanmar. *E. sikkimensis* to India and Bhutan. However, a further collection and study of specimens is essential to reach any definite colclusion.

The species generally prefer warm humid climate and usually occur between 500 and 2000 m altitudes, though widely distributed, they are never found in abundance in any particular locality. The fruits of *E. floribundus* are edible. *E. sphaericus* ('Rudraksh') is planted throughout India except the arid North west region, for its nuts, which are used as beads for rosaries, bracelets and necklaces and also for its magico-religious beliefs.

#### KEY TO THE SPECIES

- |   |                          |
|---|--------------------------|
| 1a. Drupes globose                        | 2                        |
| b. Drupes elongate                        | 3                        |
| 2a. Anthers bearded; drupes 5-loculed     | 23. <i>E. sphaericus</i> |
| b. Anthers not bearded; drupes unilocular | 2. <i>E. amoenus</i>     |
| 3a. Anthers awned                         | 4                        |
| b. Anthers not awned                      | 18                       |

- 4a. Leaves very convex, folded back to back, resembling an inverted boat  
 b. Leaves neither convex nor folded back to back
- 5a. Petals broader towards base, narrowed towards apex  
 b. Petals narrowed towards base, broader towards apex
- 6a. Flowers 5 - 10 mm across  
 b. Flowers usually more than 10 mm across
- 7a. Sepals glabrous; ovary glabrous; pyrenes 1-seeded, indistinctly 4-ridged  
 b. Sepals densely silky hairy; ovary hairy; pyrenes 2-seeded, 3-grooved
- 8a. Awns shorter than anthers  
 b. Awns as long as or longer than anthers
- 9a. Flowers 2 - 2.5 cm across  
 b. Flowers 1 - 1.5 cm across
- 10a. Leaves 16 - 35 cm long, obovate, oblong or oblanceolate; drupes 3 - 3.5 cm long  
 b. Leaves 5 - 14 cm long, elliptic, elliptic-lanceolate, elliptic-oblong or ovate-elliptic, ovate or ovate-lanceolate; drupes up to 2.5 cm long
- 11a. Awns erect; styles glabrous or shortly puberulous at base  
 b. Awns reflexed; styles densely appressed silky hairy at base
- 12a. Petioles up to 2 cm long; pedicels densely short sericeous; sepals and petals 10 - 12 mm long  
 b. Petioles 2.5 - 3.5 cm long; pedicels glabrous; sepals and petals 7 - 9 mm long
- 13a. Petals 2-lobed; lobes laciniate or not  
 b. Petals not lobed, uniformly laciniate at apex
- 14a. Leaves 30 - 45 cm long; petioles 4 - 5 cm long; petal lobes not laciniate  
 b. Leaves 10 - 15 cm long; petioles 1 - 2.5 cm long; petal-lobes deeply laciniate
- 15a. Bracts persistent, leafy, dentate; filaments as long as anthers  
 b. Bracts caducous, minute, not leafy; filaments shorter than anthers
- 16a. Leaves 24 - 40 cm long; pyrenes compressed, strongly rugose  
 b. Leaves up to 20 cm long; pyrenes terete, tubercled
- 17a. Petioles and midrib glabrous; pedicels glabrous or puberulous, straight  
 b. Petioles and midrib rufous hairy; pedicels softly tomentose, recurved
- 18a. Anthers bearded with tufts of hairs at apex  
 b. Anthers not bearded at apex
- 19a. Leaves and petioles tawny tomentose beneath  
 b. Leaves and petioles glabrous or sparsely puberulous beneath
- 20a. Leaves lanceolate, elliptic-lanceolate or oblanceolate; petioles 7 - 15 mm long; stamens  
 b. Leaves broadly ovate, ovate-oblong, ovate-elliptic or elliptic-oblong; petioles 2 - 6 cm long; stamens more than 15
- 21a. Petals ciliate  
 b. Petals not ciliate
- 22a. Leaves pustulate when dry; flower-buds ellipsoid; pyrenes faintly rugose  
 b. Leaves not pustulate when dry; flower-buds broadly ovoid or oblong-ovoid; pyrenes strongly rugose
- 23a. Petioles 2 - 2.5 cm long; flowers 5 - 10 mm across; filaments shorter than anthers; ovary globose
19. *E. recurvatus* 5  
 6 6  
 8 8  
 18. *E. prunifolius* 7  
 17. *E. petiolatus* 8  
 27. *E. varunua* 9  
 9 9  
 13 13  
 28. *E. venustus* 10  
 10 10  
 20. *E. rugosus* 11  
 11 11  
 1. *E. acuminatus* 12  
 12 12  
 4. *E. blascol* 16. *E. munronii* 14  
 16 16  
 10. *E. grandifolius* 15  
 15 15  
 6. *E. bracteatus* 24. *E. stapfianus* 17  
 17 17  
 3. *E. aristatus* 15. *E. macrocerus* 26. *E. tuberculatus* 19  
 19 19  
 26 26  
 29. *E. wallichii* 20  
 20 20  
 13. *E. lancifolius* 21  
 21 21  
 22 22  
 24 24  
 7. *E. floribundus* 23  
 23 23  
 11. *E. helferi*

- b. Petioles 3 - 5 cm long; flowers 10 - 12 mm across; filaments as long as or slightly longer than anthers; ovary oblong-ovoid 25. *E. tectorius*
- 24a. Leaves 13 - 30 x 6 - 9 cm, not pustulate when dry; petioles with 2 leafy processes at apex 22. *E. sikkimensis*
- b. Leaves 5 - 11 x 2.5 - 5 cm, pustulate when dry; petioles without leafy processes at apex 25
- 25a. Petals 4 - 5 mm long; styles ca 2 mm long; drupes 2.5 cm long, broadly ovoid, rounded at apex, pyrenes broadly ellipsoid, rounded at apex 8. *E. gaussonii*
- b. Petals 6 - 8 mm long; styles 3 - 4 mm long; drupes 3 - 3.5 cm long, narrowly obovoid, obtuse at apex, pyrenes oblong, acute at apex 21. *E. serratus*
- 26a. Leaves ferruginous tomentose beneath; bracteolate prominent, laciniate, persistent 5. *E. braceanus*
- b. Leaves glabrous or puberulous beneath; bracteoles minute, not laciniate, caducous 27
- 27a. Petioles 10 - 12 mm long, eglandular; flower buds pyramidal; drupes lanceolate, pyrenes compressed 12. *E. hygrophyllus*
- b. Petioles 1.5 - 5 cm long, with 2 glands near apex; flower-buds ovoid-conical or oblong-ovoid; drupes oblong-ovoid or elliptic, pyrenes terete 28
- 28a. Leaves obtuse at base; racemes as long as leaves; flowers 6 - 8 mm across; petals glabrous; stamens 20 - 30 14. *E. lucidus*
- b. Leaves cuneate, acute to rounded at base; racemes shorter than leaves; flowers 10 - 12 mm across; petals hairy; stamens 40 - 50 29
- 29a. Leaves acute or shortly acuminate, glandular beneath, pustulate when dry; pedicels 7 - 12 mm long; sepals glandular pubescent; anthers glabrous 9. *E. glandulosus*
- b. Leaves long acuminate, not glandular beneath, not pustulate when dry; pedicels 5 - 7 mm long; sepals not glandular pubescent; anthers puberulous 25. *E. tectorius*

**1. *Elaeocarpus acuminatus* Wallich ex Masters in Fl. Brit. India 1: 406. 1874.  
Fig. 143.**

Trees, 15 - 20 m tall. Leaves 5 - 14 x 1.5 - 4 cm, lanceolate, elliptic-lanceolate, elliptic-oblong, or ovate-elliptic, cuneate or tapering into a short petiole at base, acuminate at apex, dentate-serrate, veins prominent beneath, silky when young, glabrous with age, coriaceous; petioles 1 - 1.5 cm long, thickened at apex, geniculate, pubescent. Racemes 5 - 10 cm long, stout, axillary, puberulous. Flower-buds fusiform lanceolate or oblong-elliptic; flowers white, 1 - 1.5 cm across; pedicels 1 - 2 cm long, puberulous. Sepals 8 - 10 mm long, lanceolate, keeled, villous without, pubescent within, minutely villous on edges and keel. Petals 7 - 9 mm long, oblong-cuneate, narrowed at base, broader at apex, laciniate to less than half its length, long silky hairy on both surfaces. Stamens 35 - 40; filaments ca 2 mm long, puberulous; anthers 3 - 4 mm long, elliptic, shortly erect, awned, puberulous. Disc glands 5, broad, 2-lobed, pubescent. Ovary villous, 2-loculed; ovules in 2 rows in each locule. Drupes ca 2.5 cm long, oblong, smooth, green.

*Fl.* July - Sept.; *Fr.* Oct. - Dec.



Fig. 143. *Elaeocarpus acuminatus* Wallich ex Masters : a. flowering twig; b. flower bud; c. flower; d. petal; e. stamen; f. sepal.

*Distrib.* India: In moist evergreen forests between 1000 and 1500 m. Meghalaya.

Bangladesh.

**2. *Elaeocarpus amoenus*** Thwaites, Enum. Pl. Zeyl. 32. 1858; Masters in Fl. Brit. India 1: 404. 1874.

Trees, 15 - 20 m tall, much branched; young parts finely appressed hairy. Leaves 5 - 10 x 1.5 - 5 cm, lanceolate, oblong or ovate, usually tapering at both ends, cuneate or acute at base, acuminate or obtuse at apex, crenate-serrate, rather thick, glabrous, glandular beneath, veins prominent beneath, with glandular pits in their axils; petioles 8 - 20 mm long. Racemes arising from axils of fallen leaves, spreading or drooping. Flower buds ovate-lanceolate or globose, pilose; flowers 1 - 1.5 cm across; white, pedicels 8 - 10 mm long. Sepals 5 - 6 mm long, lanceolate, acute, pilose, reddish. Petals 8 - 10 mm long, cuneate, laciniate. Stamens 18 - 30; filaments as long as anthers, pilose; anthers 2 mm long, beardless, puberulous. Ovary 5-loculed, pilose; styles 2 - 3 mm long. Drupes 1.5 - 3 cm across, globose, smooth; pyrenes spherical, tubercled, with 3 vertical grooves, 1-celled, 1-seeded.

*Fl.* Sept. - Oct.; *Fr.* March - April.

*Distrib.* India: Moist semi evergreen forests between 1500 and 2000 m. Tamil Nadu.

Sri Lanka.

**3. *Elaeocarpus aristatus*** Roxb., [Hort. Beng. 43: 1814, nom nud.] Fl. Ind. 2: 599. 1832; Masters in Fl. Brit. India 1: 405. 1874. **Fig. 144.**

*Asm.:* *Gerala Sopa, Nagini*; *Gar.:* *Chham Nangal, Gangma Jachhang*; *Kh.:* *Dieng Thang Khapiah*; *Nep.:* *Dalchiwari*.

Trees, 20 - 40 m, tall, old trees buttressed at base. Leaves often crowded at the ends of branchlets, 24 - 40 x 6 - 10 cm, obovate, elliptic or oblanceolate, cuneate or acute at base, rounded or subacute at apex, distantly serrulate or subentire, glabrous, thinly coriaceous, midrib prominent, with glands in the axils of lateral veins beneath; petioles 1.5 - 4.5 cm long, swollen at both ends, geniculate, glabrous. Racemes 8 - 20 cm long, axillary, rusty villous, glabrescent with age. Flower-buds lanceolate, ribbed; flowers pale white, 1.8 - 2 cm across, drooping, fragrant; pedicels 1 - 2 cm long, rusty villous. Sepals 1 - 1.5 cm long, lanceolate, narrowly triangular or oblong, rusty tomentose without, glabrous within. Petals white, 1.5 - 1.8 cm long, triangular, laciniate, densely silky hairy outside. Stamens 40 - 60; filaments ca 1 cm, long, puberulous or glabrous; anthers 4 - 5 mm long, oblong, with 4 - 5 mm long erect awns. Ovary ovoid, sericeous, 2-loculed; styles subulate, longer than anthers, tapering from a conical base. Drupes 3 - 3.5 long, ellipsoid; pyrenes oblong, pointed at both ends, compressed, rugose, 1 or rarely 2-loculed.

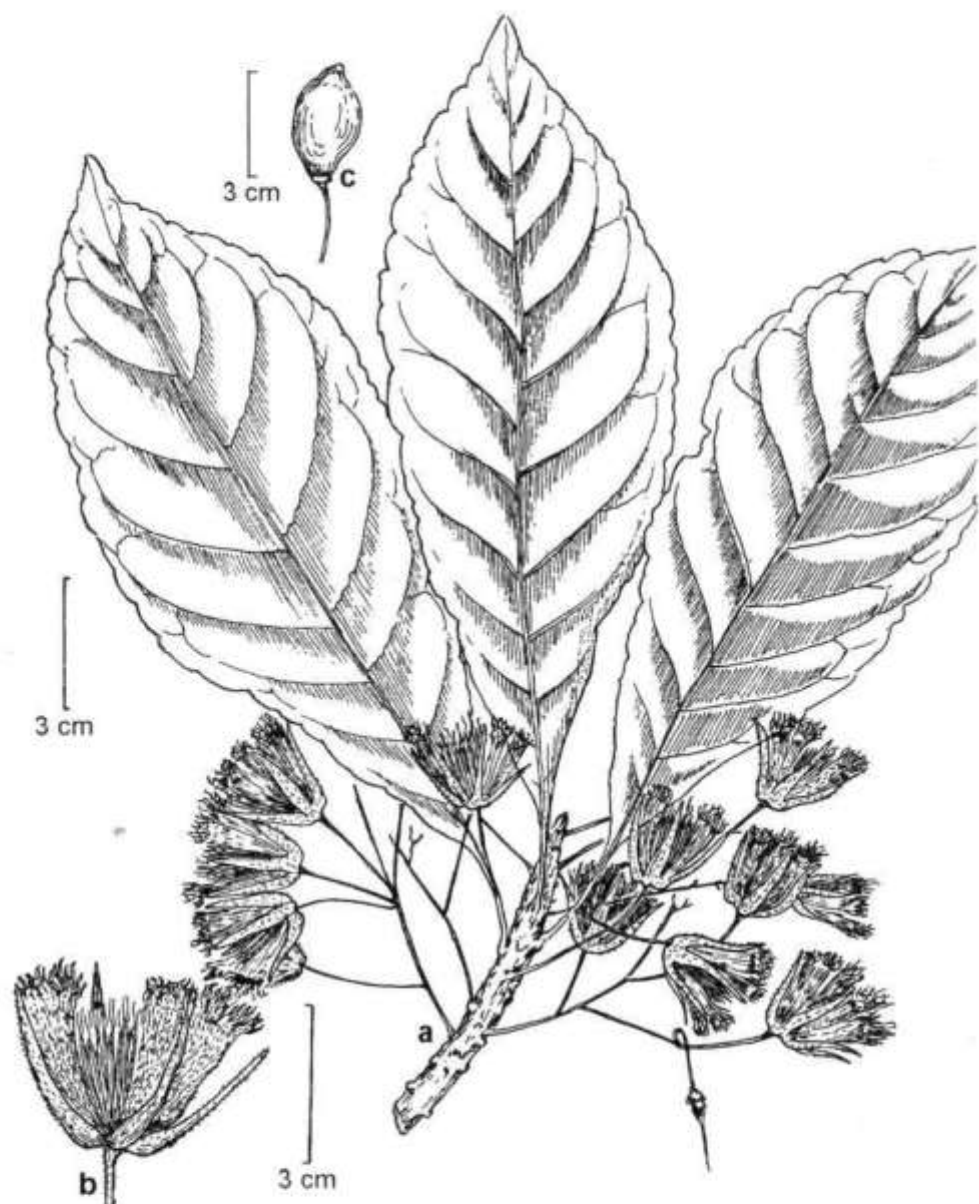


Fig. 144. *Elaeocarpus aristatus* Roxb. : a. flowering twig; b. flower; c. fruit.

*Fl.* April - June; *Fr.* July - Oct.

*Distrib.* India: In moist deciduous and evergreen forests between 1500 and 2000 m. West Bengal (Darjeeling), Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Andaman & Nicobar Islands (Nicobar Islands) and Maharashtra.

Bhutan, Bangladesh and Myanmar.

4. *Elaeocarpus blascoi* Weibel in Candollea 27: 16. 1972.

Trees, 14 - 20 m tall; branchlets more or less densely short grey silky. Leaves 5 - 7.5 x 2 - 5 cm, ovate-elliptic or elliptic, rounded or broadly cuneate at base, obtuse at apex, obscurely serrate, glabrous above, sparsely appressed hirtus or glabrescent beneath, veins prominent beneath; petioles 1 - 2 cm long, sparsely short grey sericeous. Racemes 4 - 6 cm long, axillary, 6 - 7-flowered. Flower-buds ovoid, acute, more or less densely short sericeous; flowers white, 1 - 1.5 cm across, pedicels 1 - 1.2 cm long, densely short sericeous, rarely glabrate. Sepals 10 - 11 mm long, lanceolate, acute, densely short sericeous without, velvety along margin. Petals 12 mm long, broader towards apex, laciniate into 11 - 14 segments, densely sericeous without. Stamens 33 - 36, densely appressed hirtellous; filaments 2 - 3.3 mm long; anthers 2.5 - 4 mm long, anther tip produced into a subulate, 1 mm long awn. Disc annular, 10-lobed. Ovary ovoid, densely sericeous, 2 - 3 loculed; ovules 6 in each locule; styles sericeous at base, 6 - 6.5 mm long. Drupes 1.5 cm long, ellipsoid, rounded at base and apex, laterally scarcely compressed.

*Fl.* Jan.; *Fr.* Sept.

*Distrib.* India: In moist evergreen forests between 2000 and 2150 m. Tamil Nadu.

Endemic.

5. *Elaeocarpus braceanus* Watt ex C. B. Clarke in J. Linn. Soc. 25: 8. 1899; Kanjilal *et al.*, Fl. Assam 1: 177. 1934.

Trees, 10 - 12 m tall; branchlets ferruginous tomentose. Leaves 7 - 15 x 2 - 5 cm, elliptic, elliptic-lanceolate or oblong-lanceolate, cuneate to obtuse at base, acuminate at apex, crenate-serrate, ferruginous tomentose beneath when young, puberulous with age, veins prominent beneath; petioles 1 - 2.5 cm long, ferruginous tomentose, swollen and geniculate at apex. Racemes 3.5 - 14 cm long, axillary, tomentose. Flowers-buds ovoid or roundish, subtended usually by 3 laciniate, persistent bracteoles; flowers white, 5 - 6 mm across; pedicels ca 5 mm long. Sepals 2.5 - 3 mm long, lanceolate, silky tomentose without. Petals 2.5 mm long, oblong, narrowed at base, broader at apex, laciniate. Stamens 30 - 40; filaments puberulous; anthers not bearded, ca 1 mm long.

Disc-glands hairy. Ovary villous, 2-loculed. Drupes ca 4 cm long, abruptly pointed at apex; pyrenes ovoid, terete, rugose, with 3 indistinct grooves.

*Fl.* Aug. - Oct.; *Fr.* April - June.

*Distrib.* India: In moist semievergreen forests between 1000 and 1500 m. Meghalaya, Nagaland and Manipur.

Myanmar.

**6. *Elaeocarpus bracteatus*** Kurz in J. Asiat. Soc. Beng. 40: 48. 1871; Masters in Fl. Brit. India 1: 406. 1874.

Trees, 20 - 30 m tall. Leaves 12.5 - 15 x 6 - 10 cm, elliptic, obovate or obovate-oblong, narrowed towards base, obtuse or apiculate at apex, repand-toothed, thinly coriaceous, glabrous, veins prominent beneath; petioles 1 - 2.5 cm long, thickened, geniculate at apex, glabrous. Racemes axillary, shorter than leaves. Flower white, buds oblong; flowers 2 - 2.5 cm across; pedicels 2 - 2.5 cm long, glabrous; bracts foliaceous, 1 - 2.5 cm long, oblong-obovate, sessile, dentate, glabrous, persistent. Sepals 4 - 5, 1 - 1.5 cm long, linear-lanceolate, acuminate, hairy along revolute margins. Petals 4 - 5, 1.5 - 2 cm long cuneate-oblong, broader at apex, bilobed, lobes laciniate into many subulate divisions, sparingly silky hairy outside and inside along revolute margins. Stamens 30 - 40; filaments 2 - 3 mm long; anthers 2 - 3 mm long, with equally long awns. Ovary silky villous, 2-loculed; styles 2 - 4 mm long; stigmas entire. Drupes 2 - 4 cm long, oblong, smooth; pyrenes oblong, pitted and tubercled.

*Fl.* March - April; *Fr.* July - Oct.

*Distrib.* India: In evergreen forests between 1000 and 1500 m. Assam and Arunachal Pradesh.

Myanmar.

**7. *Elaeocarpus floribundus*** Blume, Bijdr. 120. 1825; Masters in Fl. Brit. India 1: 401. 1874. *E. rigidus* Ridley in J. Asiat. Soc. Str. Settl. 54: 28, 1910. *E. ramsoii* Kunth in Feddes Repert. Sp. Nov. 44: 131. 1938. Fig. 145.

Asm.: *Jalpai*; Beng.: *Belphoi*; Hindi: *Jalpai*; Mani.: *Charphai*; Nep.: *Koving*.

Trees, 15 - 25 m tall; branchlets glabrous. Leaves crowded near ends of branchlets, 5 - 21 x 2 - 8 cm, broadly ovate or elliptic-ovate, acute or cuneate to rarely rounded at base, bluntly acute or acuminate at apex, coarsely repand-serrate, subcoriaceous, glabrous, glandular-punctate beneath, pustulate when dry, bright red before falling; petioles 3 - 5 cm long, thickened at both ends, geniculate, glabrous, occasionally with a pair



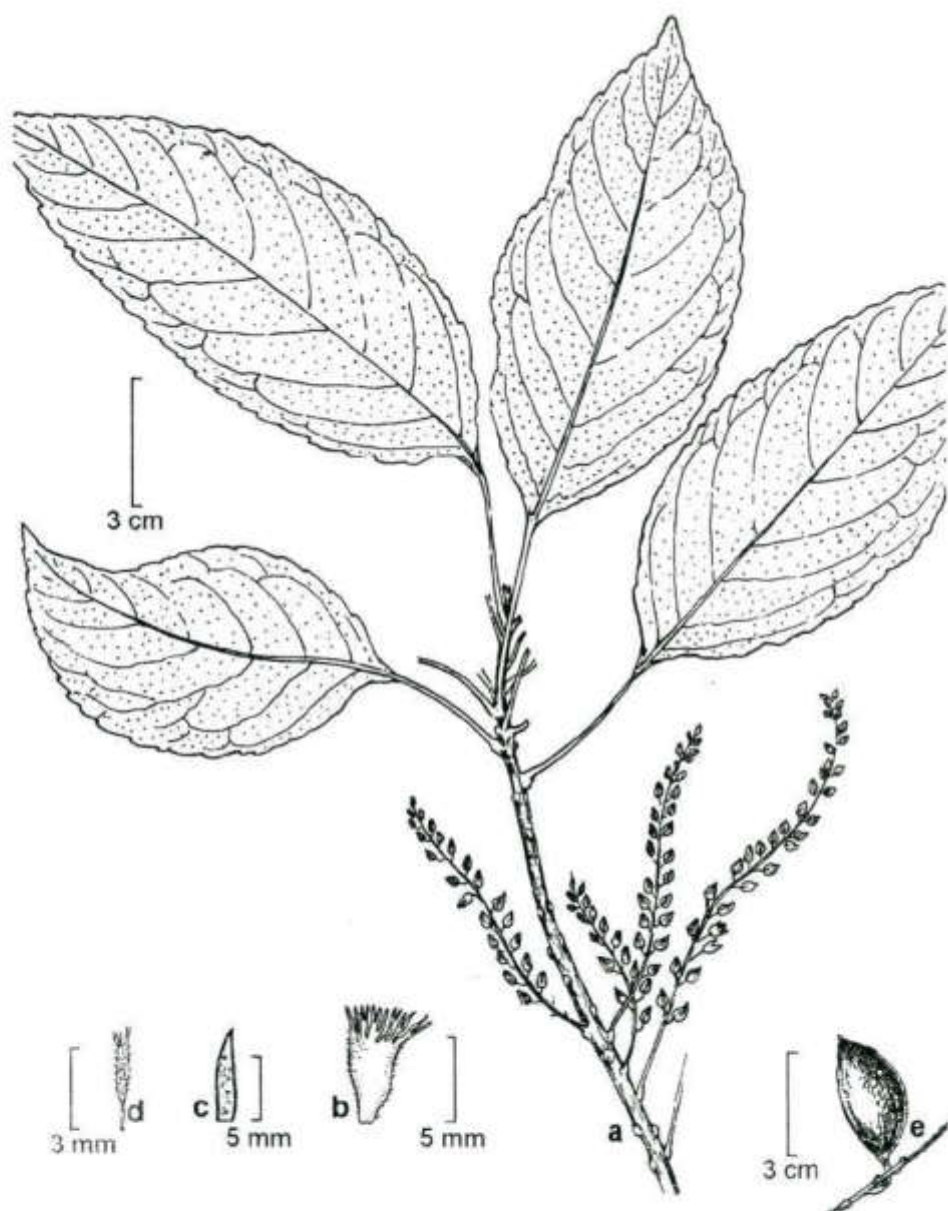


Fig. 145. *Elaeocarpus floribundus* Blume : a. flowering twig; b. petal; c. sepal; d. stamen; e. fruit.

of glands at apex. Racemes 10 - 15 cm long, axillary. Flower-buds ellipsoid, sericeous; flowers white, 6 - 7 mm across; pedicels 8 - 10 mm long, puberulous or glabrescent. Sepals 5 - 7 mm long, lanceolate, thickened and tomentose along margins. Petals white, 5 - 7 mm long, obtriangular, lacinate, ciliate along margins. Stamens 25 - 30; filaments ca 1 mm long, slender, minutely puberulous; anthers ca 2 mm long, oblong, puberulous, bearded, not awned. Disc silky villous. Ovary silky villous, 3-loculed. Drupes 2.5 - 4 cm long, oblong-ovoid, pale green, smooth, fleshy; pyrenes 1 - 3-loculed, locules 1-seeded, narrowed at both ends, shallowly rugose, 3-grooved.

*Fl.* March - Aug.; *Fr.* Oct. - Dec.

*Distrib.* India: In moist semievergreen forests, between 1000 and 1500 m. West Bengal(Darjeeling), Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Tripura and Andaman & Nicobar Islands(Andaman Islands).

Bangladesh, Bhutan, Myanmar, Malaysia and Indonesia(Java).

*Notes.* Fruits edible, often cooked and pickled, pulp pleasantly acrid; nuts made into rosaries.

#### 8. *Elaeocarpus gaussonii* Weibel in Candollea 27: 17. 1972.

Trees, 10 - 20 m tall; branchlets more or less densely short grey silky. Leaves 6.5 - 7.5 x 3.5 - 4.5 cm, elliptic or obovate, broadly or narrowly cuneate at base, obtuse or rounded at apex, serrate, teeth often with persistent subulate glands, glabrous above, more or less densely appressed short hirtus beneath ultimately glabrous, pustulate when dry, veins scarcely prominent; petioles 1 - 1.5 cm long, sparsely appressed short hirtus or glabrous, channelled above. Racemes 5 - 6 cm long, axillary, 15 - 20-flowered. Flower-buds narrowly ovoid, acute, sparsely appressed short hirtus; flowers white, 4 - 5 mm across; pedicels sparsely appressed short hirtus or glabrate. Sepals 4 - 4.5 mm long, lanceolate, acute, sparsely thinly appressed hirtus or glabrous, pustulate without, velvety along margin. Petals 5 mm long, glabrous, broader towards apex, lacinate into 15 linear segments, more or less united at base forming 3 lobes. Disc annular, velvety, deeply furrowed opposite petals, scarcely furrowed opposite sepals. Stamens 17 - 20, hirtellous; filaments 8 - 1 mm long, erect or recurved; anthers 1.5 mm long, bearded at apex. Ovary broadly ovoid, densely sericeous at base. Drupes 2.5 mm long, broadly ovoid, rounded at base and apex, laterally compressed; pyrenes broadly ellipsoid, longitudinally and narrowly 3-grooved, obsolete obtuse-tuberculate.

*Fl.* April; *Fr.* Oct.

*Distrib.* India: In moist evergreen forests at 1500 m. Tamil Nadu.

Endemic.

9. *Elaeocarpus glandulosus* Wallich ex Merr. in J. Arn. Arb. 32: 194. 1951. *E. oblongus* auct. non. Gaertn., 1788 & Smith, 1809; Wight & Arn., Prodr. 82. 1834; Masters in Fl. Brit. India 1: 403. 1874. *E. tectorius* auct. non (Lour.) Poiret 1812; Ramamoorthy in Saldanha & Nicolson, Fl. Hassan Dist. 131. 1974, excl. Syn. **Fig. 146.**

Mal.: *Kattu Kara*; Mar.: *Kasa*; Tam.: *Bikki*

Trees, up to 50 m tall. Leaves 7 - 13 x 4 - 6.5 cm, broadly ovate or elliptic, cuneate at base, acute to shortly acuminate at apex, crenate-serrate, crenations often with linear glands, coriaceous, glabrous above, glandular beneath, domatia often present, pustulate when dry; petioles 2 - 3.5 cm long, glandular at apex. Racemes 4 - 10 cm long, axillary, puberulous when young. Flower buds ovoid conical; flowers white, 10 - 12 mm across; pedicels 7 - 12 mm long, reddish, pubescent. Sepals 5 - 6 mm long, ovate, acute, brown, glandular pubescent. Petals 6 - 8 mm long, cuneate, narrowed at base, broader at apex, lacinate to about half way down, ciliate along margins. Stamens 40 - 45 in groups; filaments 1 - 2 mm long, curved, puberulous; anthers 2 - 3 mm long, oblong, glabrous. Ovary pilose, 2-locular; styles short, conical, hairy. Drupes 2.5 - 3.5 cm long, oblong or elliptic, narrowed at both ends, fleshy, rugose; pyrenes oblong, 2-locular, 2-seeded.

Fl. March - Dec.; Fr. July - April.

*Distrib.* India: In evergreen (especially in Sholas) and moist deciduous forests of Western Ghats between 1000 and 2000 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

S. Asia.

*Notes.* *E. oblongus* described by 3 different workers belong to 3 different species as synonyms. *E. oblongus* Gaertn. (1788) to *E. serratus* L. (1753), *E. oblongus* Smith (1809) to *E. tinctoria* (Lour.) Poiret (1812) and *E. oblongus* Wight & Arn. (1834) to *E. glandulosus* Wallich ex Merr.

Fruits used as emetic, useful for rheumatism, pneumonia, ulcers, piles and leprosy. Wood is white, strong and soft suitable for match boxes.

10. *Elaeocarpus grandifolius* Kurz in J. Asiat. Soc. Beng. 41: 294. 1872.

Trees, 10 - 15 m tall; branchlets rusty tomentose. Leaves 30 - 45 x 10 - 15 cm, obovate-oblong to obovate, cuneate to acute at base, acute or obtuse at apex, obscurely repand-serrate, glabrous above, puberulous beneath, especially on veins; petioles 4 - 5 cm long, thickened, geniculate, puberulous. Racemes 10 - 20 cm long, axillary, rusty tomentose. Flower buds oblong; flowers creamy white, 2 - 3 cm across; pedicels 1.5 - 3 cm long, hairy. Sepals 1 - 1.5 cm long, linear-lanceolate, rusty tomentose. Petals 2 - 2.5 cm long, narrowed at base, 2-lobed; lobes twisted, appressed rusty pubescent. Stamens

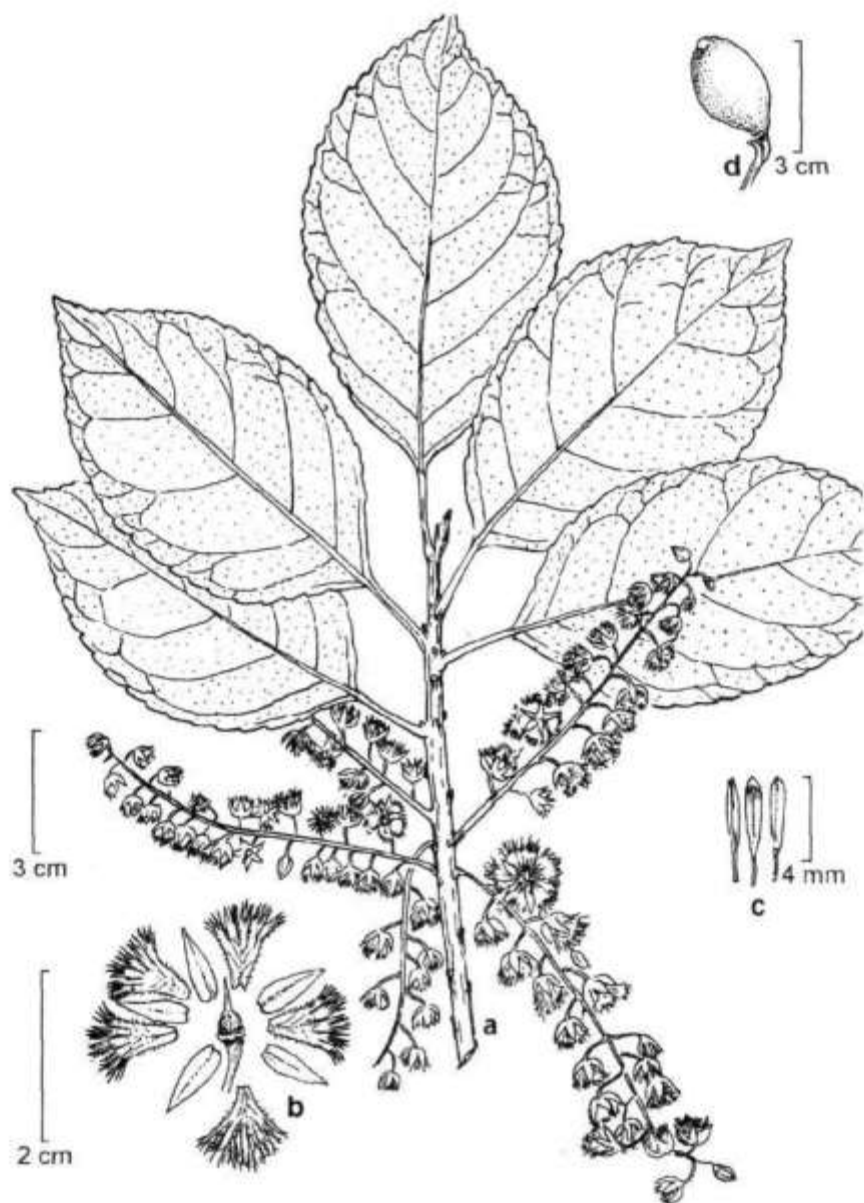


Fig. 146. *Elaeocarpus glandulosus* Wallich ex Merr. : a. flowering twig; b. floral parts; c. stamens; d. fruit.

30 - 50; filaments 2 - 3 mm long; anthers 6 - 8 mm long, with awns as long as or slightly longer than anthers. Ovary oblong, densely villous. Drupes 3 - 5 cm long, oblong, puberulous; pyrenes lacunose wrinkled, somewhat compressed.

*Fl.* Feb. - April; *Fr.* April - June.

*Distrib.* India: In moist semi evergreen forests between 1000 and 1500 m. Assam.

Myanmar.

**11. *Elaeocarpus helferi* Kurz ex Masters in Fl. Brit. India 1: 402. 1874.**

Trees, 15 - 20 m tall; branchlets puberulous. Leaves 5 - 20 x 2 - 6 cm, oblong-lanceolate or elliptic, rounded at base, acute to cuspidate or shortly acuminate at apex, crenate-serrate, coriaceous, glabrous, veins prominent beneath; petioles 2 - 2.5 cm long, glabrous, thickened, somewhat geniculate. Racemes 3 - 8 cm long, axillary. Flowerbuds broadly ovoid, obtuse; flowers white, 5 - 10 mm across; pedicels 4 - 6 mm long, grey puberulous. Sepals 2 - 4 mm long, ovate-lanceolate, acute, hairy. Petals 4 - 7 mm long, cuneate at base, broader at apex, lacinate half way down, ciliate along margins. Stamens 35 - 45; filaments short; anthers ca 1 mm long, bearded at tip. Ovary globose, hairy, 3-loculed; styles ca 2 mm long; stigmas entire. Drupes 2.3 cm long, oblong-ovoid; pyrenes oblong-ovoid, rugose, with longitudinal grooves, 2 - 3-loculed.

*Fl.* April - June; *Fr.* Aug. - Oct.

*Distrib.* India: In moist evergreen forests of Andaman & Nicobar Islands.

Myanmar.

**12. *Elaeocarpus hygrophyllus* Kurz in J. Asiat. Soc. Beng. 43: 133. 1874; Kanjilal *et al.*, Fl. Assam 1: 176. 1934. Fig. 147.**

Trees, 15 - 20 m tall; branchlets glabrous. Leaves 6 - 15 x 3 - 6 cm, obovate, oblanceolate, cuneate-oblong, cuneate at base, bluntly apiculate or rounded at apex, cuspidately crenate-serrate, glabrous, midrib stout; petioles 10 - 12 mm long, stout, flattened above, swollen at both ends, geniculate, glabrous. Racemes 5 - 10 cm long, puberulous, glabrescent with age. Flower buds pyramidal; flowers white, 6 - 8 mm across; pedicels 5 - 6 mm long, sericeous. Sepals 5 - 6 mm long, lanceolate, acute, sericeous without, velvety along margins. Petals 6 - 7 mm long, cuneate, lacinate, glabrous. Stamens 30 - 40; filaments short, minutely puberulous; anthers not bearded. Ovary villous, 3-loculed. Drupes 2 - 3 cm long, lanceolate, pointed at both ends; pyrenes compressed, tubercled.

*Fl.* March - May; *Fr.* July - Sept.

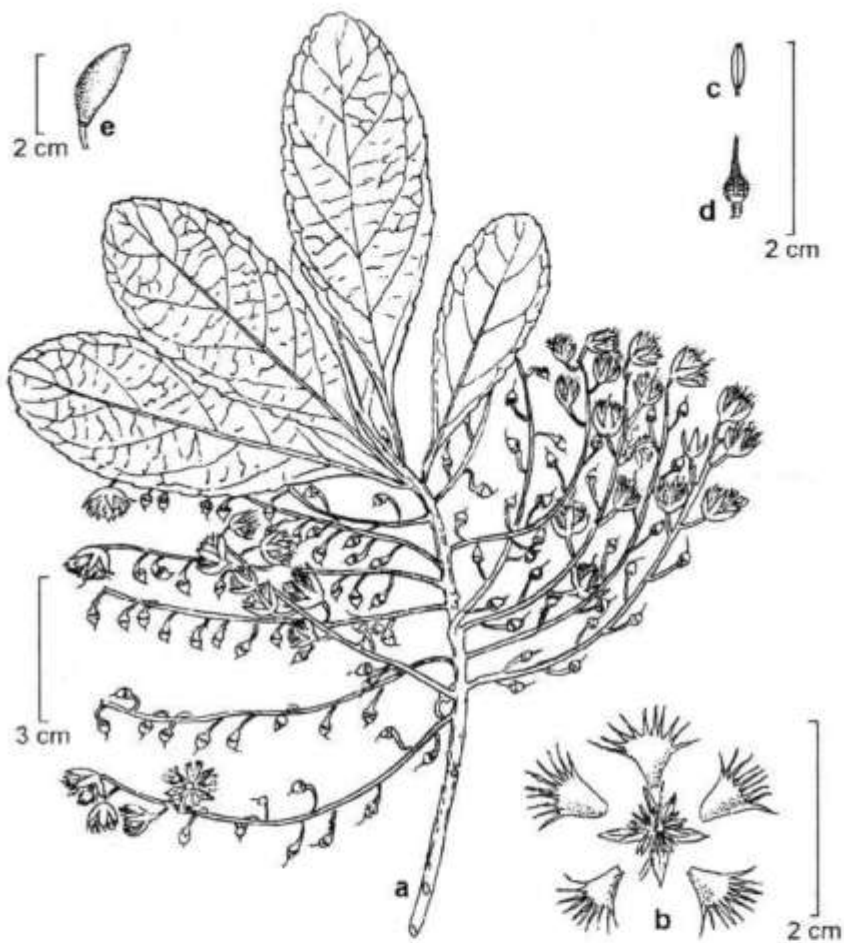


Fig. 147. *Elaeocarpus hygrophyllus* Kurz : a. flowering twig; b. floral parts; c. stamen; d. pistil; e. fruit.

*Distrib.* India: In evergreen forests in swampy places, between 800 and 1000m. Assam.

Myanmar.

13. *Elaeocarpus lanceifolius* Roxb., [Hort. Beng. 42. 1814, nom. nud.] Fl. Ind. 2: 598. 1832. '*lanceaefolius*'; Masters in Fl. Brit. India 1: 402. 1874. Kanjilal *et al.*, Fl. Assam 1: 175. 1934, incl. var. *vestitus*. *E. serrulatus* Benth. in Hook., J. Bot. 3: 362. 1852, non Roxb. 1814. Fig. 148.

Kj.: *Dieng-soh-khyllam*; Nep.: *Bhadrase*, - *Badrass*.

Trees, up to 20 m tall; branchlets pubescent. Leaves 5 - 15 x 2 - 4 cm, elliptic, lanceolate, elliptic-lanceolate or oblanceolate, cuneate to attenuate at base, acute to acuminate at apex, distantly crenate-serrate, glabrous or sparsely pubescent beneath, pustulate beneath when dry, thinly coriaceous or chartaceous; petioles 7 - 15 mm long, puberulous or glabrous, obscurely geniculate at apex. Racemes 5 - 8.5 cm long, axillary, puberulous. Flower-buds ovate-lanceolate, subtended by small, linear-lanceolate, caducous bracts; flowers white, 6 - 9 mm across; pedicels 8 - 12 mm long, slender, puberulous. Sepals 3 - 5 mm long, lanceolate, keeled, puberulous or glabrate without, silky puberulous within. Petals white, 4 - 6 mm long, obtriangular, lacinate, ciliate. Stamens 15 - 30; filaments ca 2.5 mm long, pubescent; anthers 1.5 - 2 mm long, oblong with short bristles at apex, puberulous. Disc of 5 rounded glands, hairy. Ovary villous, 3-loculed; styles villous at base. Drupes 2.5 - 3 cm long, oblong-ovoid to ellipsoid, green; pyrenes oblong, strongly rugose, with 3 longitudinal grooves, unilocular, 1-seeded.

*Fl.* March - Aug.; *Fr.* Oct. - Dec.

*Distrib.* India: In moist deciduous and evergreen forests between 1500 and 2200 m. West Bengal (Darjeeling), Sikkim, Assam, Meghalaya, Nagaland, Manipur, Karnataka and Andhra Pradesh.

Nepal, Bhutan, Myanmar, S.China, Taiwan, Hongkong and Indonesia (Java).

*Notes.* Fruits are edible, wood suitable for making tea boxes, charcoal and also used for house building. Nuts used for rosaries, necklace, bracelets.

The chromosome number reported is  $2n = 30$  (Mehra & Sarin, *Silvae Gent.* 22(3): 66 - 70. 1973).

14. *Elaeocarpus lucidus* Roxb., [Hort. Beng. 42. 1814, nom. nud.] Fl. Ind. 2: 600. 1832; Masters in Fl. Brit. India 1: 403. 1874.



Fig. 148. *Elaeocarpus lanceifolius* Roxb. : a. flowering twig; b. fruit; c. pistil; d. disc; e. petal; f. stamen.



Trees, 15 - 20 m tall; branchlets pubescent. Leaves 6 - 15 x 3 - 7 cm, elliptic or ovate-lanceolate, obtuse or rounded at base, acute to acuminate at apex, serrate-mucronate, veins prominent beneath, glabrous to more or less puberulous along the midrib; petioles 1.5 - 3 cm long with 2 glands near apex. Racemes 6 - 12 cm long, axillary. Flower-buds ovoid-conical; flowers white, 6 - 8 mm across; pedicels 4 - 6 mm long, puberulous. Sepals 4 - 5 mm long, lanceolate, glandular pubescent. Petals 4 - 6 mm long, lacinate half way down, glabrous. Stamens 20 - 30, arranged in groups, with reddish glands between groups; filaments ca 1 mm long; anthers ca 1 mm long, puberulous, not bearded. Disc thick, 5-lobed, villous. Drupes 2 cm long, oblong-ovoid, unilocular, 1-seeded.

*Fl.* Feb. - May; *Fr.* July - Sept.

*Distrib.* India: In moist deciduous and semievergreen forests between 1000 and 1200 m. West Bengal, Assam, Meghalaya and Andhra Pradesh.

Bangladesh.

**15. *Elaeocarpus macrocerus*** (Turcz.) Merr. in J. Arn. Arb. 32: 183. 1951. *Monocera macrocera* Turcz. in Bull. Soc. Imp. Nat. Moscou 19(2): 494. 1846. *Elaeocarpus littoralis* Kurz in J. Asiat. Soc. Beng. 43: 132. 1874 & For. Fl. Brit. Burma 1: 167. 1877. *E. obtusus* auct. non Blume, 1825; King in J. Asiat. Soc. Beng. 60: 134. 1891. *E. monocera* auct. non Cav., 1800; Masters in Fl. Brit. India 1: 405. 1874, p.p.

*Asm.*: *Pani sopa*, *Phutkuli*.

Trees, 10 - 20 m tall; branchlets pubescent or glabrescent. Leaves 6 - 20 x 3 - 12 cm, obovate-oblong, oblanceolate or spatulate, cuneate at base, obtuse or subacute at apex, distantly cuspidately crenate-serrate, thinly coriaceous, glabrous. Racemes 3 - 10 cm long, axillary, corymbose, puberulous. Flowers buds lanceolate or ovoid, acute, 5-ribbed; flowers dull white, 2 - 2.5 cm across; pedicels 2 - 3 cm long, slender, puberulous or glabrate. Sepals 1.5 - 2 cm long, linear-lanceolate, ovate-lanceolate or oblong, glabrous within, greyish hairy without, margin thickened, tomentose. Petals 2 - 2.5 cm long, oblong-cuneate, narrowed at base, broader at apex, lacinate, canescent within, pilose without. Stamens 30 - 60; filaments 3 - 4 mm long, hairy; anthers 3 - 4 mm long, oblong, puberulous, with 3 - 4 mm long, erect awns. Ovary ovoid, acute to obtuse, smooth; pyrenes terete, strongly tubercled, unilocular, 1-seeded.

*Fl.* Feb. - March; *Fr.* May - June.

*Distrib.* India: In moist evergreen and semievergreen forests between 500 and 1000 m. Assam and Andaman & Nicobar Islands (Nicobar Islands).

Myanmar, Indo-China, Malay Peninsula and Indonesia.

**16. *Elaeocarpus munroii*** (Wight) Masters in Fl. Brit. India 1: 407. 1874. *Monocera munroii* Wight, Ill. Ind. Bot. 1: 83. 1840 & Icon. Pl. Ind. Orient. t. 952. 1845.

Fig. 149.

Kan.: *Kabikki*, *Idanji Mara*; Mal.: *Pungari*; Tam.: *Narebikki*

Trees, up to 50 m tall. Leaves crowded towards ends of branchlets, 5 - 10 x 2.5 - 4.5 cm, ovate, ovate-lanceolate or obovate, rounded and subcordate or truncate at base, caudate-acuminate or acute at apex, crenate-serrate, crenations often with a gland, chartaceous, glabrous, veins prominent beneath; petioles 2.5 - 3.5 cm long, slender, glabrous. Flower-buds ovoid or ovate-lanceolate; flowers white, 1 - 1.5 cm across; pedicels 5 - 15 mm long, glabrous, curved in fruits. Sepals 7 - 9 mm long, linear-lanceolate, acute, almost glabrous. Petals 7 - 9 mm long, elliptic-oblong, narrowed at base, broad at apex, lacinate, silky hairy on both surfaces. Stamens 20 - 40; filaments 1 mm long, pubescent; anthers 3 - 4 mm long, oblong, awns ca 1 mm long, reflexed. Ovary silky pubescent, 2-loculed, ovules 2; styles longer than stamens, tapering, hairy at base. Drupes 1.5 - 2 cm long, ellipsoid, yellowish-green turning to bluish when ripe, smooth, shining; pyrenes unilocular, 1-seeded.

Fl. Sept. - Nov.; Fr. Jan. - April.

*Distrib.* India: In evergreen forests of Western Ghats between 700 and 2000 m. Maharashtra, Karnataka, Tamil Nadu and Kerala; rare.

Endemic.

*Notes.* Fruits are eaten by local people.

**17. *Elaeocarpus petiolatus*** (Jack) Wallich ex Steudel, Nom. Bot. ed. 1: 545. 1840; Corner in Gard. Bull. Str. Settl. 10: 324. 1939. *Monocera petiolata* Jack in Malay. Misc. 1(5): 43. 1820. *Elaeocarpus resinousus* Blume, Bijdr. 122. 1825. *Monocera integra* C. Mueller, Annot. Fam. Elaeocarp. 12. 1849. *Elaeocarpus integra* (C. Mueller) Wallich ex Masters in Fl. Brit. India 1: 408. 1874.

Lus.: *Holthak*; Tipp.: *Hun*

Trees, 20 - 30 m tall; branchlets glabrate. Leaves 7 - 20 x 4 - 9 cm, elliptic-lanceolate or oblong-elliptic, narrowed at base, bluntly acuminate or acute at apex, distantly serrulate or subentire, glabrous, coriaceous, veins prominent; petioles 2 - 6.5 cm long, glabrous, geniculate at apex. Racemes 7 - 12 cm long, axillary, glabrate. Flower buds ellipsoid or oblong-oblong; flowers white, ca 1.5 cm across; pedicels 5 - 12 mm long, curved at apex, puberulous. Sepals 6 - 8 mm long, lanceolate, glabrous without, puberulous and keeled within, margins villous. Petals 7 - 9 mm long, oblong, broad and saccate at base, narrowed at apex, lacinate, silky on both surfaces, ridged in centre.



Fig. 149. *Elaeocarpus munroii* Masters : a. flowering part of branch b. fruits; c. seed.

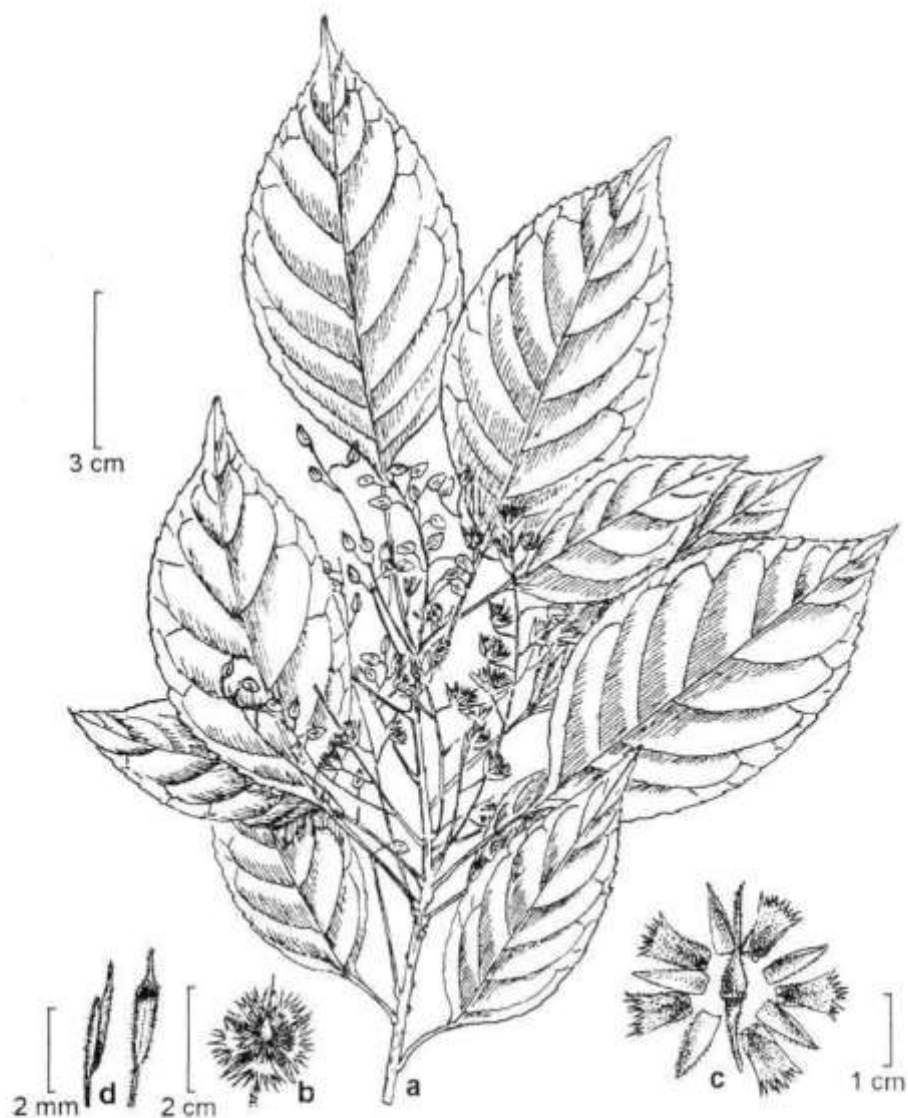


Fig. 150. *Elaeocarpus prunifolius* (C. Mueller) Masters : a. flowering part of branch; b. flower; c. floral parts; d. stamens.

Stamens 20 - 30; filaments shorter than anthers, adpressed pubescent or glabrate; anthers 2 - 2.5 mm long, oblong, shortly awned, awns reflexed, puberulous or glabrescent. Disc of 2 - 10, round, glabrescent glands. Ovary oblong, glabrous, 2-loculed, with 2 superposed rows of ovules; styles slender tapering. Drupes 1.5 - 2 cm long, oblong-ovoid, smooth; pyrenes rugose, tubercled, indistinctly 4-ridged, unilocular, 1-seeded.

*Fl.* Dec. - March; *Fr.* July - Sept.

*Distrib.* India: In moist deciduous forests between 800 and 1000 m. Assam and Andaman & Nicobar Islands.

Bangladesh, Myanmar, Malaysia and Indonesia.

**18. *Elaeocarpus prunifolius*** (C. Mueller) Masters in *Fl. Brit. India* 1: 407. 1874. *Monocera prunifolius* C. Mueller, *Annot. Fam. Elaeocarp.* 15. 1849. **Fig. 150.**

*Kh.*: *Soh-khylllem-ai-blang, Dieng-la-khmar.*

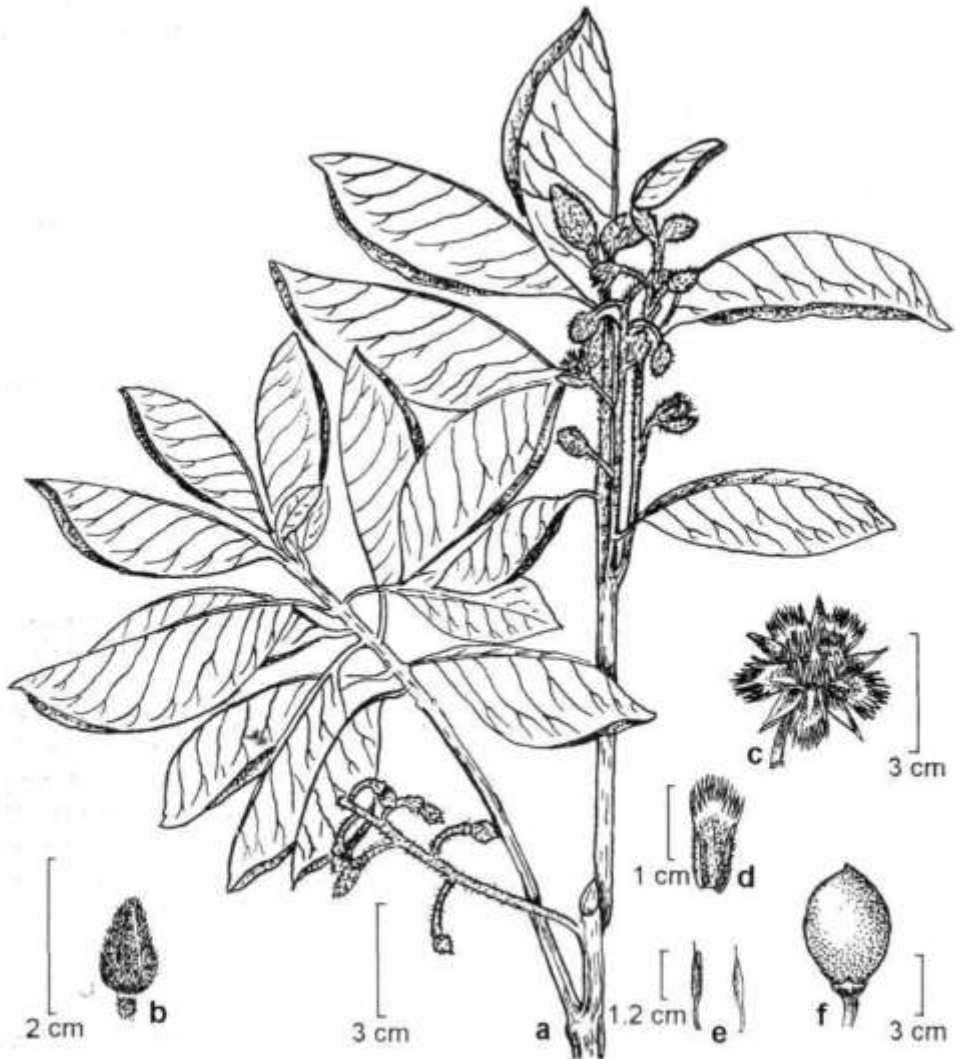
Trees, 5 - 20 m tall; branchlets glabrous. Leaves 5 - 12 x 2 - 3.5 cm, oblong-lanceolate to elliptic-lanceolate, cuneate at base, acute to acuminate at apex, crenate-serrate or subentire, subcoriaceous, glabrous, glands present or absent; petioles 1 - 3 cm long, swollen and geniculate at apex. Racemes 3 - 9 cm long, axillary, silky pubescent, puberulous with age. Flower buds ovoid or oblong-lanceolate, adpressed hairy; flowers white or pale yellow, 5 - 10 mm across; pedicels 5 - 6 mm long; bracts leafy, broadly spatulate, caducous. Sepals 5 - 8 mm long, oblong-lanceolate, pilose or glabrate without, thinly adpressed hairy and distantly pouched at base within, margins villous. Petals 5 - 10 mm long, oblong, broad sacciform with 2 pits at base, narrowed at apex, lacinate, rarely entire, adpressed silky on both surfaces. Stamens 15 - 30, minutely puberulous; filaments short; anthers ca 2 mm long with short awns. Ovary oblong or ovoid, sericeous. Drupes 1.5 - 2 cm long, oblong-ovoid; pyrenes 10 - 12 mm long, ovoid, pointed at tip, rugose, obscurely 3-angled.

*Fl.* Jan. - March; *Fr.* Aug. - Oct.

*Distrib.* India: In moist deciduous and semi evergreen forests between 1000 and 1500 m. West Bengal (Darjeeling), Meghalaya and Manipur.

Bangladesh.

**19. *Elaeocarpus recurvatus*** Corner in *Gard. Bull. Str. Settl.* 10: 319. 1939. *E. ferrugineus* (Wight) Beddome, *Fl. Sylv.* t. 112. 1871, non (Jack) Steudel 1840; Masters in *Fl. Brit. India* 1: 406. 1874. *Monocera ferruginea* Wight, *Icon. Pl. Ind. Orient.* t. 205. 1839, non Jack 1830. **Fig. 151.**



**Fig. 151.** *Elaeocarpus recurvatus* Corner : a. flowering twig; b. flower bud; c. flower; d. petal; e. stamens; f. fruit.

Trees, 30 - 40 cm tall; young parts covered with dense rusty or greyish tomentum of stellate hairs. Leaves 7.5 - 15 x 4 - 7 cm, oblong-ovate or elliptic, cucullate, folded back lengthwise resembling an inverted boat without keel, narrowed at base, shortly acuminate or acute at apex, shallowly serrate, serrations tipped with short hairs, coriaceous, cinnamon tomentose beneath; petioles 1.5 - 2.5 cm long, sometimes up to 4 cm long, stout, thickened at apex, tomentose. Racemes 5 - 10 cm long, axillary, densely rusty tomentose. Flower-buds elliptic; flowers white, 1.5 - 1.8 cm across; pedicels 1.5 - 1.8 cm long, hispid tomentose. Sepals 1.5 cm long, lanceolate, densely tomentose without, glabrous within. Petals 1.5 cm long, oblong-cuneate, narrowed at base, broad at apex, lacinate, appressed long hairy. Stamens 20 - 30; filaments ca 1 mm long, puberulous; anthers 2.5 - 4 mm long, oblong, puberulous, awns ca 1 mm long, slender, erect. Ovary, elliptic or oblong-ovoid, densely hairy, 3-loculed; styles slender. Drupes 1.5 - 1.8 cm long, ovoid or elliptic, fleshy, green, shining; pyrenes 3-loculed.

*Fl.* March - July; *Fr.* July - Feb.

*Distrib.* India: In Shola forests of Western Ghats between 2000 and 2500 m. Tamil Nadu and Kerala; rare.

Endemic.

**20. *Elaeocarpus rugosus* Roxb.** [Hort. Beng 42, 1814, nom. nud.] ex G. Don, *Gen. Hist.* 1: 559, 1831; Masters in *Fl. Brit. India* 1: 405, 1874. *E. apiculatus* Masters in *Fl. Brit. India* 1: 407, 1874. **Fig. 152.**

*Asm.:* *Gatronga, Phulchampa, Bor chopra, Bor potoa*; *Garó:* *Ankhi-ai-phak.*

Trees, 25 - 35 m tall, old trees buttressed at base; branchlets rufous hairy. Leaves usually crowded at ends of branchlets, 16 - 35 x 7 - 15 cm, obovate, oblong or oblanceolate, narrowed and obtuse at base, bluntly apiculate, obtuse or subacute at apex, distantly minute serrate or subentire, coriaceous, glabrous, midrib prominent; petioles 1.5 - 2 cm long on flowering branchlets, shorter on young branchlets, swollen at both ends, puberulous. Racemes 10 - 16 cm long, axillary, pubescent. Flower-buds cylindrical, conical, ovoid or oblanceolate, 5-ribbed; flowers pale white, 1 - 1.5 cm across; pedicels 2 - 2.5 cm long, tomentose; bracts leafy, 2 - 3 cm long, oblanceolate, serrate, caducous. Sepals 1 - 1.5 cm long, linear-lanceolate, acuminate, buff tomentose without. Petals 1 - 1.8 cm long, oblong-cuneate, narrowed at base, broader at apex, tomentose or silky hairy without, glabrous within. Disc a shallow cup, pubescent. Stamens 30 - 60; filaments 1.5 - 2.5 mm long, puberulous; anthers 5 - 6 mm long, oblong, puberulous; awns shorter than anthers, erect or reflexed at length. Ovary oblong-ovoid, silky villous, 2-loculed; styles longer than ovary, tapering above. Drupes 3 - 3.5 cm long, obovoid or oblong, greenish yellow; pyrenes compressed, sharp edged, strongly rugose, unilocular, 1-seeded.

*Fl.* Feb. - April; *Fr.* Sept. - Oct.



Fig. 152. *Elaeocarpus rugosus* Roxb. ex G. Don : a. flowering twig; b. petal;  
c. stamen.



*Distrib.* India: In moist deciduous and evergreen forests between 1000 and 1500 m. Assam, Arunachal Pradesh, Meghalaya, Tamil Nadu and Andaman & Nicobar Islands (Andaman Islands).

Bangladesh, Myanmar and Malaysia.

*Notes.* Masters (l.c.) included Coorg (Karnataka) in distribution under this species, but so far no collection could be traced in any herbaria from that area and is not recorded even in a recent flora of the area (K.R.K. Murthy and S.N. Yoganarasimhan, *Fl. Coorg* 82 - 83. 1990).

**21. *Elaeocarpus serratus* L., Sp. Pl. 515. 1753, 'serrata'; Masters in Fl. Brit. India 1: 401. 1874, p.p.; *E. oblongus* Gaertn., Fruct. Sem. Pl. 1: 202, t. 43. f. 3. 1788; Masters in Fl. Brit. India 1: 403. 1874, non Smith 1809 & Wight 1838. *E. cuneatus* Wight, Ill. Ind. Bot. 1: 83. 1840; Masters in Fl. Brit. India 1: 402. 1874. *E. perim-kara* DC., Prodr. 1: 519. 1824. *Ganitrus sphaericus* Gaertn., Fruct. Sem. Pl. 2: 271. 1791, p.p. *Perin-kara* Rheede, Hort. Malab. 4: 51, t. 24. 1683.**

**Fig. 153.**

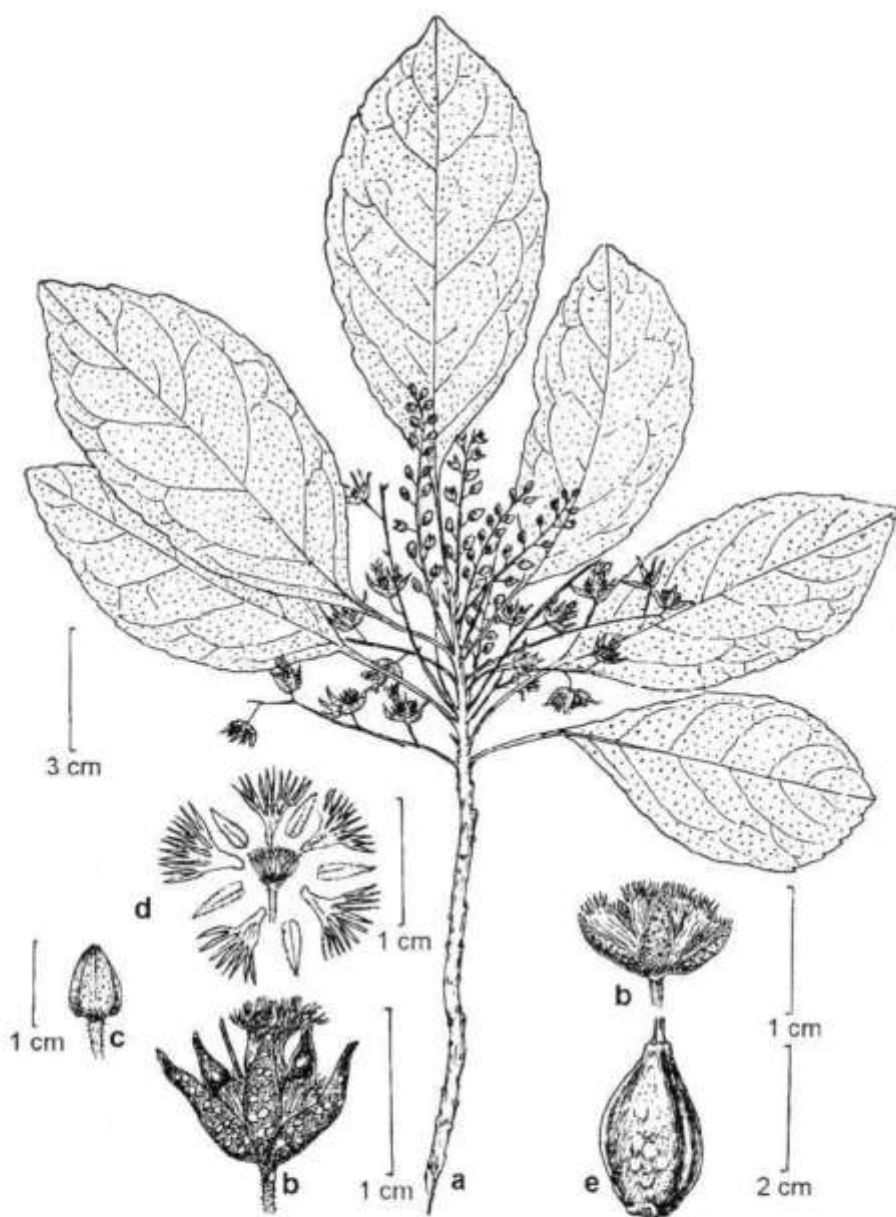
Kan.: *Beejada mara*, *Danda amba*; Mal.: *Nalla karra*, *Valiya Kara*, *Perin kara*; Tam.: *Ularg Karai*; Eng.: *Ceylon Olive*.

Trees, 25 - 30 m tall; branchlets with persistent leaf scars. Leaves 5 - 13 x 2.5 - 6 cm, oblong, obovate or elliptic, cuneate, acute or obtuse at base, acute, obtuse or shortly acuminate at apex, repand-serrate or crenate, coriaceous, glabrous, veins prominent beneath; pustulate when dry; petioles 2 - 3 cm long, glandular pubescent, rarely glabrous. Racemes 4 - 8 cm long, axillary, drooping, pustulate. Flower buds ovoid-lanceolate or ovoid-conical; flowers creamy white, pedicels 8 - 10 mm across; 8 - 10 mm long, pubescent initially becoming puberulous and pustulate. Petals 7 - 8 mm long, obovate, cuneate, narrowed at base, lacinate, glabrous, occasionally pustulate. Stamens 30 - 35; filaments ca 1 mm long, puberulous; anthers ca 2 mm long, oblong, puberulous, bearded. Disc thick, glandular woolly. Ovary oblong or obovoid, pilose, 2 - 3-loculed; styles 3 - 4 mm long, subulate, hairy; stigmas entire. Drupes 2.5 - 3.5 cm long, oblong-obovoid or ellipsoid, obtuse at apex, greenish yellow; pyrenes 2 - 2.5 cm long, oblong, acute at apex, rugose or tuberculate, 1 - 2 (- 3)-loculed, 1 - 2-seeded.

*Fl.* March - June; *Fr.* July - Oct.

*Distrib.* India: In moist deciduous to semievergreen forests of Western Ghats, 1500 m. Maharashtra, Karnataka, Tamil Nadu, Kerala and Sikkim.

Sri Lanka, Nepal, Bhutan, Myanmar, China, Malaysia and Indonesia (Java).



**Fig. 153.** *Elaeocarpus serratus* L. : a. flowering twig; b. flower; c. flower bud; d. floral parts; e. fruit.

*Notes.* Fruits are eaten and also pickled by local people. Wood suitable for packing cases and match boxes. Leaves used for treating rheumatism and as an antidote for poison.

**22. *Eleaocarpus sikkimensis* Masters in Fl. Brit. India 1: 402. 1874.**

Asm.: *Seleng*; Nep.: *Bhadrase*.

Trees, 10 - 20 m tall; branchlets pubescent. Leaves 13 - 20 x 6 - 9 cm, ovate-oblong or elliptic, acute to cuneate at base, acute or acuminate at apex, distinctly cuspidate, serrate, glabrous, thinly coriaceous, often with glands in axils of lateral veins along midrib; petioles 2 - 6 cm long, thickened at both ends, with 2 leafy processes at apex. Racemes 6 - 10 cm long, axillary, pilose. Flower-buds ovate-lanceolate, pointed, sericeous, subtended by subsistent, boat-shaped, hairy bracteoles; flowers white, 6 - 8 mm across; pedicels 7 - 15 mm long, hairy. Sepals lanceolate, sparsely pilose to adpressed pubescent outside, glabrous and keeled within. Petals white, obtriangular, lacinate, glabrous. Stamens 20 - 30, ca 4 - 5 mm long; anthers bearded at apex. Disc thick, obscurely lobed, sericeous. Ovary conical, sericeous, 3-loculed; styles persistent. Drupes 4 - 4.5 cm long, ellipsoid to oblongoid; pyrenes ovoid-ellipsoid, tubercled, 3-loculed.

*Fl.* Jan. - March; *Fr.* July - Aug.

*Distrib.* India: In semievergreen forests between 1500 and 2000 m. West Bengal (Darjeeling), Sikkim and Assam.

Bhutan.

*Notes.* The chromosome number reported for the species is  $2n = 24$  (Arora, in Bull. Bot. Surv. India 1: 37. 1961).

**23. *Eleaocarpus sphaericus* (Gaertn.) K.Schumann in Engler & Prantl, Nat. Pflanzenfam. 3, 6: 5. 1890; Santapau in Rec. Bot. Surv. India 16: 32. 1953. *Ganitrus sphaericus* Gaertn., Fruct. Sem. Pl. 2: 271, t. 139. 1791, p.p.; Wight, Icon. Pl. Ind. Orient. 1: 66. 1838. *Eleaocarpus ganitrus* Roxb. [Hort. Beng. 42. 1814, nom. nud.] ex G. Don, Gen. Hist. 1: 559. 1831; Roxb., Fl. Ind. 2: 592. 1822; Masters in Fl. Brit. India 1: 400. 1874. **Fig. 154.****

Asm.: *Rudrai*; Beng.: *Rudrakya*, *Rudraksh*; Guj., Hindi, Mal. & Sans.: *Rudraksh*; Kan.: *Rudrakshi*; Kh.: *Soh Langskei*; Tam.: *Akkam*, *Rudrakai*; Tel.: *Rudrakshalu*; Eng.: *Wooden beggar bead*, *The Utrasum bead tree*.

Trees, 20 - 40 m tall, often buttressed at base; young parts puberulous. Leaves 7 - 15 x 2.5 - 5 cm, oblong-lanceolate, oblanceolate or elliptic, cuneate or acute at base, acute or acuminate at apex, minutely crenate-serrate or subentire, thinly sericeous becoming



Fig. 154. *Elaeocarpus sphaericus* (Gaertn.) K. Schumann : a. fruiting twig; b. nut; c. part of inflorescence.

glabrous, often with glands at the branches of lateral nerves beneath, chartaceous; petioles 1 - 1.5 cm long, sharply margined, pubescent. Racemes 5 - 8 cm long, axillary, drooping, glabrous. Flower-buds ovoid-conical; flowers white, 8 - 10 mm across, nodding; pedicels 8 - 9 mm long, hairy. Sepals 6 - 7 mm long, linear-lanceolate or oblong, acuminate, silky canescent outside, 1-ribbed inside. Petals white, 7 - 9 mm long, oblong or obtriangular lacinate, pubescent along margins near base. Stamens 30 - 40; filaments ca 1 mm long, puberulous; anthers 2.5 - 4 mm long, puberulous, acuminate bearing short, white bristles at apex, locules unequal. Ovary globose, silky villous, 4 - 5-loculed, rarely 1 - 4 or 6 - 10-loculed; styles longer than stamens. Drupes 1.5 - 2.5 cm across, globose, deep blue or purple and succulent when ripe, mealy outside, usually 5-loculed; pyrenes globose, usually 5-locular, rarely 1 - 4- or 6 - 10-locular, 5-seeded, strongly tubercled and marked with as many longitudinal furrows as locules.

*Fl.* Jan. - March & Aug. - Sept.; *Fr.* April - July & Oct. - Dec.

*Distrib.* India: In moist evergreen forests between 1500 and 2000 m. Bihar, West Bengal (Darjeeling), Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur and Maharashtra.

Nepal, Bangladesh, Myanmar and Malaya.

*Notes.* The sour fruit pulp is edible; the stones are used as beads for rosaries, bracelets and necklaces. Sometimes cultivated for its tubercled stones.

**24. *Elaeocarpus stapfianus*** Gagnepain in Lecomte, *Nat. Syst.* 1: 136. 1910; Kanjilal *et al.*, *Fl. Assam* 1: 179. 1934.

Trees, 15 - 20 m tall. Leaves 10 - 15 x 3.5 - 6 cm, oblong or oblong-obovate, narrowed at base, obtusely acuminate at apex, distantly serrulate or subentire, thinly coriaceous, glabrous; petioles 1 - 2.5 cm long. Racemes 4 - 7 cm long, axillary, few-flowered. Flower buds ovoid, acute, glabrescent; flowers white, 1.5 - 2 cm across; pedicels 2 - 3 cm long; bracts minute, caducous. Sepals 1.5 - 1.7 cm long, glabrescent or sparsely pubescent without. Petals 1.5 - 2 cm long, narrowed at base, broad at apex, tip 2-lobed, lacinate into many segments, silky pilose. Stamens 20 - 25; filaments shorter than anthers, pubescent; anthers 4 - 6 mm long with equally long awns. Ovary oblong-ovoid, sericeous, 2-loculed. Drupes 3 - 4 cm long, ovate to oblong; pyrenes 2.5 cm long, pointed at both ends, compressed, muricate, margins ridged; ridges denticulate, unilocular.

*Fl.* March - April; *Fr.* June - Aug.

*Distrib.* India: In semievergreen forests between 800 and 1000 m. Arunachal Pradesh.

Indo-China.



Fig. 155. *Elaeocarpus tectorius* (Lour.) Poiret : a. flowering twig; b. flower; c. fruit.

**25. *Elaeocarpus tectorius* (Lour.) Poiret in Lam., Encycl. Suppl. 2: 704. 1812. *Craspedum tectorium* Lour., Fl. Cochinch. 336. 1790. *Elaeocarpus oblongus* auct. non Gaertn. 1788 & Wight & Arn. 1834; Smith in Rees, Cyclop 12: n. 2. 1809. *E. leptostachyus* Wallich [Cat. No. 2672. 1831, nom. nud.] ex C. Mueller, Anot. Fam. Elaeocarp. 23. 1849; Masters in Fl. Brit. India 1: 403. 1874. *E. robustus* Roxb., [Hort. Beng. 42. 1814, nom. nud.] Fl. Ind. 2: 597. 1832; Masters in Fl. Brit. India 1: 402. 1874, p.p. **Fig. 155.****

Asm.: *Poreng, Seleng*; Garo: *Agong, Bolrogong*; Kan.: *Hinnalatorde*; Kh.: *Dien-glasw*; Mal.: *Kattu Kara, Malam Kara*; Or.: *Nard champa, Panasia, Patragundi*; Tam.: *Bikki*.

Trees, 15 - 35 m tall, with aerial roots at base in swampy places; branchlets rusty pubescent. Leaves 6 - 24 x 3 - 8.5 cm, elliptic-oblong to ovate-oblong, broadly cuneate to rounded at base, acute to acuminate at apex, repand-serrate, veins prominent beneath, coriaceous, rusty pubescent when young, glabrous with age; petioles 1 - 5 cm long, thickened at both ends, often with 2 glands near apex, glabrous. Racemes 4 - 15 cm long, axillary, pubescent. Flower-buds oblong-ovoid, acute; flowers white, 10 - 12 mm across; pedicels 5 - 7 mm long, grey puberulous. Sepals 5 - 6 mm long, lanceolate or ovate, acute, densely villous along margins. Petals 5 - 7 mm long, cuneate-oblong or obtriangular, lacinate at apex, ciliate along margins. Stamens 40 - 50; filaments 1 - 3.5 mm long, glabrous or minutely puberulous; anthers ca 1 mm long, oblong, puberulous, rarely with a few bristles at apex. Disc thick, 5-lobed, tomentose. Ovary, oblong to ovoid, downy, 3-loculed; styles ca 2 mm long, hairy. Drupes 2 - 3.5 cm long, ellipsoid or oblong-ovoid, greenish-yellow; pyrenes 2 - 3-locular, with 2 longitudinal grooves prominently rugose, locules 1-seeded.

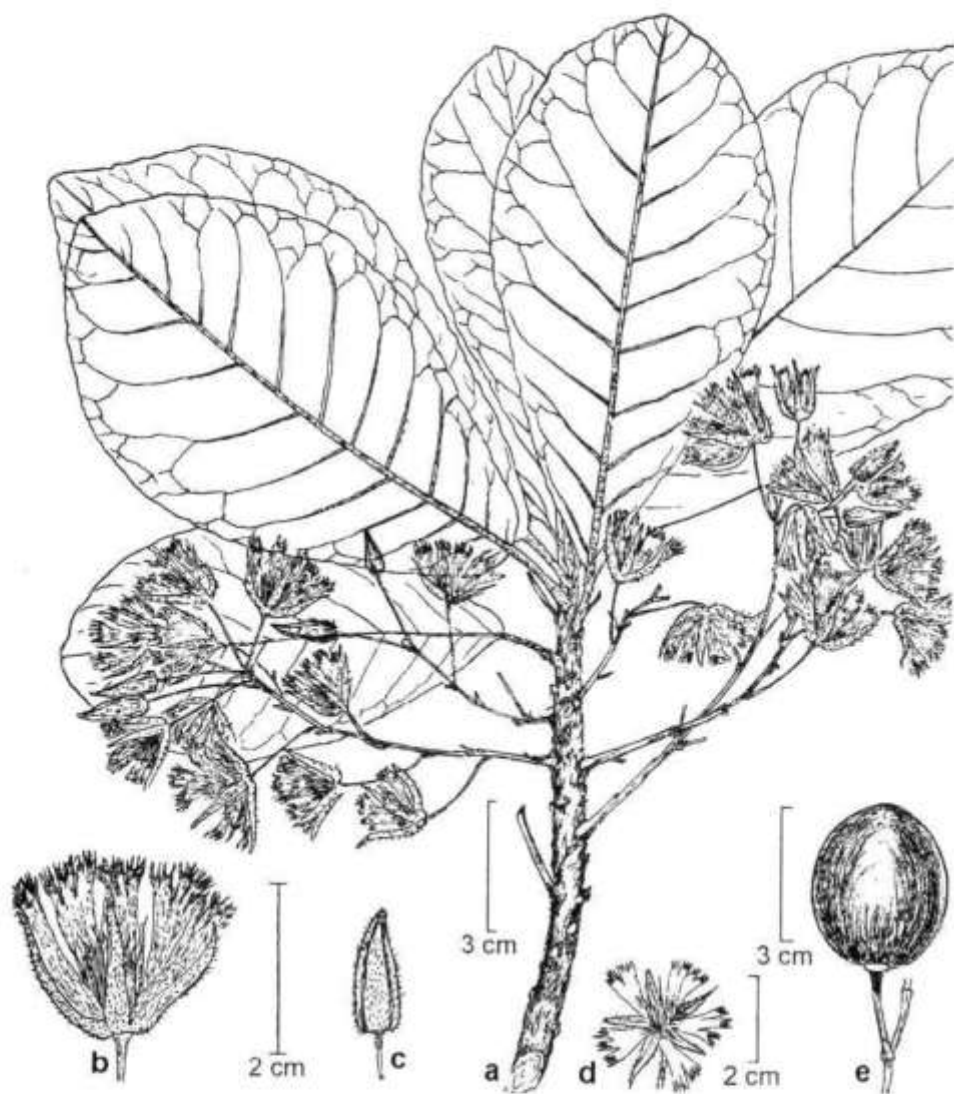
*Fl.* May - June; *Fr.* Aug. - Oct.

*Distrib.* India: In moist deciduous and evergreen forests between 1500 and 2000 m. Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Orissa, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands (Andaman Islands).

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, Indo-China, China, Malaysia and Indonesia (Sumatra).

**26. *Elaeocarpus tuberculatus* Roxb., [Hort. Beng. 93. 1814, nom nud. ] Fl. Ind. 2: 594. 1832; Masters in Fl. Brit. India 1: 404. 1874. *Monocera tuberculata* (Roxb.) Wight & Arn., Prodr. 83. 1834. **Fig. 156.****

Kan.: *Bhutali, Dandemara*; Mar.: *Rudrak*; Tam.: *Rutthracham*; Mal.: *Pilahi, Naggara*, Eng.: *Deccan olive*.



**Fig. 156.** *Elaeocarpus tuberculatus* Roxb. : a. flowering twig; b. flower; c. flower bud; d. fruit.



Trees, 80 - 90 m tall, occasionally buttressed at base; bark grey and white mottled; wood brown streaked with darker colour. Leaves crowded at ends of branchlets, 6 - 20 x 4 - 12.5 cm, obovate, narrowed, rounded or truncate at base, rounded to obtuse, sometimes retuse or acute at apex, obscurely crenate-dentate, or subentire, subcoriaceous, glabrous, veins prominent beneath, midrib rufous hairy; petioles 1.5 - 4 cm long, thickened at apex, rufous hairy. Racemes 3 - 12 cm long, axillary, rufous hairy. Flower buds lanceolate, ribbed; flowers 2 - 2.5 cm across, drooping; pedicels 1.5 - 2.5 cm long, softly rufous tomentose, recurved. Sepals 1 - 1.5 cm long, linear-lanceolate or oblong, acute, hairy. Petals 1.5 - 2 cm long, oblong-cuneate, narrowed at base, broader at apex, lacinate, silky hairy without. Stamens 40 - 80; filaments 1.5 - 2 mm long, pubescent; anthers 4 - 6 mm long, oblong, puberulous, with awns almost as long as anthers. Ovary oblong, silky tomentose, 2-locular; styles hairy at base. Drupes 2 - 4 cm long, ovoid, smooth; pyrenes terete, tubercled, 1 - 2-loculed.

*Fl.* Dec. - Feb.; *Fr.* May - Oct.

*Distrib.* India: In evergreen forests between 1000 and 1500 m Maharashtra, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands (Andaman Islands); rare.

Malaysia.

*Notes.* Nuts used as a substitute of 'Rudraksha' (*Elaeocarpus sphaericus*); used as beads for rosaries, necklaces and bracelets. Wood used for planking, packing cases and splints.

**27. *Elaeocarpus varunua*** Buch.-Ham. [in Wallich, Cat. No. 2666g, h. 1831, nom. nud.] ex Masters in Fl. Brit. India 1: 407. 1874.

*Asm.:* Bhadraik or Bhadraksha, Niganibual; *Kh.:* Dieng-ri-lam, Dieng-Si-sah, Dieng-Soh-Dhakap; *Naga:* Pong - o - test; *Nep.:* Bhadrase.

Trees, 10 - 25 m tall; branchlets grey silky pilose. Leaves 7 - 26 x 3 - 7.5 cm, elliptic or elliptic-oblong, subacute or rounded at base, finely acuminate at apex, cuspidately crenate-serrate, glabrous above, sparsely pubescent on veins beneath, often with glands in axils of lateral veins towards the margin, chartaceous or thinly coriaceous; petioles 3 - 6.5 cm long, thickened and geniculate at apex, glabrescent. Flower-buds lanceolate or ovoid-lanceolate; flowers white, ca 1.5 cm across; pedicels 5 - 12 mm long, stout, curved, sericeous. Sepals 6 - 7 mm long, lanceolate, narrowly triangular or ovate-lanceolate, silky tomentose. Petals white, 5 - 6 mm long, oblong, broad and thickened at base, narrowed at apex, lacinate, pale and silky below apex outside. Stamens 25 - 30; filaments 5 - 8 mm long; anthers shortly awned, awns reflexed, puberulous. Disc 10-lobed, red. Ovary ovoid-oblong, villous. Drupes 1.5 - 2 cm long, oblong to oblong-ovoid, rounded at ends, shining; pyrenes subterete, pointed at base, 3-grooved, finely rugose, hirsute, unilocular.

*Fl.* Feb. - April; *Fr.* July - Oct.

*Distrib.* India: In semievergreen forests between 1000 and 1500 m. Uttar Pradesh(Kumaon), West Bengal(Darjeeling), Sikkim, Assam, Arunachal Pradesh, Meghalaya and Nagaland.

Nepal, Bangladesh, Myanmar and Malaya.

*Notes.* Wood suitable for making tea boxes.

**28. *Elaeocarpus venustus*** Beddome, *Fl. Sylv.* t. 174. 1872. *E. monocera* auct. non Cav. 1800; Masters in *Fl. Brit. India* 1: 405. 1874, p.p.

Tam.: *Tamarai*

Trees, 10 - 15 m tall; branchlets glabrous. Leaves 6 - 12 x 3 - 5 cm, elliptic or obovate, attenuate at base, acute at apex, minutely cuspidate-serrate, glabrous, coriaceous, veins prominently impressed above, axils of primary veins with glands beneath; petioles 1 - 2 cm long, glabrous. Racemes 4 - 7 cm long, axillary, glabrous. Flower-buds ovoid or ovoid-lanceolate, acute; flowers white, 2 - 2.5 cm across; pedicels 1.5 - 2 cm long, glabrous. Sepals 1 - 1.5 cm long, lanceolate, glabrous without, pubescent within. Petals 1.5 - 2 cm long, narrowed at base, broader at apex, laciniate, silky without and at base within. Stamens 30 - 50; anthers minutely puberulous, shortly awned or mucronate. Disc 10-lobed. Ovary oblong, pubescent, 2-loculed. Drupes 4 - 5 x 2.5 cm, oblong-ovoid, smooth, shining green; pyrenes ovoid, tubercled, unilocular.

*Fl.* July - Sept.; *Fr.* Oct. - Dec.

*Distrib.* India: In evergreen forests of Western Ghats between 1000 and 1500 m. Tamil Nadu and Kerala; rare.

Endemic.

*Notes.* The trees are handsome and are potential ornamental and shade plants for their large white flowers and evergreen foliage.

**29. *Elaeocarpus wallichii*** Kurz in *J. Asiat. Soc. Beng.* 43: 133. 1874; Kanjilal *et al.*, *Fl. Assam* 1: 174. 1934.

Trees, 15 - 30 m tall; stems sometimes stilted on aerial roots; branchlets greyish or tawny tomentose. Leaves 15 - 25 x 7 - 12 cm, oblong to elliptic or obovate-oblong, rounded at base, acuminate at apex, distantly serrate or subentire, glabrous above, puberulous or tawny tomentose; petioles 2 - 5 cm long, geniculate, often with 2 glands at apex. Racemes 10 - 20 cm long, axillary, tomentose. Flower-buds ovoid; flowers white,

5 - 6 mm across; pedicels 7.5 - 10 mm long, puberulous. Sepals 2 - 5 mm long, lanceolate or oblong-lanceolate, acute. Petals 4 - 5 mm long, cuneate, laciniate, glabrous. Stamens 20 - 30; anthers bearded. Ovary oblong-ovoid, villous, 3-loculed. Drupes oblong-ovoid, 2 cm long; pyrenes tubercled.

*Distrib.* India: In moist deciduous forests between 800 and 1000 m. Assam(Goalpara) and Orissa.

Myanmar.

#### DOUBTFUL SPECIES

***Elaeocarpus dubius*** A. DC., Bull. Herb. Boiss. ser. 2, 3: 366. 1907: G.H. Spare & Fischer in Kew Bull. 1931: 282. 1931

Spare & C. Fischer, while reporting plants new to Assam, reported this species from Mishmi, Delei Valley (3000 - 4000 ft), based on a collection of Kingdon-Ward(No. 8125). They reported flowering in April. The species was collected from "precipitous well wooded slope in a jungle filled ravine". The collection of Kingdon-Ward could not be located and so far no specimens of this species could be seen in any of the Indian herbaria.

#### 2. *Sloanea* L.

Trees. Leaves simple, alternate, entire, subentire or serrate, pinnately veined, often with tufts of hairs in axils of veins beneath; petioles often swollen and geniculate; stipules small, linear, rarely large, foliaceous, caducous. Flowers axillary, solitary or fascicled, rarely cymes or racemes. Flowers pale white, often fragrant. Sepals 4(- 5), free or connate at base, valvate or imbricate. Petals 4(- 5), distinct or sepaloid or absent, free, rarely connate at base, entire or variously laciniate. Stamens numerous, free; filaments long or short, hairy; anthers linear or oblong, hairy, awned or not, 2-loculed, dehiscing by transverse slits at apex. Disc thick, broad, flat or cushion-shaped. Ovary superior, sessile, tomentose, 2 - 7-loculed, with numerous ovules in each locule; styles short or long, subulate, often twisted, hairy at base; stigmas entire. Fruits 2 - 5(- 7)-valved woody capsules; valves smooth or covered with bristles or spines; spines simple, broad-based, glabrous or hairy, deciduous or persistent; locules 2 - 4-seeded, rarely 1-seeded. Seeds ovoid, usually artillate, testa bony, shining.

Tropical Asia including East and South East Asia, Australia and America, ca 120 species; 4 in India.

*Literature.* COODE, M.J.E. (1983). A conspectus of sloanea (Elaeocarpaceae) in the Old world. Kew Bull. 38: 347 - 427. SMITH, C.E. (1954). The New World of species of Sloanea (Elaeocarpaceae). Contr. Gray Herb. 175: 1 - 114. TIREL, C. (1980). Nouvelles Caledonia. Adansonia 2, 20: 91 - 106.

*Notes.* Hutchison in his *The Genera of flowering plants*, vol. 2(1967) treats *Sloanea* L. (1753) to be distinct from *Echinocarpus* Blume(1825) on the basis of sepals being imbricate in 2 series in *Echinocarpus* and valvate in 1 series in *Sloanea*. According to him, the species distributed in Old World i.e. Eastern and S.E. Asia, Australia etc. belong to *Echinocarpus* and those distributed in the New World belong to *Sloanea*. and this was followed by Santapau & Henry (*Dictionary of the flowering plants in India* 1973). However, Airy shaw (in J.C. Willis, *A Dictionary of the flowering plants and ferns*, 1973) treats both as congeneric, merging *Echinocarpus* under *Sloanea* and this view is followed in this flora.

#### KEY TO THE SPECIES

- |     |   |                           |
|-----|---|---------------------------|
| 1a. | Capsules covered with dense, decicuous spines; spines parallel-sided or clavate, 2 - 3 mm long    | 2                         |
| b.  | Capsules covered with lax, persistent spines; spines broad-based, pointed, 8 - 12 mm long or more | 3                         |
| 2a. | Leaves glabrous beneath or with a few hair tufts; petioles glabrous; capsules 2 - 3 cm long       |                           |
|     |   | 1. <i>S. dasycarpa</i>    |
| b.  | Leaves tomentose beneath; petioles tomentose; capsules 3.5 - 4.5 cm long                          |                           |
|     |   | 4. <i>S. tomentosa</i>    |
| 3a. | Leaves 5 - 10 x 1.5 - 3.5 cm; petioles up to 2.5 cm long  |                           |
|     |   | 2. <i>S. signum</i>       |
| b.  | Leaves 12.5 - 25 x 5 - 10 cm; petioles 3.5 - 5 cm long  |                           |
|     |   | 3. <i>S. sterculiacea</i> |

1. *Sloanea dasycarpa* (Benth.) Hemsley in Hook., *Icon. Pl.* 27: 2, t. 2628. 1901.  
*Echinocarpus dasycarpus* Benth. in J. Linn. Soc. 5. Suppl. 2: 73. 1861; Masters in *Fl. Brit. India* 1: 400. 1874. Fig. 157.

Nep.: *Gobria*, *Gobre*.

Trees, 50 - 60 m tall; branchlets minutely hairy, often sulcate. Leaves usually crowded at tips of branchlets, 10 - 20 x 4 - 6.5 cm, elliptic-oblong, obovate or lanceolate, cuneate or rounded at base, acute or shortly acuminate at apex, serrulate or entire, veins prominent beneath, glabrous or with tufts of hairs in the axils of veins along midrib beneath, coriaceous; petioles 1 - 3.5 cm long, swollen at both ends, glabrous. Flowers yellowish-white, 1 - 3.5 cm across; axillary, solitary; pedicels 3 - 4.5 cm long, elongating in fruit, puberulous. Sepals 4, 7 - 8 mm long, unequal, broadly ovate to ovate-lanceolate or elliptic, tomentose outside. Petals 4, pale or creamy yellow, 10 - 12 mm long, obovate, variously cut at apex, pubescent. Stamens many; filaments 3.5 - 5 mm long, densely hairy; anthers 2 - 2.5 mm long, oblong, apiculate or shortly acuminate to acute, pubescent. Disc flattened, pitted. Ovary 2.5 - 3 mm long, ovoid, villous, 4-loculed; styles 4.5 - 7 mm long. Capsules ca 3 cm across, globose-ovoid, 4 - 5-valved, woody, covered with dense, short, deciduous spines; spines 2 - 3 mm long. Seeds ca 6 mm long, oval, black, with red aril.

*Fl.* July - Nov.; *Fr.* Jan. - March.

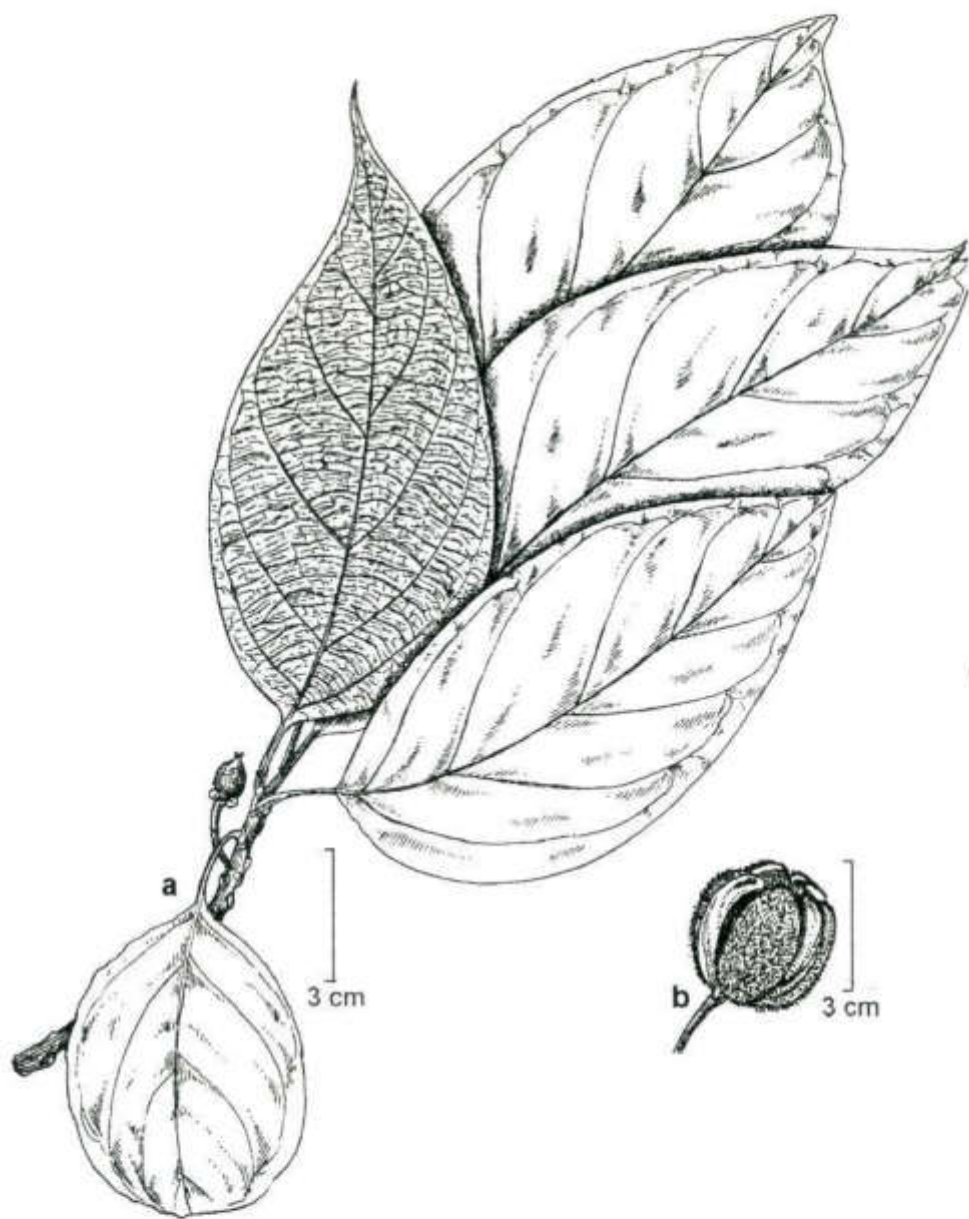


Fig. 157. *Sloanea dasycarpa* (Benth.) Hemsley : a. fruiting twig; b. fruit.

*Distrib.* India: In moist evergreen forests between 1500 and 2000 m. West Bengal(Darjeeling), Sikkim, Assam, Meghalaya and Nagaland.

Nepal, Bhutan, Myanmar and China(Yunan).

*Notes.* Wood used for planking and for making tea chests.

**2. *Sloanea sigun*** (Blume) Schumann in Engler & Prantl, Nat. Pflanzenfam. 3, 6: 5. 1890. *Echinocarpus sigun* Blume, Bijdr. 56. 1825. *E. murex* Benth. in J. Linn. Soc. 5. Suppl. 2: 71. 1861; Masters in Fl. Brit. India 1: 399. 1874.

Trees, 20 - 25 m tall, sometimes buttressed; branches lenticellate, glabrous. Leaves crowded at tips of branchlets, 5 - 10 x 1.5 - 3.5 cm, oblong, oblong-lanceolate, oblong-elliptic or obovate, rounded or obtuse at base, acuminate or acute at apex, entire or subentire, glabrous, chartaceous, midrib raised on both surfaces; petioles 1.5 - 2.5 cm long, swollen at both ends, glabrous. Flower-buds ovoid; flowers creamy-white, 1.5 - 3 cm across, axillary, solitary; pedicels 2 - 3 cm long, puberulous. Sepals 4, 6 - 8 mm long, broadly ovate, acute, puberulous. Petals 4, 7 - 9 mm long, oblong, variously cut at apex, puberulous. Stamens many; filaments 2 - 3 mm long, hairy; anthers 2 - 3 mm long, oblong, with 2 - 3 mm long awns. Disc thick, broad, flattened, pitted. Ovary ovoid, 3 - 4-loculed, densely velvety; styles 5 - 9 mm long. Capsules 3.5 - 5.5 cm long, ovoid, yellowish, 3 - 4-loculed with 1 - 4 seeds in each locule, 4 - 5-valved; valves woody, downy, covered with 8 - 12 mm long spines, spines; dilated at base. Seeds ovoid to oblongoid, black with red waxy aril.

*Fr.* April - July; *Fr.* Aug. - Oct.

*Distrib.* India: In moist evergreen forests between 1000 and 1500 m. Meghalaya.

Myanmar, Thailand, Malay Peninsula and Indonesia.

**3. *Sloanea sterculiacea*** (Benth.) Rehder & Wilson in Sarg., Pl. Wilson. 2: 362. 1916, p.p. *Echinocarpus sterculiaceus* Benth in J. Linn. soc. 5 Suppl 2: 72. 1861; Masters in Fl. Brit. India 1: 400. 1874.

Trees, 20 - 25 m tall, often buttressed; branchlets glabrous or tomentose. Leaves 12.5 - 25 x 5 - 10 cm, ovate, obovate or elliptic-oblong or oblanceolate, cuneate, rounded or subcordate at base, acute to abruptly short acuminate at apex, serrulate, glabrous or tomentose beneath, veins prominent beneath, coriaceous; petioles 3.5 - 5 cm long, somewhat thickened and geniculate at apex, glabrous or finely pelted. Flowers creamy white, 2 - 3 cm across, axillary, solitary, or in few-flowered fascicles; pedicels 2 - 4 cm long. Sepals 4, 6 - 9 mm long, unequal, ovate or oblong, tomentose. Petals 4, 6 - 9 mm long, oblong or suborbicular, variously cut at apex, pubescent. Stamens numerous; filaments 2 - 4 mm long, densely hairy; anthers 2 - 3 mm long, linear or oblong, shortly

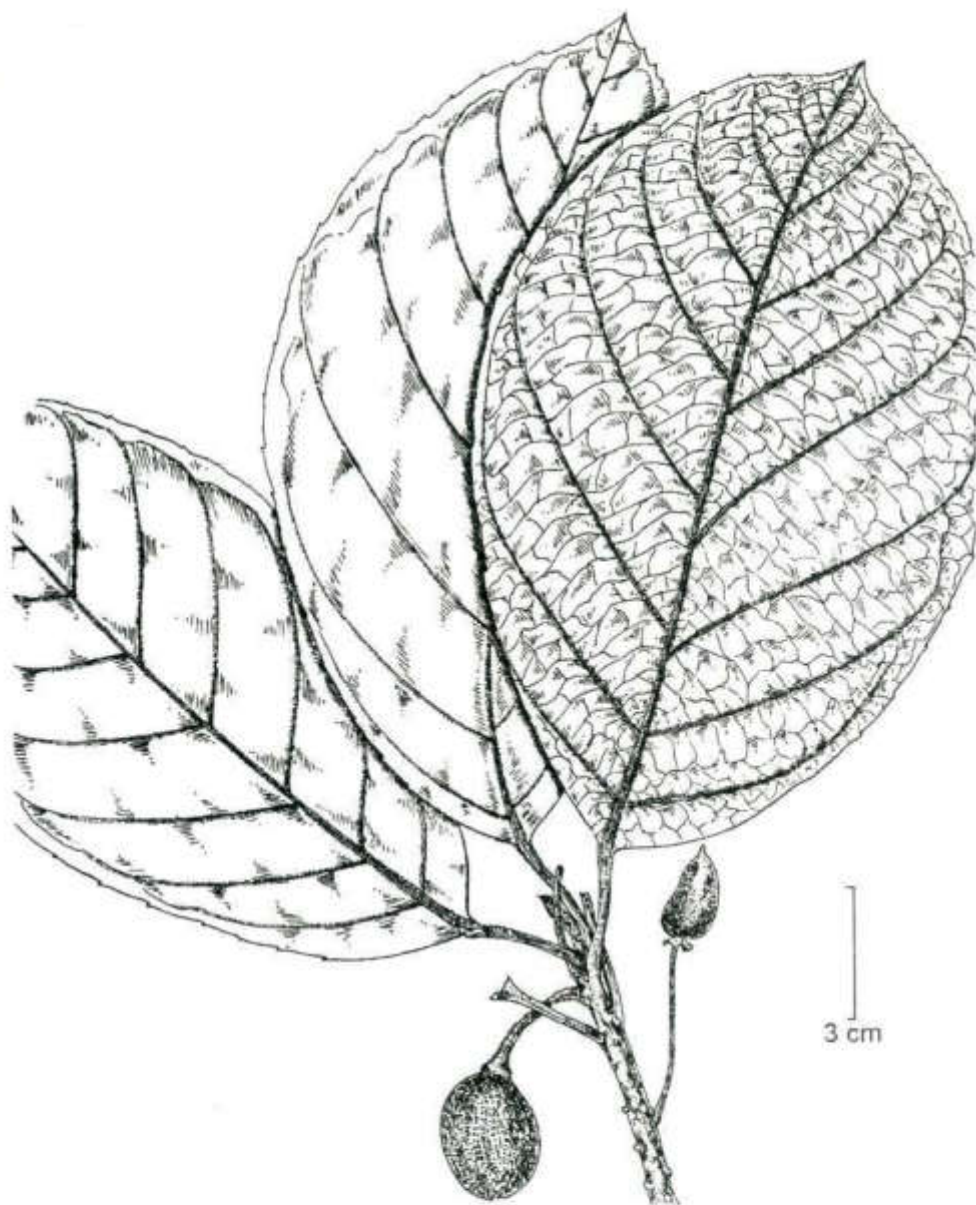


Fig. 158. *Sloanea sterculiacea* (Benth.) Rehder & Wilson var. *sterculiacea*.

awned. Disc flattened, pitted. Ovary globose or ovoid, densely tomentose, 4-loculed; styles 5 - 6 mm long, subulate, hairy at base, sometimes twisted at apex. Capsules 4.5 - 7 cm across, globose to ovoid, pendulous, 4 - 5-valved; valves covered with dense, pointed, 1 - 2 cm long, stiff spines, valves up to 4-seeded.

#### KEY TO THE VARIETIES

- 1a. Leaves elliptic-oblong, shortly acuminate, glabrous or slightly puberulous beneath; petioles glabrous. Pedicels glabrous or sparsely puberulous 3.1. var. **assamica**  
 b. Leaves ovate to obvate, acute, tomentose beneath; petioles and pedicels tomentose 3.2. var. **sterculiacea**

**3.1. var. assamica** (Benth.) Coode in Kew Bull. 38: 387. 1983. *Echinocarpus assamicus* Benth. in J. Linn. Soc. 5. Suppl. 2: 72. 1861; Masters in Fl. Brit. India 1: 399. 1874. *Sloanea assamica* (Benth.) Rehder & Wilson in Sarg. Pl. 1: Wilson. 2: 362. 1916.

Asm.: *Joba-hingori, Phul-hingori.*

Fl. Oct. - Nov.; Fr. Jan. - April.

*Distrib.* India: In moist deciduous forests between 800 and 1000 m. West Bengal (Darjeeling), Sikkim, Assam, Arunachal Pradesh and Meghalaya.

Bhutan and Myanmar.

**3.2. var. sterculiacea**

**Fig. 158.**

Nep.: *Beng. Gobre.*

Fl. Sept. - Nov.; Fr. Jan. - April.

*Distrib.* India: In moist deciduous forests between 600 and 1000 m. Uttar Pradesh (Kumaon), Sikkim and Assam.

Nepal, Bhutan, Bangladesh, Myanmar and China (Yunnan).

**4. Sloanea tomentosa** (Benth.) Rehder & Wilson in Sarg., Pl. Wilson. 2: 362. 1916. *Echinocarpus tomentosus* Benth. in J. Linn. Soc. 5 Suppl. 2: 72. 1861; Masters in Fl. Brit. India 1: 400. 1874. **Fig. 159.**

Nep.: *Runche.*

Trees, 30 - 40 m tall; branchlets densely brown tomentose. Leaves often crowded at tips of branchlets, 15 - 22 x 7 - 10 cm, elliptic or ovate, acute or narrowed to subcordate



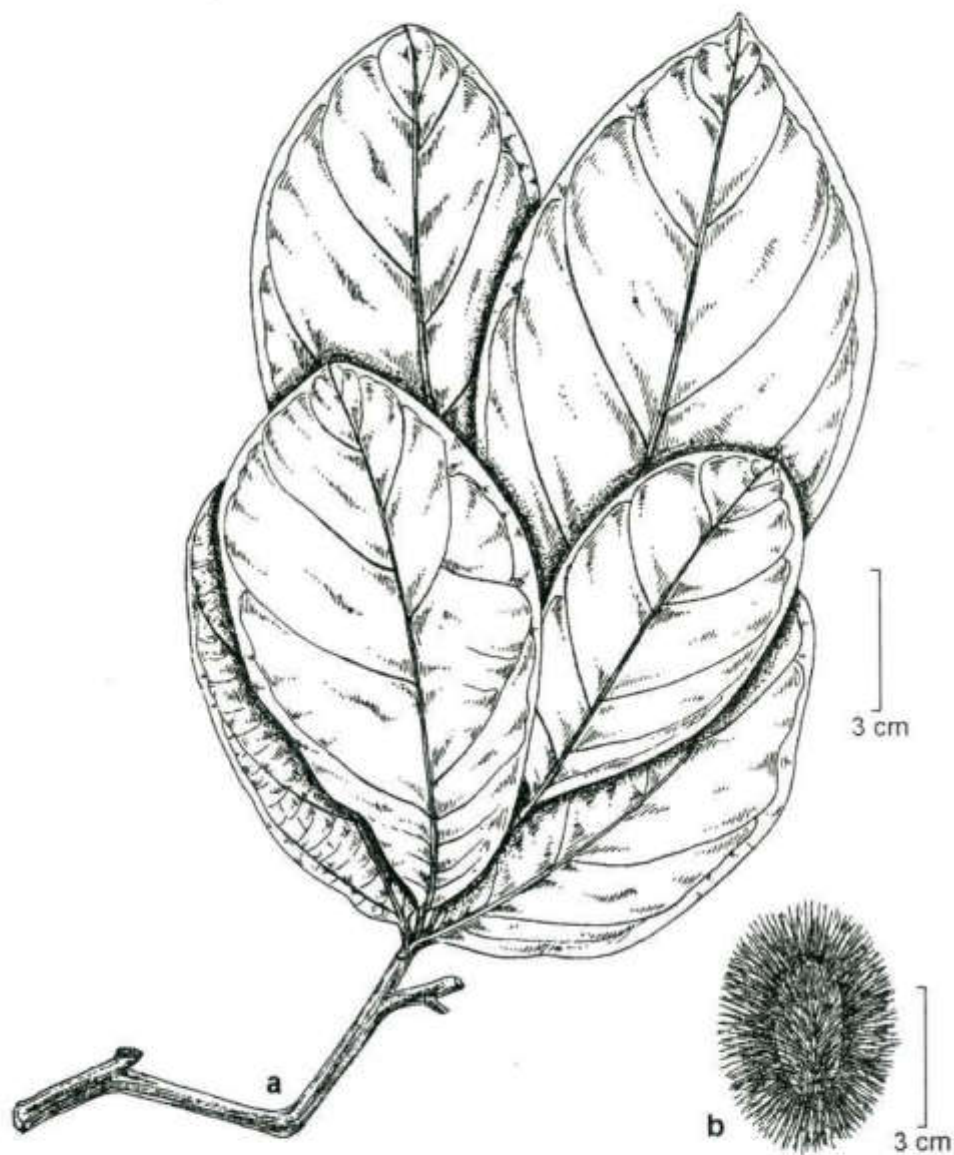


Fig. 159. *Sloanea tomentosa* (Benth.) Rehder & Wilson : a. leafy twig; b. fruit.

or rounded at base, acuminate at apex, coarsely toothed, coriaceous, veins prominent beneath, glabrous above, tomentose beneath; petioles 2 - 5 cm long, swollen at both ends, densely tomentose. Flowers pale white, 1 - 2 cm across, axillary, solitary, subtended by often bract-like leaves; pedicels 2 - 4 cm long, tomentose, often elongating in fruits. Sepals 4(- 5), 7 - 10 mm long, ovate or oblong-ovate, pointed, tomentose outside. Petals 4(- 5), creamy white, free or connate, 8 - 10 mm long, oblong, concave, variously cut at apex, pubescent. Stamens numerous; filaments 3 - 4 mm long, pilose; anthers 2 - 3.5 mm long, linear with ca 1.5 - 2 mm long awns. Disc broad, flattened or cushion-shaped, pitted. Ovary globose, 4-loculed, sericeous; styles 8 - 10 mm long, hairy at base. Capsules 3.5 - 4 cm across, globose or ovoid; 4 - 5-valved; valves 3 - 4 cm long, woody, densely covered with 2 - 3 mm long plumose bristles; bristles dilated towards apex, deciduous. Seeds arillate.

*Fl.* July - Sept.; *Fr.* Oct. - Dec.

*Distrib.* India: In moist deciduous and semievergreen forests between 1500 and 2000 m. Uttar Pradesh, West Bengal (Darjeeling), Sikkim, Assam, Meghalaya and Manipur.

Nepal, Bhutan, Myanmar, Thailand and China (Yunnan).

#### CULTIVATED SPECIES

**Muntingia calabura** L., Sp. Pl. 509. 1753.

Large shrubs or small trees, 4 - 7 m tall; branches spreading; branchlets densely villous, glandular pubescent. Leaves 2-ranked, 6 - 11 x 2 - 4 cm, lanceolate or oblong-lanceolate, obliquely semicordate at base, acuminate at apex, serrate, chartaceous, veins 3 - 5 on either side of midrib, glandular hairy above, woolly beneath; petioles 5 mm long; stipules 1, rarely 2 with one reduced, lateral, 5 mm long, filiform, hairy. Inflorescences sessile, usually supra-axillary, fascicles of 2 or 3 flowers, rarely solitary, with 3 filiform bracts at base. Flowers white, rarely pink, 1.5 - 3 cm across; pedicels 2 - 2.5 cm long. Sepals 5, 1.5 cm long, lanceolate, caudate-acuminate, valvate, shortly connate at base, densely pubescent on both surfaces. Petals 5, thin, obovate, ovate or suborbicular, shortly clawed, equalling sepals, entire, imbricate and almost crumpled in bud. Intra staminal disc, annular on edge of shallowly concave receptacle, bearing a ring of hairs on exterior margin. Stamens many, ca 1 cm long; filaments filiform; anthers elliptic, shorter than filaments, dorsifixed, versatile, longitudinally dehiscent. Ovary superior, 5 - 6 mm long, ellipsoid, 5-carpellary, syncarpous, 5-locular, ovules numerous on 2 pendulous placent, raised on a gynophore; styles short or absent; stigmas capitate, 5-grooved; berries red or yellow, 1 - 1.5 cm across, subglobular, appearing irregularly many locular; pulp juicy, sweet. Seeds numerous, obovoid-ellipsoid, minute; testa crustaceous.

*Fl. & Fr.* Almost throughout the year.

Introduced and cultivated in India.

Tropical America, West Indies and from southern Mexico to Peru, Northern Argentina and Brazil.

*Notes.* This species is commonly cultivated as an ornamental for its profuse showy flowers. The pulpy fruits are edible and attract birds when in fruits. The tough fibre of the inner bark is used for making ropes and cordage. This species can be propagated by cuttings and is drought resistant.

## LINACEAE

(P.K. Hajra)

Herbs or shrubs or rarely trees; branchlets glabrous, rarely hirsute or tomentose. Leaves usually alternate rarely opposite, simple, sessile or petiolate, entire, crenate, serrate or crenate-serrate; stipules lateral or intrapetiolar, rarely absent. Inflorescence racemose, cymose, spicate or of solitary flowers. Flowers bisexual, regular. Sepals 4 - 5, imbricate, free or connate at base. Petals 5, blue, yellow or white, rosy, contorted, hypogynous or rarely perigynous, fugacious. Stamens as many as or double or triple the number of petals, sometimes alternating with small staminodes; filaments connate at base; anthers introrse, 2-locular. Ovary 3 - 5-locular, each locule often subdivided by a false septum, ovules 2 in each locule, pendulous from inner angle; styles 3 - 5, filiform; stigmas capitate. Fruit a septicial capsule or drupe; seeds compressed, shining; endosperm copious, scanty or absent; embryo straight, cotyledons flat.

Cosmopolitan, ca 12 genera and 290 species; 5 genera and 12 species in India.

*Notes.* The circumscription of the family Linaceae has been debated by several botanists. J.D. Hooker (Fl. Brit. India 1: 409-417. 1874) has dealt with 7 genera and 22 species under the tribes: Eulineae, Hugonieae, Erythroxyloae and Ixonantheae.

Winkler (in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 19a : 107. 1931) treated it as a family excluding the tribe Nectaropetaleae and his treatment is followed in this flora.

*Literature.* ABDULLA, P (1972). Linaceae. In: Nasir, E. and S. I. Ali, Fl. W. Pakistan 21: 1 - 6. HAJRA, P.K. (1983). Linaceae & Ixonantheae. In: Fasc. Fl. India 13: 1 - 16. OCKENDON, D.J. & S.M. WALTERS (1968) Linaceae (*Linum*). In: TUTIN et al., Fl. Europea 2: 206 - 211. WINKLER, H. (1931). Linaceae In: ENGLER, A. & K.PRANTL, Nat. Pflanzenfam. ed. 2, 19a: 82 - 130.

### KEY TO THE GENERA

- |  |                        |
|--|------------------------|
| 1a. Erect undershrubs or herbs; stamens as many as petals  | 2                      |
| b. Shrubs often climbing by hooks; stamens usually double the number of petals   | 3                      |
| 2a. Sepals with one or two rows of gland-tipped bristles   | 1. <i>Anisadenia</i>   |
| b. Sepals without gland-tipped bristles  | 4                      |
| 3a. Flowers ebracteolate   | 2. <i>Hugonia</i>      |
| b. Flowers bracteolate   | 3. <i>Indorouchera</i> |
| 4a. Herbs with branches erect; Leaves sessile, mostly 1-nerved; petals neither clawed nor crested at base; styles 5; capsules 5 or falsely 10-locular              | 4. <i>Linum</i>        |
| b. Undershrubs with branches both erect and prostrate; leaves petiolate, pinnately nerved; petals clawed and crested at base; styles 3 - 4; capsules 3 - 4-locular | 5. <i>Reinwardtia</i>  |

### 1. *Anisadenia* Wallich ex Meissn.

Rhizome perennial. Leaves alternate or somewhat whorled at tip of stem, coriaceous, serrate; stipules intrapetiolar, striate. Racemes terminal; pedicels reflexed; bracts minute, coriaceous, concave, grooved, caducous. Sepals 5, lanceolate, coriaceous, strongly nerved, 3 outer with spreading gland-tipped bristles, 2 inner glandular. Petals 5, contorted. Stamens 5, alternate with equal number of setiform staminodes between them; glands adnate to staminal tube, often 3, with one larger. Ovary 3-locular, ovules 2 in each locule, collateral; styles 3. Fruits capsular, oblong, membranous, 1-seeded by abortion. Seeds oblong with thin endosperm; embryo straight.

Subtropical and temperate zones of China, India and Nepal, ca 3 species; 2 in India.

#### KEY TO THE SPECIES

- |   |                        |
|---|------------------------|
| 1a. Stems leafy throughout; leaves 1 - 6 cm long; nectar-glands 5               | 1. <i>A. pubescens</i> |
| b. Stems generally leafy towards apices; leaves 3 - 10 cm long; nectar-glands 1 | 2. <i>A. saxatilis</i> |

1. *Anisadenia pubescens* Griffith, Not. Pl. Asiat. 4: 535. 1854 & Icon. Pl. Asiat. t. 593(right hand figure). 1854; Hooker f., Fl. Brit. India 1: 413. 1874.

Perennial herbs, 15 - 45 cm high; stems pubescent, leafy throughout, prostrate, often much branched; branches 5 - 24 cm long. Leaves 1 - 6 x 0.5 - 2.5 cm, elliptic to lanceolate, acute to cuneate at base, acute or shortly acuminate at apex, entire or undulate, appressed silky hairy above, whitish villous beneath, nerves very oblique, generally 4-pairs, conspicuous on both surfaces; petioles 0.2 - 2.5 cm long, hairy. Flowers 1 - 1.5 cm in diam., 2 - 3 in terminal racemes; peduncles 1 - 5 mm long, erect, tomentose. Sepals 5 - 7 mm long, robust, gland-tipped hairy. Petals white, 12 - 15 mm long. Stamens ca 8 mm long. Ovary ovoid, 3-locular; styles 3, ca 11 mm long; stigma globose.

*Fl. & Fr.* July - Nov.

*Distrib.* India: In subtropical and temperate evergreen forests of Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Bhutan and China.

2. *Anisadenia saxatilis* Wallich [ Cat. No. 1510. 1829, nom. nud.] ex Meissn., Pl. Vasc. Gen. Comment. 2: 96. 1838; Hook. f., Fl. Brit. India 1: 412. 1874. *A. khasyana* Griffith, Not. Pl. Asiat. 4: 534. 1854. & Icon. Pl. Asiat. t. 593 (middle figure). 1854.

Perennial herbs or undershrubs, 12 - 46 cm high; stems simple, curved at base, stout, ascending, lower part creeping, rooting at base. Leaves 3 - 10 x 0.5 - 3.5 cm, lanceolate, or elliptic-lanceolate, attenuate at base, acute or shortly acuminate at apex, entire or undulate, glabrous above, glabrous to sparsely pubescent beneath, lateral nerves 5 - 6; petioles 0.5 - 5.0 cm long, glabrous. Flowers ca 10 mm across in 3 - 10 cm long, terminal racemes; peduncles 1 - 3 mm long; bracts ca 6 mm long. Sepals 3 - 5 mm long. Petals pink, 8 - 10 mm long, obovate, persistent. Stamens ca 5 mm long; filaments connate below; anthers ca 1 mm long. Ovary ovoid, ca 2 mm long; styles ca 4 mm long; stigma globose.

*Fl. & Fr.* July - Nov.

*Distrib.* India: In tropical evergreen forests of Himalayas up to 2500 m. Uttar Pradesh, Sikkim, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Nepal and Bhutan

## 2. *Hugonia* L.

Scandent or straggling shrubs, often tomentose; lateral branches short and modified as coiled hooks. Leaves alternate, entire, crenate or serrate, penninerved, stipulate. Inflorescence cymose, terminal or axillary or flowers solitary or fascicled. Sepals 5, imbricate, unequal. Petals 5, yellow, contorted, hypogynous, fugacious. Stamens 10, 5 longer alternating with 5 shorter, connate at base into a short tube. Ovary 5-locular; ovules 2, collateral in each locule; styles 5, filiform; stigmas capitate, lobed. Fruits drupaceous, globose, fleshy. Seeds compressed.

Tropical Asia and Africa, ca 65 species; 2 in India.

### KEY TO THE SPECIES

- |   |                     |
|---|---------------------|
| 1a. Leaves elliptic or lanceolate, crenate; lateral nerves 16 - 19 pairs          | 1. <i>H. belli</i>  |
| b. Leaves elliptic-obovate or obovate-oblong, entire; lateral nerves 8 - 14 pairs | 2. <i>H. mystax</i> |

1. *Hugonia belli* Sedgwick in Ind. For. 46: 424. 1920.

Fig. 160.

Scandent shrubs, densely tomentose. Leaves 7 - 20 x 2 - 7 cm, tapering at base, narrowly obtuse or acute at apex, brown tomentose, nerves conspicuous on both surfaces; petioles 6 - 11 mm long, tomentose; stipules ca 15 mm long, linear-laciniate. Lower peduncles modified into circinate hooks, upper peduncles ca 15 mm long; bracts 10 mm long; pedicels thick. Sepals ca 6 x 5 mm, ovate, acute. Petals 15 mm long, quickly withering. Stamens ca 10 mm long; filaments unequal. Ovary globose; styles filiform;

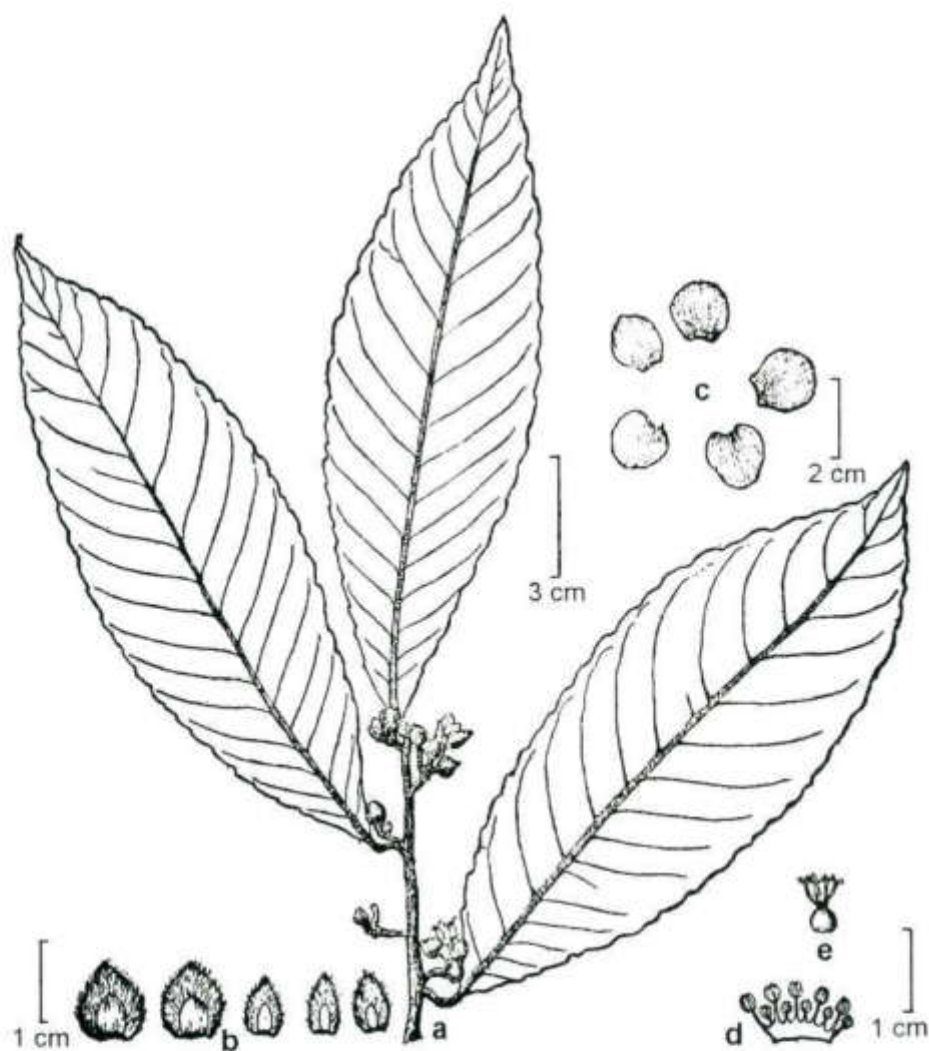


Fig. 160. *Hugonia belli* Sedgwick : a. flowering branch; b. sepals; c. petals; d. androecium; e. pistil.

stigma bilobed. Drupes ca 2 cm broad, globose, longitudinally striate, 10-locular, dark brown.

*Fl. & Fr.* Nov. - Jan.

*Distrib.* India: Karnataka and Kerala.

Endemic.

**2. *Hugonia mystax* L., Sp. Pl. 675. 1753 'myxstrax'; Hook. f., Fl. Brit. India 1: 413. 1874.**

Kan.: *Motira kanni*; Tam.: *Agori, Motira kanni*; Tel.: *Gatrinta*.

Shrubs rambling or climbing; branches yellow tomentose; branchlets short, horizontal, leafless towards base. Leaves 8 x 1 - 3.5 cm, elliptic-obovate, or obovate-oblong, tapering at base, obtuse or subacute at apex, hairy along midrib, lateral nerves prominent on both surfaces; petioles ca 4 mm long, hairy. Flowers ca 2.5 cm across; peduncles ca 1 mm long, yellow tomentose; bracts ca 7 mm long, subulate. Sepals ca 7 x 3 mm, imbricate, ovate-lanceolate, fulvous pubescent. Petals ca 12 x 7 mm, unequal, twisted, alternate with sepals, shortly unguiculate. Stamens ca 8 - 10 mm long, alternately long and short, all fertile; anthers cordate-ovate, erect, 2-loculed, opening by two longitudinal clefts. Ovary globular, glabrous, ovules pendulous; styles ca 4 mm long; stigmas lobed. Drupes ca 1 cm in diam., surrounded by persistent scarlet sepals. Seeds pendulous.

*Fl. & Fr.* Aug. - Oct.

*Distrib.* India: Orissa, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

*Notes.* The yellow root bark is aromatic and is employed as an antidote to poisons. The bruised root is applied to inflammatory swellings. The root powder is administered as an anthelmintic and febrifuge.

### 3. *Indorouchera* Hall. f. (*Roucheria* Mill.)

Trees, erect or scandent shrubs with revolute, woody tendrils. Leaves entire or glandular-serrate, coriaceous, penninerved; stipules minute, caducous. Flowers in axillary fascicles, or in short fascicled spikes, yellow, subsessile, 5-merous, subtended by bracteoles. Sepals 5, subequal. Petals 5, hypogynous, contorted, fugaceous. Stamens 10, all fertile, alternately long and short; filaments connate into a short tube. Ovary 3 - 5-locular; ovules 2, collateral in each locule; styles 3 - 5, filiform; stigmas cuneate,



2-lobed. Drupes subglobose, stone 3-6-angled, locules 1-2-seeded. Seeds compressed, pendulous; endosperm somewhat fleshy; cotyledons foliaceous.

Malaysia, Indonesia and India. ca 4 species; one in India.

*Literature.* BACKER, C.A. & R.C. BAKHUIZEN VAN DEN BRINK (1963). Fl. Java 1: 24 - 242. RAO, M.K.V. & T. CHAKRABARTY (1984). *Indorouchera* Hall. f. (Linaceae). A new generic record for India. J. Econ. Tax. Bot. 5: 931 - 932.

*Indorouchera griffithiana* (Planch.) Hall. f. in Meded. Rijksherb. Leiden No. 35: 50, 1918; M.K.V. Rao & T. Chakrab. in J. Econ. Tax. Bot. 5: 931, 1984. *Rouchera griffithiana* Planch. in Hook., J. Bot. 6: 143, 1847; Hook. f., Fl. Brit. India 1: 414, 1874.

Climbing, woody shrubs, glabrous; branchlets 1-2-hooked at base; hooks ca 2 cm long. Leaves 7-14 x 2-4.5 cm, lanceolate, elliptic- or obovate-lanceolate, cuneate at base, obtusely caudate-acuminate at apex, crenate-serrate, glabrous, shining above, lateral nerves 7-10 pairs, slender, arched; petioles 0.7-2 cm long. Flowers ca 8 mm across, sessile, fragrant, 7-8 in axillary fascicles; pedicels very short, densely bracteate. Sepals ca 2 mm long, obtuse or acute. Petals yellow, ca 7 mm long, narrow, very fugaceous. Stamens ca 4 mm long. Ovary ellipsoid-obovoid, 3-locular. Drupes ca 7 mm long, ellipsoid, orange-red, 1-seeded.

*Fl. & Fr.* April - Dec.

*Distrib.* India: In evergreen forests up to 75 m. Andaman & Nicobar Islands (Great Nicobar Island).

Malesia.

#### 4. *Linum* L.

Perennial or annual herbs, sometimes suffrutescent, usually glabrous. Leaves simple, usually alternate, narrow, entire, 1-many-nerved; stipules absent or glandulariform. Flowers bisexual in corymbose panicles or in cymes. Sepals 5, entire. Petals 5, contorted, fugacious. Stamens united at base, 5 fertile, alternating with 5 minute staminodes; glands opposite petals, adnate to staminal tube. Ovary 5-carpellary, 5-locular becoming 10-locular by intrusion of incomplete to complete false septa; ovules 2 in each locule, pendulous; styles 5, usually free; stigmas capitate to linear. Fruits capsular, septicidally splitting into 5 simple 2-seeded or ten 1-seeded cocci. Seeds compressed, usually smooth; endosperm scanty; embryo straight.

Mainly in temperate and subtropical regions of N.America, Mediterranean region, India, Pakistan and Sri Lanka, ca 230 species; 5 in India.

*Literature.* GIANNASI, D.E. & C. M. ROGERS (1970). Taxonomic significance of floral pigments in *Linum* (Linaceae). *Brittonia* 22: 163 - 174. ROGERS, C.M (1972). The taxonomic significance of the fatty acid content of seeds of *Linum*. *Brittonia* 24: 415 - 419. SEETHARAM, A & D. SRINIVASACHAR (1972). Cytomorphological studies in the genus *Linum*. *Cytologia* 37: 661 - 671. XAVIER, K.S. & C.M. ROGERS (1963) Pollen morphology as a taxonomic tool in *Linum*. *Rhodora* 65: 137 - 145.

## KEY TO THE SPECIES

- |  |                           |
|--|---------------------------|
| 1a. Flowers ca 5 mm across, yellow             | 2                         |
| b. Flowers ca 2.5 cm across, blue              | 3                         |
| 2a. Capsules equalling sepals                  | 2. <i>L. mysurense</i>    |
| b. Capsules shorter than sepals                | 4                         |
| 3a. Annual herbs; stems usually simple at base | 5. <i>L.usitatissimum</i> |
| b. Perennial herbs; stems many from base       | 3. <i>L. perenne</i>      |
| 4a. Pedicels longer than sepals                | 1. <i>L. corymbulosum</i> |
| b. Pedicels about equalling sepals             | 4. <i>L. strictum</i>     |

1. *Linum corymbulosum* Reichenb., Fl. Germ. Excurs. 843. 1832. *L. strictum* L. subsp. *corymbulosum* (Reichenb.) Rouy, Fl. France 4: 60. 1897. *L. strictum* L. var. *corymbulosum* (Reichenb.) Planch. in Hook., J. Bot. 7: 476. 1848; Hook. f., Fl. Brit. India 1: 411. 1874.

Herbs annual, erect, 15 - 45 cm high; stems slender, branched, glabrous or hirsute. Leaves 2 - 3 cm long, linear to lanceolate, scarid along margin. Flowers in lax spreading corymbose cymes; pedicel ca 1 cm long, slender. Sepals free, ca 6 mm long, ovate, acuminate, scarid and glandular along margin. Petals yellow, ca 6 mm long, obovate, contorted, glabrous. Stamens 5, alternating with 5 staminodes; filaments ca 2 mm long; anthers ca 1 mm long, elliptic-oblong. Ovary ovoid; styles ca 2 mm long, free; stigmas subcapitate. Capsules subglobose, dehiscent into 10 cocci, cocci 1-seeded. Seeds oblong, reddish brown, shiny.

*Fl. & Fr.* March - June.

*Distrib.* India: Jammu & Kashmir (Kashmir).

Pakistan, Afghanistan, W. Asia, S. Europe to E. Africa through Mediterranean region and Canary Islands.

2. *Linum mysurense* Heyne [in Wallich, Cat. No. 1507. 1828, nom. nud.] ex Benth. in Lindley Bot. Reg. 16: sub t. 1326. 1830; Hook. f., Fl. Brit. India 1: 411. 1874.

Kan.: *Undri*.

Herbs annual, erect, 10 - 50 cm high, usually branched above, glabrous. Leaves 10 - 20 x 3 - 8 mm, oblong-elliptic or obovate or linear-ovate, tapering acute or obtuse at base, mucronate at apex, glabrous, 3-nerved. Flowers yellow, ca 3.5 mm across, solitary or in paniced corymbs; pedicels 2 - 5 mm long. Sepals 5, ca 3 mm long, elliptic-lanceolate, ovate or obovate, apiculate, scarious laterally, membranous, finely serrulate towards apex, glabrous, 3-nerved. Petals yellow, ca 5 mm long, obovate or orbicular, acute at base, rounded at apex. Stamens 5, connate at base; filaments dilated below. Ovary ca 2 mm long; glabrous; styles 2, connate at base. Capsules ca 3 mm long, globose, shortly apiculate, surrounded at base by persistent sepals. Seeds 10, elliptic, somewhat compressed.

*Fl. & Fr.* Sept. - Jan.

*Distrib.* India: Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

*Notes.* This species is reported to be a collateral host, of *Melampsora lini* (Shrenk.) Lev., a serious rust on linseed plant in India.

3. *Linum perenne* L., Sp. Pl. 1: 277. 1753; Hook. f., Fl. Brit. India 1: 411. 1874.

Perennial herbs, 15 - 90 cm high; stems many from the base; branches ascending or erect, glabrous. Leaves sessile, 0.5 - 2.5 cm long, lanceolate or lower oblong, obtuse and upper linear, acute at apex, 1 - 3-nerved. Flowers ca 2 cm across, in 3 - 5-flowered cymes; pedicels up to 10 mm long. Sepals 4 - 5 mm long, ovate or obovate, acute, glandular along margin, 3 - 5-nerved. Petals free, 10 - 12 mm long, obovate, blue. Stamens 5, alternating with 5 small staminodes. Ovary 5-locular, ovules 1 in each locule; styles 5, connate at base, heterostylous; stigmas capitate to subcapitate. Capsules 5 - 7 mm across, subglobose, dehiscent into 10 cocci, larger than white-margined sepals. Seeds compressed, shining dark brown.

*Fl. & Fr.* April - Oct.

*Distrib.* India: In Western Himalayas between 2500 and 4000 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan, China(Tibet), C. & E. Europe, C.I.S. and W. North America.

*Notes.* A potential ornamental species with its showy flowers. The seeds are considered emollient in Europe and China.

4. *Linum strictum* L. Sp., Pl. 279. 1753; Hook. f., Fl. Brit. India 1: 411. 1874.

Annual or biennial herbs, 10 - 50 cm high, usually corymbosely branched above, glabrous to sparsely pubescent. Leaves sessile, 10 - 15 mm long, linear, linear-oblong or lanceolate, acute or rounded at base, acute or acuminate at apex, scabrid along margin. Flowers ca 8 mm across, in corymbose cymes; pedicels short. Sepals 3 - 6 mm long, glandular along margin. Petals yellow. Ovary globose; styles free; stigmas capitate. Capsules ca 6 mm in diam., globose.

*Fl. & Fr.* April - Aug.

*Distrib.* India: Jammu & Kashmir (Kashmir).

Pakistan, Afghanistan, W. Asia, S. Europe and Mediterranean region.

*Notes.* This species is reported to be cultivated in Afghanistan for seed oil and fodder. The seeds are considered emollient in Spain.

**5. *Linum usitatissimum* L.**, Sp. Pl. 277. 1753; Hook. f., Fl. Brit. India 1: 410. 1874.  
*L. trinervium* Roth, Nov. Pl. Sp. 187. 1821.

Beng.: *Tisi*; Guj.: & Hindi: *Alsi*; Kan.: *Agasi*; Or.: *Peso*; Tam.: *Alivirai*; Tel.: *Avisi*;  
Eng.: *Flax or linseed*;

Annual herbs, 60 - 120 cm high; stems terete, erect, branched above; branches ascending towards apex. Leaves subsessile, 1 - 4 cm long, linear to linear-lanceolate, attenuate at both ends, glabrous, 3-nerved. Flowers ca 2 - 3 cm in diam., in axillary cymes. Sepals 6 - 10 mm long, ovate to elliptic, acuminate, prominently 3-nerved. Petals blue or purple, rarely white, 10 - 20 mm long, obovate or broadly rounded. Stamens 5, ca 10 mm long connate at base. Ovary ovoid; styles free; stigmas linear-clavate, often cohering. Capsules globose, scarcely exceeding sepals, mucronate.

*Fl. & Fr.* Jan. - Aug.

*Distrib.* Cultivated throughout India up to 2000 m in the Himalayas. Sometimes found as an escape.

Not known in wild, origin uncertain, widely cultivated in Europe and Asia.

*Notes.* The well known flax plant, grown in India for the oil from seed Linseed oil and also for fibre (flax) elsewhere.

### 5. *Reinwardtia* Dumort.

Undershrubs or shrubs. Leaves alternate, entire or crenate-serrate, membranaceous, penninerved; stipules minute, subulate, caducous. Flowers yellow or white

solitary or in very short fasciculate, axillary racemes or in dense corymbs at the end of branches, pedicellate, bracteate. Sepals 5, ovate or lanceolate, acuminate, entire. Petals 5, contorted, fugaceous, much longer than sepals. Stamens 5, hypogynous, connate at base, alternating with 5 interposed subulate staminodes, glands 2 - 3, adnate to the staminal tube. Ovary 3 - 5-locular. Ovules 2 in each locule; styles 3 - 4 (5 - 7), filiform, free or connate below; stigmas subcapitate. Fruits capsular, globose, splitting usually into 6 - 8 valves or cocci. Seeds reniform; endosperm thin; embryo straight.

Restricted to Asia (India, China to Malesia), 2 species; both occur in India.

*Literature.* SHARMA, M. (1972) Pollen morphology of *Reinwardtia indica* Dum. *Pollen et Spores* 4: 269 - 272.

#### KEY TO THE SPECIES

- |  |                              |
|--|------------------------------|
| 1a. Leaves distinctly crenate-serrate; flowers 3 - 3.5 cm across; styles usually 4       | <b>1. <i>R. cicanoba</i></b> |
| b. Leaves entire or minutely crenate-serrate; flowers ca 2.5 cm across; styles usually 3 | <b>2. <i>R. indica</i></b>   |

**1. *Reinwardtia cicanoba*** (Buch.-Ham. ex D. Don) Hara in *J. Jap. Bot.* 40: 328. 1965 & *Fl. E. Himal.* 168. 1966. *Linum cicanobum* Buch.-Ham. ex D. Don, *Prodr.* 217. 1825 *Linum tetragynum* Colebr. ex Benth. in Lindley, *Bot. Reg.* 16: sub t. 1326. 1830. *Reinwardtia tetragyna* (Benth.) Planch. in Hook., *J. Bot.* 7: 523. 1848; Hook. f., in *Fl. Brit. India* 1: 412. 1874. **Fig. 161.**

Undershrubs. Leaves 2 - 12 x 0.7 - 5.5 cm, elliptic-lanceolate, attenuate at base, acuminate at apex, glabrous, lateral nerves usually 6; petioles 0.2 - 3.5 cm long. Flowers 3 - 3.5 cm across. Sepals 0.5 - 1.5 cm long, lanceolate, shortly acuminate. Petals 2 - 4 cm long, obovate, notched at tip. Stamens 1.5 - 2 cm long; filaments minutely hairy; anthers 2 - 3 mm long. Ovary globose; styles usually 4, rarely 3 or 5, connate at base. Capsules obtuse, shorter than the sepals.

*Fl. & Fr.* Sept. - Nov.

*Distrib.* India: Eastern Himalayas, Sikkim and Meghalaya

Nepal and China.

**2. *Reinwardtia indica*** Dumort., *Comm. Bot.* 19. 1822. Duthie, *Fl. upp. Gang.* Pl. 1: 123. 1903. *Linum trigynum* Roxb. in *Asiat. Res.* 6: 357. 1799, non L. 1753. *Reinwardtia trigyna* (Roxb.) Planch. in Hook., *J. Bot.* 7: 522. 1848; Hook. f., *Fl. Brit. India* 1: 412. 1874.

Hindi: *Balbasant*.

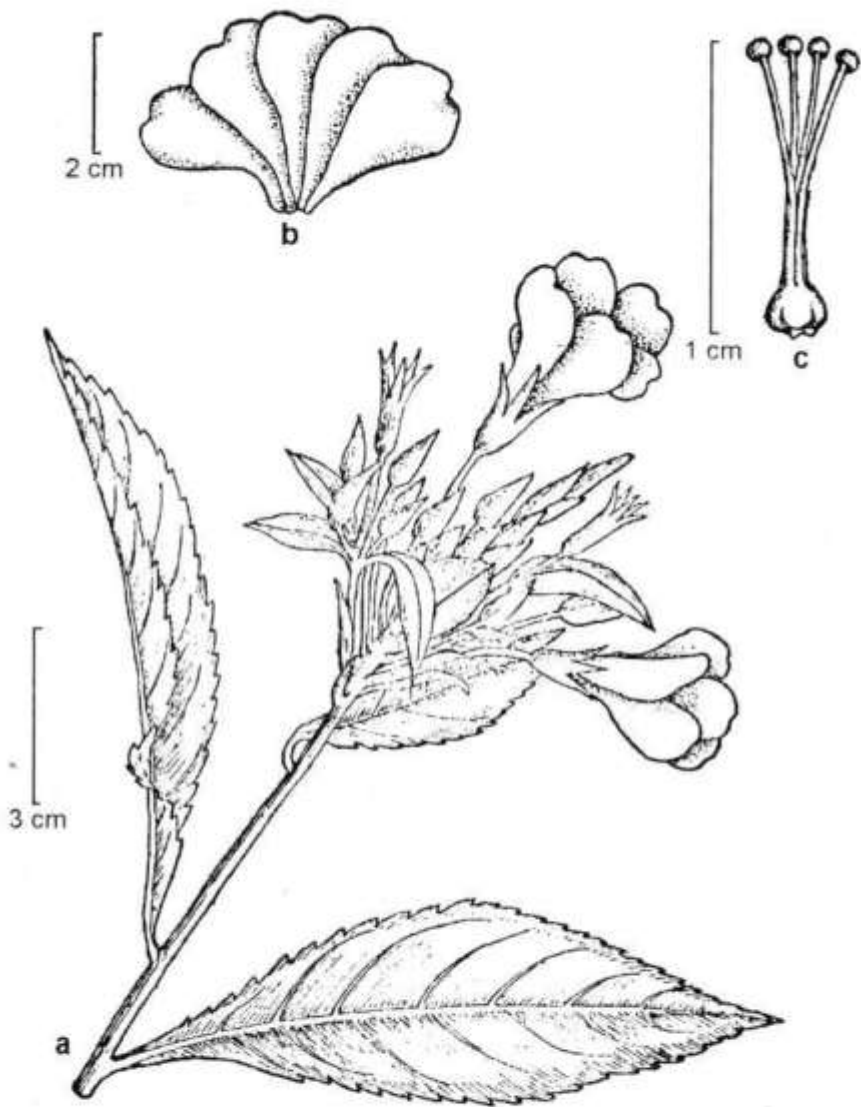


Fig. 161. *Reinwardtia cicanoba* (Buch.-Ham. ex D. Don) Hara. : a. flowering branch; b. petals; c. pistil.

Tufted undershrubs, 75 - 140 cm high; branches erect and prostrate; branchlets angled or terete, glabrous. Leaves 1 - 2 x 0.5 - 4.5 cm, usually elliptic-obovate or narrowly oblong-lanceolate, decurrent into a short petiole at base, acute or rounded and mucronate at apex, glabrous, lateral nerves usually 5 - 9; petioles 2 - 3 cm long, somewhat sheathing at base. Flowers ca 2.5 cm across, yellow, scented, solitary or crowded at ends of branchlets or in up to 4.5 cm long racemes; pedicels up to 2 cm long, sparsely pilose, bracteate and bracteolate. Sepals 0.5 - 1 cm long, ovate to lanceolate, acute, 3 - 5-parallel veined. Petals bright golden yellow, 1 - 3.5 cm long, broadly ovate to obovate, abruptly narrowed at base. Stamens 5 alternating with 5 staminodes, 0.5 - 3 cm long; filaments dilated and connate at base with 2 - 3 glands adnate to the base; anthers basifixed. Ovary ovoid-triangular; styles usually 3, rarely 4, 5 or 7, free or connate at base; stigmas of long styles larger than those of short ones. Capsules globose, shorter than sepals, dehiscing into 6 - 8 cocci, cocci 1-seeded. Seeds thin, reniform, compressed.

*Fl. & Fr.* Sept. - March.

*Distrib.* India: Throughout.

Pakistan, Nepal, Bhutan, Myanmar, Thailand, Indo-China and China.

#### DOUBTFUL SPECIES

**Hugonia ferruginea** Wight & Arn., Prodr. 72. 1834. K.N. Subramanian & K.B. Kalyani (in Ind. For. 101: 569. 1975.) reported it from Belabyalacheba Valley, Raichuti Range of Andhra Pradesh. The specimen could not be traced. On critical examination, the specimens of this species collected from Andhra Pradesh (*K.N.Subramanian* 2362,FRC and *K.Subramaniam* 6367, MH) were found to be intermediate between *H.mystax* L. and *H.ferruginea* Wight & Arn.(Type: Locality? Wight cat.no.296, MH). Additional collections and field observations are essential to determine the correct identity of these specimens.

#### CULTIVATED SPECIES

**Linum grandiflorum** Desf., Fl. Atlant. 1: 278, t. 78. 1798; Babu, Herb. Fl. Dehradun 98. 1977.

Annual herbs, up to 65 cm high; stems erect, branched glabrous. Leaves 1 - 3 cm long, ovate-lanceolate, acute. Flowers ca 4 cm across, solitary or in terminal or leaf-opposed corymbose clusters. Sepals ca 6 cm long ovate, acuminate with scarious hairy margins, accrescent. Petals free up to 2 cm long, scarlet or red with a dark purple centre. Stamens 5, connate at base; filaments dilated at base. Ovary ovoid; styles 5, filiform, connate at base; stigmas linear. Capsules depressed globose. Seeds oblong-ellipsoid, brown, compressed.

*Fl. & Fr.* Feb. - June

Cultivated in gardens for its beautiful scarlet, red or bluish purple flowers.

Cosmopolitan.



## ERYTHROXYLACEAE

(U. Chatterjee & B.D. Sharma)

Trees or shrubs, rarely dioecious or subdioecious. Leaves simple, alternate, often distichous, rarely opposite, entire. Stipules axillary, small, intrapetiolar, mostly or entirely connate, persistent or early caducous. Flowers small, axillary, solitary or in fascicles, actinomorphic, bisexual, unisexual, hypogynous. Calyx campanulate, 5 - 6-lobed, persistent, free or shortly connate at base, imbricate. Petals 5 - 6, free, imbricate, deciduous, mostly appendaged inside. Stamens 10 or rarely 14 in 2 whorls, persistent; filaments connate at base into a staminal tube with usually toothed margin, free parts filiform; anthers ellipsoid, basifixed, cordate at base, 2-locular, dehiscence longitudinal, latrorse. Ovary 1 - 3-locular, ovules 1 - 2 in each locule, normally only one locule fertile, sterile ones sometimes enlarged in fruit, ovules pendulous, anatropous; styles 3, erect, free or more or less connate with obliquely clavate or flattened stigmas. Fruit a drupe. Seeds with or without endosperm; embryo oblong, erect; cotyledons flat to plano-convex.

Throughout tropics and subtropics, 3 genera and ca 250 species. One genus and 6 species in India.

*Literature.* KUNTH, C.S. in Humboldt, A., Bonpland A. & C.S. Kunth (1822). Nov. Gen. Sp. Pl. 5: 175. SCHULZ, O.E. (1907) IN: ENGLER, A. Das Pflanzenreich 29: 1 - 176. & (1931). Die Nat. Pflanzenfam. ed. 2. 19a: 130 - 143. PAYENS, J.P.W.D. (1958). Erythroxylaceae. In: STEENIS, C.G.G.J. VAN, Fl. Males. 1, 5: 543 - 552.

### **Erythroxylum P. Br.**

Trees or shrubs, base of lateral twigs often with small distichous bracts, sometimes occurring between leaves. Leaves simple, alternate, involute in buds, entire, distichous, margin leaving more or less permanent trace as two longitudinal lines on the upper surface. Stipules intrapetiolar, entirely connate, rarely bifid, often bicarinate. Flowers small, solitary or fasciculate in leaf axils or on short branches, often dimorphous or even 3 - 4-morphous, pentamerous, actinomorphic, bisexual; pedicels bracteolate, more or less thickened, often only under the calyx. Calyx 5 - 6-lobed, free or connate at base, imbricate. Petals 5 - 6, free, deciduous, appendaged, alternating with calyx lobes. Stamens 10 or rarely 12 - 14 in 2 whorls, persistent, filaments connate at base into a staminal tube, often with toothed margin; anthers ellipsoid, basifixed, cordate at base, 2-loculed, dehiscence longitudinal. Ovary 1 - 3-loculed, ovules pendulous, anatropous, 1 - 2 in each locule; styles 3, erect, free or sometimes connate at base; stigmas flattened or clavate. Fruit a drupe. Seeds 1 with thin testa, with or without endosperm.

Throughout tropical and subtropical regions, chiefly in America and Madagascar, ca 200 species; 7 in India.

*Literature.* PLOMAN, T. (1976). Orthography of *Erythroxylum* (Erythroxylaceae). *Taxon* 25: 141 - 144.

#### KEY TO THE SPECIES

- |  |                                  |
|--|----------------------------------|
| 1a. Stipules persistent  | 2                                |
| b. Stipules caducous   | 3                                |
| 2a. Leaves cuneate-obovate to obovate; petals with 3-lobed appendages; drupes ovoid and straight   |                                  |
|  | <b>4. <i>E. monogynum</i></b>    |
| b. Leaves oblong-lanceolate to lanceolate or elliptic-lanceolate; petals with 2-lobed appendages; drupes oblong-falcate                  | <b>2. <i>E. kunthianum</i></b>   |
| 3a. Leaf apex obtuse or rounded  | 4                                |
| b. Leaf apex acute or acuminate  | 5                                |
| 4a. Leaves elliptic-lanceolate; stipules finely serrate; drupes elliptic-oblong and slightly curved                                      |                                  |
|  | <b>5. <i>E. moonii</i></b>       |
| b. Leaves oblong-lanceolate to obovate or oblong ovate; stipules entire; drupes linear-oblong, straight                                  |                                  |
|  | <b>6. <i>E. obtusifolium</i></b> |
| 5a. Branches lenticellate giving warty appearance; leaves oblong to oblong-obovate, glaucous, lateral nerves horizontal; drupes falcate  | <b>1. <i>E. cuneatum</i></b>     |
| b. Branches striate and more or less smooth; leaves linear-elliptic to lanceolate, not glaucous, lateral nerves oblique; drupes straight | <b>3. <i>E. lanceolatum</i></b>  |

**1. *Erythroxylum cuneatum*** (Miq.) Kurz in J. Asiat. Soc. Beng. 43: 135. 1874. *Urostigma? cuneatum* Miq. in Hook. London, J. Bot. 6: 585. 1847. *Erythroxylon burmanicum* Griffith, Not. Pl. Asiat. 4: 468, t. 581 f. 3. 1854; Hook. f., Fl. Brit. India 1: 414. 1874.

**Fig. 162.**

Trees or shrubs, 2 - 45 m tall; bark grey to brown, inner one yellow to reddish brown; branchlets lenticellate giving warty appearance, brown to black, flattened at ends. Leaves 1.5 - 8 x 1.2 - 3.7 cm, obovate-oblong or obovate, attenuated or cuneate at base, obtuse to emarginate and mucronate at apex, dark green to greenish brown above, light brown and glaucous beneath; midrib prominent beneath, nerves horizontal not forming an intramarginal nerve; petioles 3 - 5 mm long; stipules triangular to lanceolate, entire, distinctly bicarinate, usually as long as petiole, caducous. Flowers solitary or in clusters up to 8, dimorphic with variable forms, faintly scented; bracteoles 1 mm long, deltoid, scarious; pedicels thickened towards calyx. Calyx 1.5 - 2 mm, lobes triangular, obtuse. Petals 1.5 - 4 mm, white, greenish-white to light green, yellow, oblong or oblong-elliptic, convex, ligule 3-lobed, half as long as blade. Brachystylous flowers with equal or unequal stamens; filaments 1.5 - 4.5 mm long; anthers less than 1 mm long. Ovary ovoid to subglobular; styles 2 - 3, connate at base; stigma capitate, broader than style. Dolichostylous flowers also with equal or unequal stamens; filaments less than 1 mm long, thickened at base; anthers less than 1 mm long. Ovary ellipsoid to subglobular;

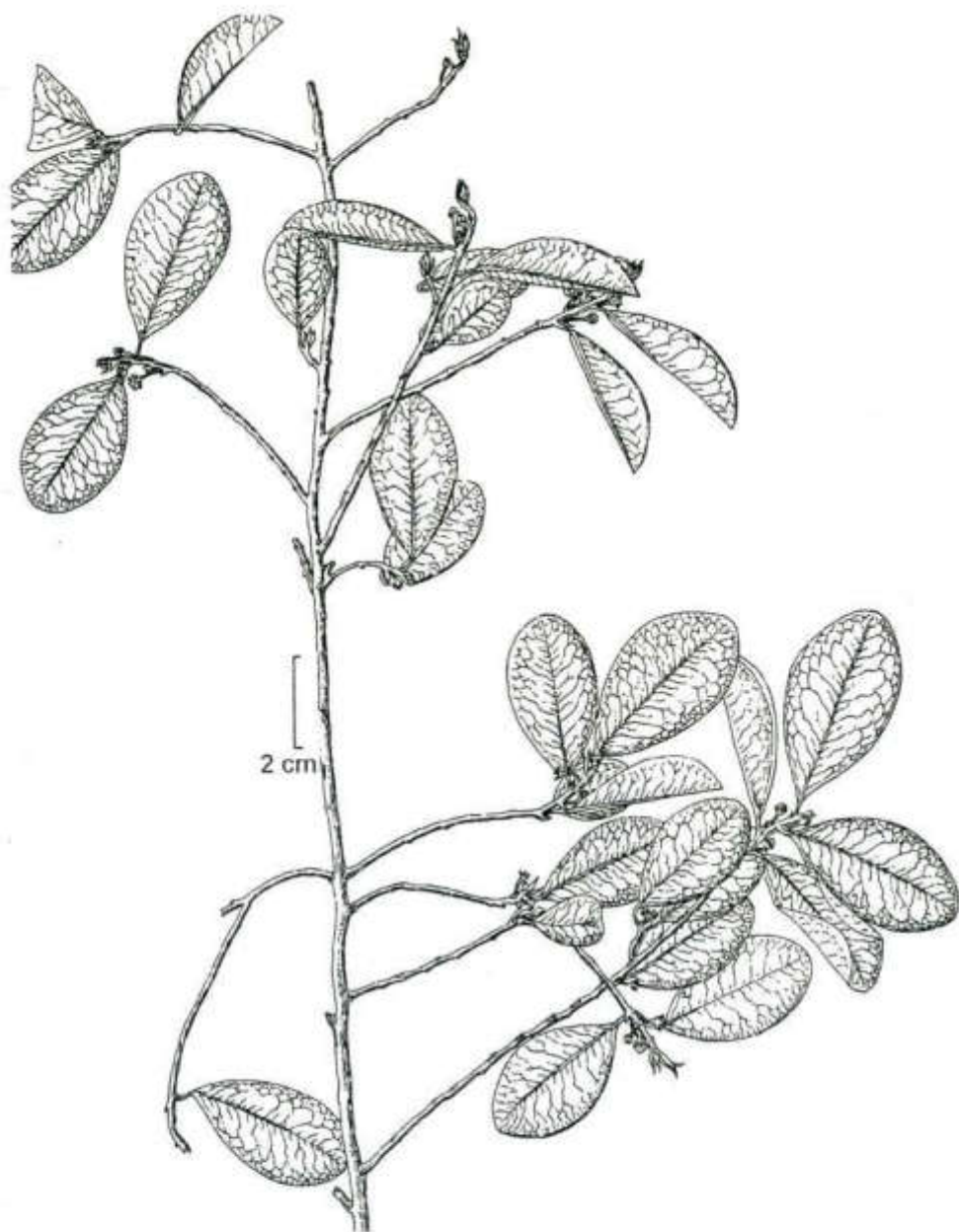


Fig. 162. *Erythroxylum cuneatum* (Miq.) Kurz

styles connate at base with varying lengths; stigmas capitate, broader than style. Drupes red, 7 - 12 x 3 - 6 mm, oblong-ovoid, slightly falcate, trigonous when dry, distinctly furrowed with pointed tip. Seed 1, flattened often somewhat curved, with distinct furrows; endosperm scanty, embryo curved.

*Fl. & Fr.* Jan. - March.

*Distrib.* India: In the coastal forests. Andaman & Nicobar Islands.

Myanmar, Thailand, Vietnam and Malesia.

*Notes.* The wood is very durable and easy to work and is used for house building and construction of bridges. The leaves are reported to be used in the preparation of vegetable soup.

**2. *Erythroxylum kunthianum*** Kurz in J. Asiat. Soc. Beng. 41: 294. 1872; Hook. f., Fl. Brit. India 1: 414. 1874. **Fig. 163.**

*Kh.:* *Dieng-pyllengtham, Dieng-pain-khar, Dieng-juwat, Dieng-sugsi.*

Shrubs or small trees, up to 8 m tall, much branched; branchlets lenticellate, young shoots reddish; bark greyish-white, rough, thin; wood white, inside red with white streaks which turn brown on exposure. Leaves 1.8 - 7 x 0.8 - 2.6 cm, oblong-lanceolate, lanceolate, elliptic-lanceolate, rarely elliptic-obovate, obtuse at base, acute or acuminate, rarely obtuse at apex, entire, chartaceous, opaque above, pale glaucous brown beneath, midrib prominent, reddish, lateral nerves obscure; young leaves red; petioles 1 - 5 mm long; stipules intrapetiolar, subulate, deeply bifid with serrate margin, persistent. Flowers 2 - 5 mm long, white, solitary, bisexual; pedicels 1.3 cm long, slender, thickened upward. Sepals 5, rarely 6, free, 1.2 x 3 mm, persistent. Petals 5, 1 - 2 mm long, elliptic-oblong with a bifid, white ligulate appendage near base. Stamens 10, rarely 14, unequal, usually alternately short, staminal tube less than 1 mm long, slender; anthers basifixed, dehiscence longitudinal. Ovary 1 mm long, 3-loculed; styles 3, short, free from base. Drupes red, 10 - 14 x 3.5 - 4 mm, oblong-falcate, obtuse, subtrigonous, shining, with persistent calyx.

*Fl.* Mar. - June; *Fr.* June - Sept.

*Distrib.* India: Common undergrowth in evergreen forests up to 1520 m. Meghalaya.

Bangladesh and Myanmar.

*Notes.* The bark is reported to be used for chewing with 'Pan'. The wood is light brown, hard and takes a beautiful polish.

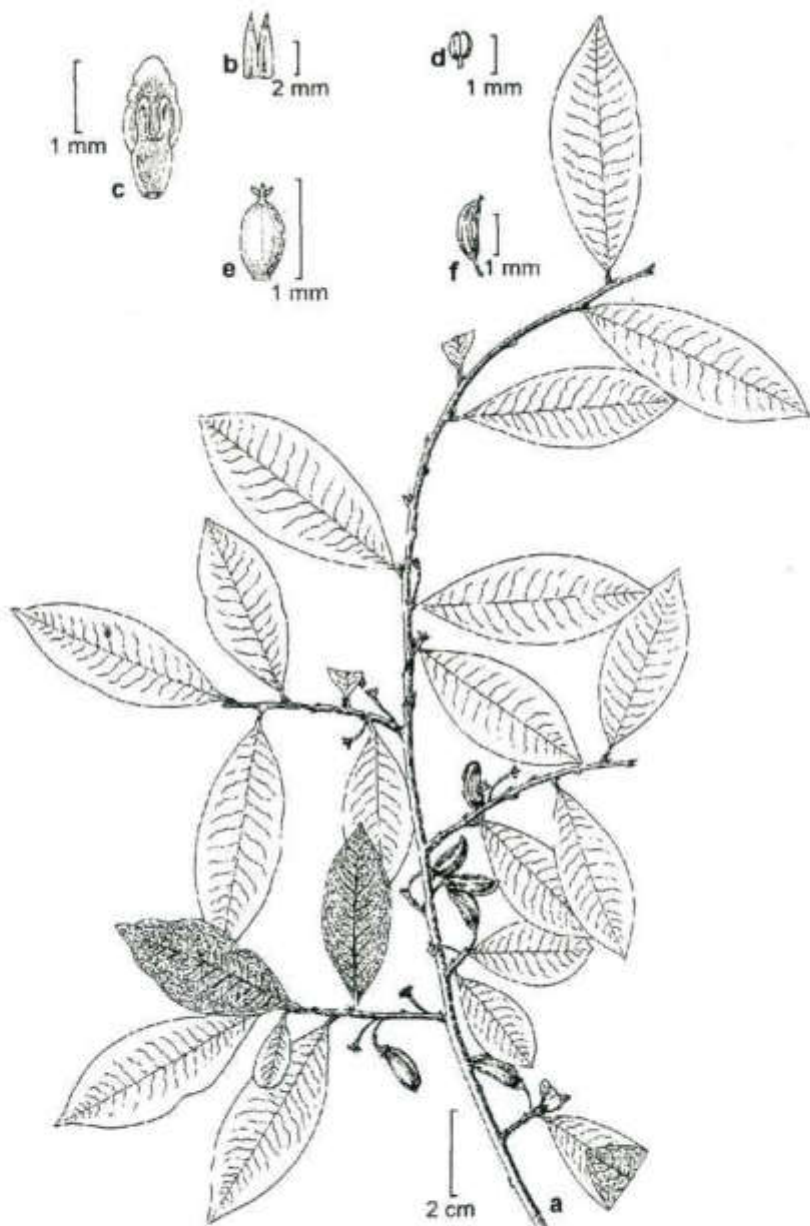


Fig.163. *Erythroxylum kunthianum* Kurz : a. fruiting branch; b. stipule; c. petal; d. stamen; e. pistil; f. fruit.

**3. *Erythroxylum lanceolatum*** (Wight) Walp., Rep. Bot. Syst. 1: 407. 1842; Hook. f., Fl. Brit. India 1: 415. 1874; *Sethia lanceolatum* Wight, Ill. Ind. Bot. 1: 136. 1840. *S. erythroxyloides* Wight, Ill. Ind. Bot. 1: 136. 1840.

Erect shrubs, much branched; branches striate and more or less smooth. Leaves 5 - 10 x 2 cm, linear-elliptic to lanceolate, attenuated at base, acute at apex, shining on both surfaces, chartaceous, veins reticulate, anastomosing, lateral ones oblique, recurved near margin, midrib prominent; petioles 5 mm, slender; stipules caducous, entire, subulate, scars conspicuous. Flowers heterostylous, solitary, axillary; peduncles slender. Calyx 5-lobed, persistent. Petals 5, free, imbricate. Stamens 10, varying in length, anther dehiscence longitudinal. Styles 3, varying in length, united up to two-third of their length, stigmas globose. Drupes straight, subtrigonus. Seed 1, flattened.

*Fl. & Fr.* Feb.

*Distrib.* India: Along banks of streams in hilly regions up to 915 m. Tamil Nadu.

**4. *Erythroxylum monogynum*** Roxb., Pl. Corom. 1: t. 88. 1795; Hook. f., Fl. Brit. India 1: 414. 1874; *Sethia indica* DC., Prodr. 1: 576. 1824. *Erythroxylum indicum* (DC.) Beddome, Fl. Sylv. t. 81. 1871. **Fig. 164.**

Kan.: *Devadaru*; Mal.: *Devataru*; Tam.: *Devadaru*, *Chemanatti*, *Sempulichan*; Tel.: *Adivi goranti*, *Devadaru*, *Gadara*.

Shrubs or small trees, glabrous, 2 - 10 m tall, much branched; bark brown, very rough, lenticellate, twigs often with deciduous scales at base, wood scented. Leaves 1 - 4.5 x 0.5 - 2.4 cm, simple, cuneate-obovate, obovate, obtuse at apex, entire or recurved, veins reticulate, anastomosing, midrib prominent beneath; petioles 3 - 8 mm long; stipules persistent, finely serrate. Flowers white, creamy, green or greenish to greenish-white, scented, dimorphous, 1 - 4 in axillary fascicles; peduncles 2 mm long; pedicels 1 - 8 mm long; thickened towards calyx. Calyx campanulate, persistent, glabrous, 5-lobed, lobes 2 x 2 mm, triangular, acute. Petals yellowish-white or greenish, 3 mm long, ligulate, 3-lobed, spreading, caducous. Stamens 10 in 2 whorls, equal; staminal tube 1 - 2 mm long, free filaments 2 mm long, slender; anthers basifixed, dehiscence longitudinal. Ovary 2 x 1 mm, oblong, longer than staminal tube, rarely equal to or shorter, 1 - 3 loculed; stigmas 2 - 3, clavate. Drupes straight, green turning to blood red when ripe, 10 x 4 mm, ovoid, furrowed, with persistent calyx and filaments below, 1-seeded.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: In dry hilly regions and evergreen forests up to 915 m, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Sri Lanka.

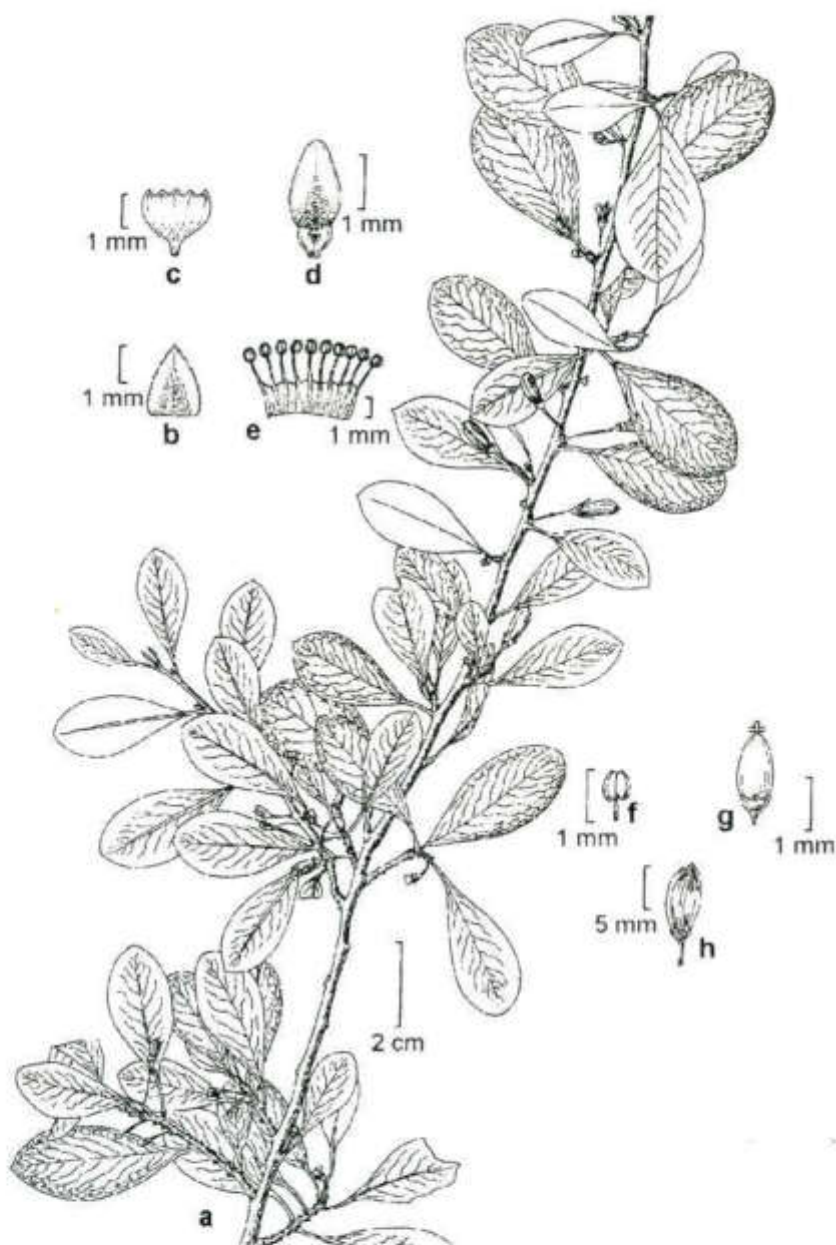


Fig. 164. *Erythroxylum monogynum* Roxb. : a. branch with flowers and fruits; b. stipule; c. calyx; d. petal; e. androecium; f. stamen; g. pistil; h. fruit.

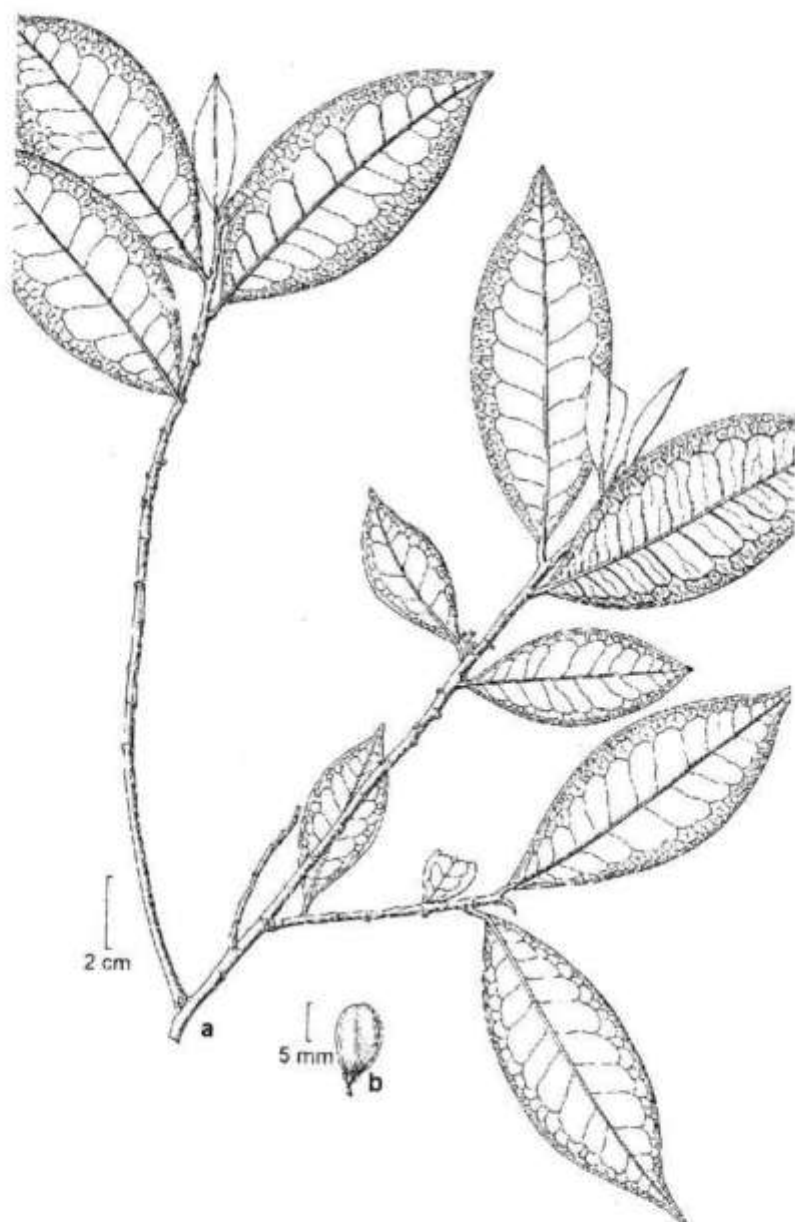


Fig. 165. *Erythroxylum moonii* Hochr. : a. flowering branch; b. fruit.



*Notes.* The dried leaves are cooked and eaten during famine. Sometimes the leaves are also used as fodder for cattle. An infusion of the wood and bark is used in treating stomachic and as diaphoratic and diuretic.

**5. *Erythroxylum moonii*** Hochr. in Bull. Inst. Bot. Buitenz. 22: 54. 1905. *Sethia acuminata* Arn. in Act. Acad. Nat. Cur. 18: 324. 1836. *Erythroxylum acuminatum* (Arn.) Walp., Rep. Bot. Syst. 1: 407. 1842, non Ruiz & Pavon 1794. *E. lucidum* Moon ex Hook. f., Fl. Brit. India 1: 415. 1874, non Kunth 1822. **Fig. 165.**

Small trees, much branched; branchlets glabrous; bark light brown, lenticellate giving warty appearance, twigs often with deciduous scales at base. Leaves 3.5 - 12 x 1.2 - 4 cm, elliptic-lanceolate, obtuse at base, acute to obtuse or obtusely caudate-acuminate at apex, entire or recurved, veins reticulate, horizontal, anastomosing, midrib prominent beneath, shining on both surfaces; petioles 5 mm long, slender; stipules finely serrate, caducous. Flowers 2 mm long, 1 - 2 together, axillary; pedicels 3 mm long, stout; bracteoles 2, triangular. Calyx 2 x 2 mm, campanulate, persistent, lobes triangular, acute. Petals 2 mm long, slightly exerted, elliptic-oblong, with trifid ligulate appendage near base, persistent. Stamens 10, equal, staminal tube 1.2 mm long, free filaments short, slender; anthers dehiscence longitudinal. Ovary ovoid, 3-loculed; styles 3, connate. Drupes 13 x 4 mm, elliptic-oblong, furrowed, slightly falcate, glabrous, shining, 1-seeded.

*Fl. & Fr.* Feb. - May.

*Distrib.* India: In evergreen forests as an undergrowth up to 305 m. Tamil Nadu.

Sri Lanka.

*Notes.* The juice of fresh leaves is reported to possess anthelmintic property.

**6. *Erythroxylum obtusifolium*** (Wight) Thwaites ex Hook. f., Fl. Brit. India 1: 415. 1874. *Sethia lanceolata* Wight var. *obtusifolia* Wight, Ill. Ind. Bot. 1: 136. 1840. *S. obtusifolium* (Wight) Thwaites, Enum. Pl. Zeyl. 54. 1858. **Fig. 166.**

Small trees or shrubs, much branched, branches warty. Leaves 2.5 - 8.5 x 1 - 4 cm, oblong-lanceolate, obovate-obtuse, oblong ovate to ovate, attenuate at base, rounded or obtuse at apex, entire, dark brown above, reddish brown beneath, shining on both surfaces, veins prominently reticulate beneath; petioles 2 - 7 mm long; stipules entire, caducous, scars conspicuous. Flowers 5 mm long, white or greenish white, solitary, axillary, heterostylous; pedicels 7 mm long, thickened towards calyx. Calyx 2 mm long, 5-lobed, persistent. Petals 5, 3 mm long, free, imbricate. Stamens 10; filaments less than 1 mm long, slender; anthers less than 1 mm long, dehiscence longitudinal. Ovary ovoid; styles slightly longer than stamens, nearly free or united about two-thirds of their length, recurved at apex; stigmas globose. Drupes red, 2 cm long, linear-oblong, straight,

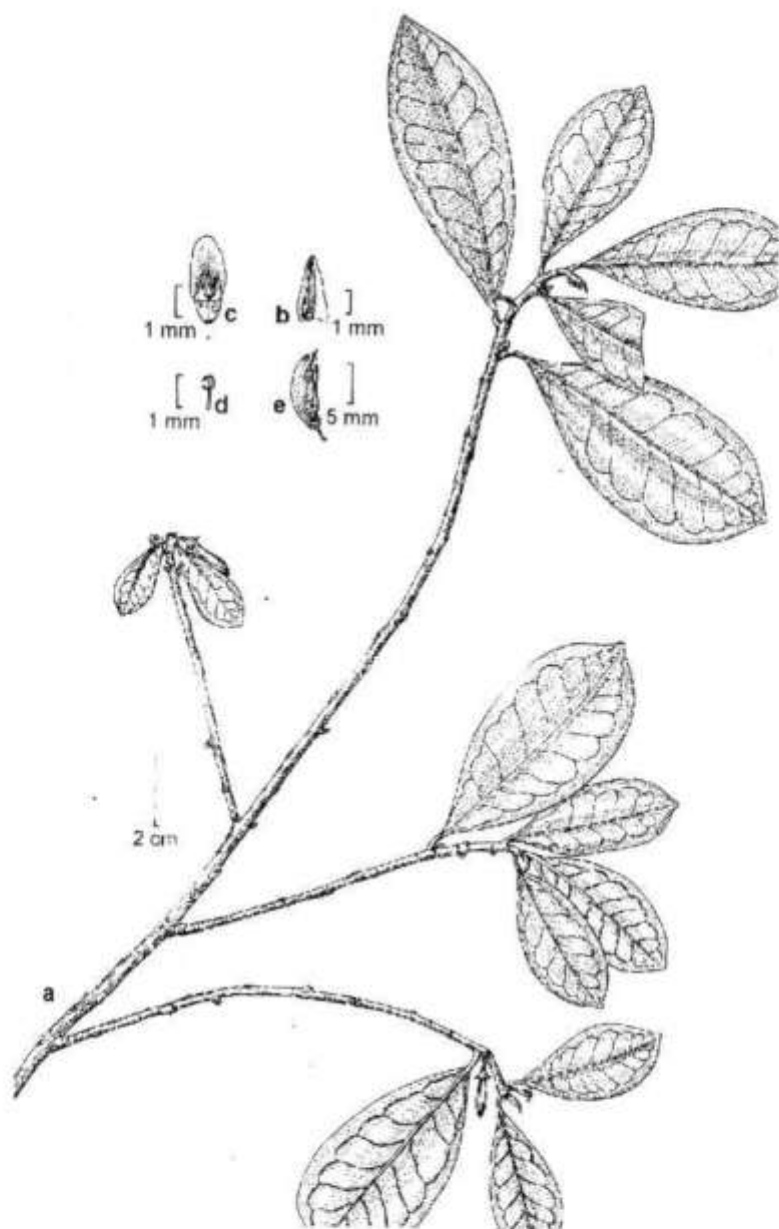


Fig. 166. *Erythroxylum obtusifolium* (Wight) Thwaites ex Hook. f. : a. branch with flowers and fruits; b. stipule; c. petal; d. stamen; e. fruit.

subtrigonus, with persistent calyx and filaments below, style and stigma above. Seed 1, flattened.

*Fl. & Fr.* March - May.

*Distrib.* India: In montane regions up to 1220 m, Tamil Nadu.

Sri Lanka.

#### CULTIVATED SPECIES

*Erythroxylum coca* Lam., *Encycl.* 2: 393. 1786.

Small trees or shrubs, young twigs warty. Leaves broadly elliptic, dark green above, paler and glaucous beneath deciduous; stipules persistent. Bracts numerous. Flowers yellow or yellowish-green, heterostylous; styles free. Drupes red, almost always on bare branches. Seeds subtrigonus, endosperm abundant.

Cultivated in Assam, Bihar, Maharashtra, Karnataka, Tamil Nadu and West Bengal.

Native of tropical South America.

*Notes.* This species is of great importance since cocaine is extracted from its leaves. Cocaine is used as a stimulant and as an anaesthetic specially in eye surgery. The leaf is bitter in taste and somewhat astringent. The cultivation of this species and production of cocaine (in drug form) is restricted and prohibited by law.

## IXONANTHACEAE

(P. K. Hajra)

Trees. Leaves alternate, simple, stipulate or exstipulate. Flowers small, bisexual, in axillary fascicles of racemes, cymes or panicles; bracts small, caducous. Sepals 5, contorted, shortly connate at base. Petals 5, free, contorted, persistent. Stamens 10 - 25, inserted on an annular disc or very shortly united at base. Ovary(2-) 4 - 5 carpellary, superior, 5 - 6-locular; ovules 2 or 1 in each locules; styles simple or shortly branched. Fruit a large drupe or samara or capsule, septicidal, coriaceous. Seeds arillate or winged with fleshy endosperm.

Tropical and subtropical regions of the world, 8 genera and ca 48 species; one genus with a single species in India.

*Literature.* HAJRA, P.K. (1983). Ixonanthaceae in Fasc. Fl. India 13: 13 - 15. KOOL, R.(1980). A taxonomic revision of the genus Ixonanthes Linaceae. Blumea 26: 191 - 204. OLTMANN, O. (1971). Pollen morphologisch Systematisch Untersuchungen innerhalb der Geraniales. Lehre J. Camer 1 - 163. WINKLER, H. (1931). Linaceae. In: Engler, A. & K. Prantl, Nat. Pflanzenfam. ed. 2, 3, 19a: 124.

*Notes.* J.D. Hooker (*Fl. Brit. India* 1: 410. 1874) treated this family as a tribe under Linaceae while Winkler (in Engler & Prantl, *Nat. Pflanzenfam.* ed 2, 3, 19a: 82 - 130. 1931) treated it as a subfamily Ixonanthoideae. Excell & Mendonca (*Bull. Soc. Brot.* 25: 105. 1951) raised it to the rank of a family which was subsequently followed by others including Hutchinson (*Fam. Fl. Pl.* 3rd. ed. 314-315. 1973) and in this flora as well.

### Ixonanthes Jack

Trees, glabrous. Leaves alternate, simple, entire or crenate-serrate, reticulate; stipules minute or absent. Flowers small, in axillary, dichotomously branched, corymbose panicles. Sepals 5 - 6, shortly connate at base. Petals 5 - 6, contorted, persistent, hardened round the fruit. Stamens 10 - 20, inserted on outer rim of perigynous, annular or cupular disc. Ovary 5 - 6-locular or 10 - 12-locular by false septa, ovules 2 in each locule; styles simple; stigmas capitate-lobed. Capsules oblongoid or conical, coriaceous or woody, septicidal, opening inward. Seeds winged or crowded with a mitriform aril; endosperm fleshy; cotyledons foliaceous.

In Tropical and Subtropical Asia and New Guinea, ca 12 species; one in India.

*Ixonanthes reticulata* Jack, Malay. Misc. 2, 7: 51. 1822; Hook. f., *Fl. Brit. India* 1: 417. 1874; R. Kool in *Blumea* 26: 200. 1980. *Gordonia decandra* Roxb., *Fl. Ind.* 2: 573. 1832. *Ixonanthes khasiana* Hook. f., *Fl. Brit. India* 1: 416. 1874. **Fig. 167.**

Garó: *Selabl, Ihing-buphai* (Kuki).

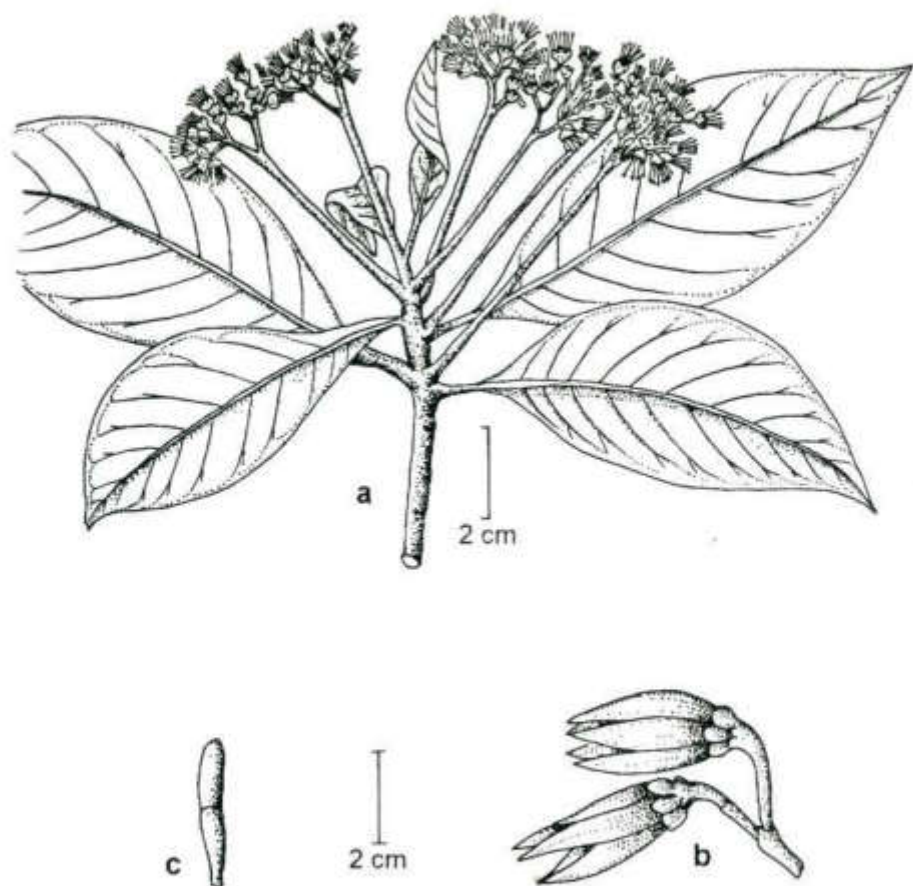


Fig. 167. *Ixonanthes reticulata* Jack : a. flowering twig; b. fruits; c. seed.

Trees, ca 40 m tall; trunk 80 cm in diam., fluted at base. Leaves 7 - 13 x 2.5 - 5 cm, elliptic-lanceolate to oblong, narrowed and decurrent into short petiole at base, obtusely acuminate at apex, entire, membranous, glabrous, secondary nerves 6 - 9 on either half with many intermediate nerves, very oblique; petioles 0.6 - 1.8 cm long, glabrous. Peduncles slender, 4 - 10.5 cm long, obscurely winged. Flowers ca 5 mm across; pedicels 3 - 8 mm long. Sepals 2 - 5 x 1 - 4 mm. Petals 3 - 7 x 2 - 4 mm, suborbicular, enlarged and hardened round the fruit. Stamens 10; filaments linear; anthers oblong. Ovary 5-locular; styles ca 3 cm long; stigmas discoid. Capsules 3 - 4 x 1 - 1.5 cm, oblong, pointed at apex, 5-valved. Seeds winged at tip, ca 2.5 cm long, wing 1 - 1.5 x 0.4 - 0.6 cm, obliquely oblong.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Assam and Meghalaya.

Myanmar, S. Vietnam, N. Vietnam, S. China, Hong Kong and Malesia.

*Notes.* Wood light brown, even grained, traversed by numerous wavy concentric but discontinuous bands of soft tissue, medullary rays very fine - suitable for cabinet work (*Kanjilal et al.*, Fl. Assam 1: 186. 1934).

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